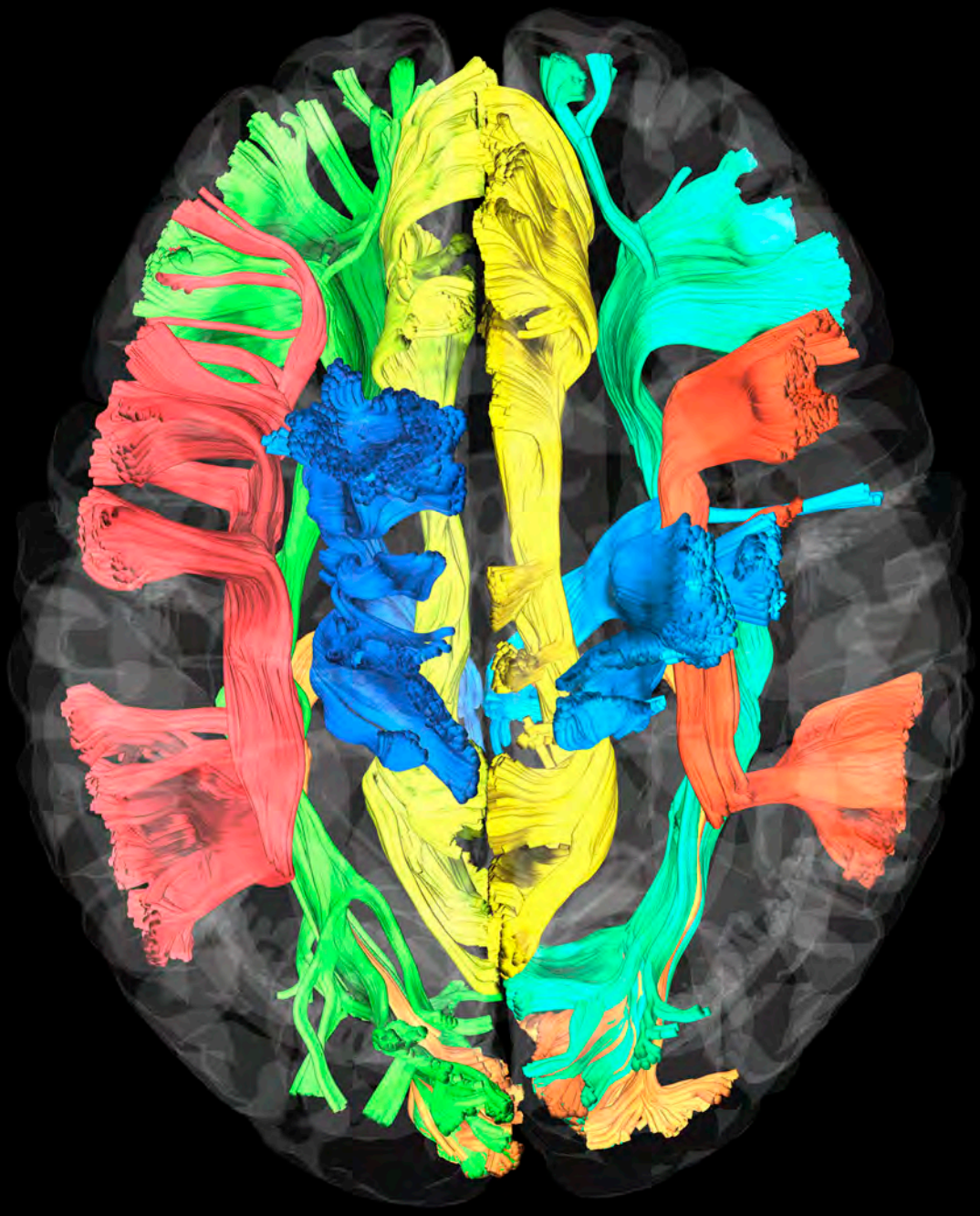
University of Pittsburgh

Department of Neurological Surgery

2024 Annual Report



University of Pittsburgh

UPMC
LIFE CHANGING MEDICINE

2024 Department of Neurological Surgery Annual Report

University of Pittsburgh

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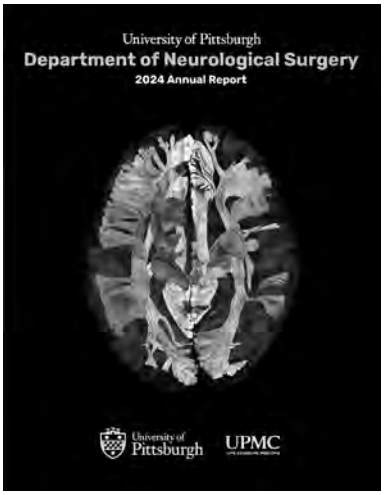


On the Cover: *Tractogram of major brain pathways mapped using high-resolution diffusion MRI. This advanced tractography technique provides a highly detailed view of the brain's 'wiring,' giving neurosurgeons an optimal 'pathway' to brain tumors and other sensitive areas, while preserving brain function.*

Faculty, Residents & Staff

Faculty

• Chair and Professor:
Robert M. Friedlander, MD, MA

• Professors:
C. Edward Dixon, PhD
Paul A. Gardner, MD
Peter C. Gerszten, MD, MPH
Jorge A. González-Martínez, MD, PhD
Costas G. Hadjipanayis, MD, PhD
D. Kojo Hamilton, MD
L. Dade Lunsford, MD
John J. Moossy, MD
Ajay Niranjan, MD, MBA
David O. Okonkwo, MD, PhD
Ian F. Pollack, MD
Mingui Sun, PhD
Parthasarathy D. Thirumala, MD

• Associate Professors:
Kalil G. Abdullah, MD
Taylor Abel, MD
Nitin Agarwal, MD
Sameer Agnihotri, PhD
Jeffrey Balzer, PhD
Diane L. Carlisle, PhD
Donald J. Crammond, PhD
Avniel Ghuman, PhD
Bradley Gross, MD
Baoli Hu, PhD
Ava Puccio, PhD, RN
Fang-Cheng (Frank) Yeh, MD, PhD
Georgios Zenonos, MD

• Assistant Professors:
Edward Andrews, MD,
Katherine M. Anetakis, MD
James Cushing Bayley, MD
Thomas J. Buell, MD
Marco Capogrosso, PhD
Shaun W. Carlson, PhD
David T. Fernandes Cabral, MD
Luke C. Henry, PhD
Robert Kellogg, MD
Gary Kohanbash, MD
Michael J. Lang, MD
Michael McDowell, MD
Antony MichealRaj, PhD
Martin G. Piazza, MD
Natalie Sandel Sherry, PsyD, ABPP-CN
Pascal O. Zinn, MD, PhD

• Clinical Professors:
Matt El-Kadi, MD, PhD
Joseph C. Maroon, MD
Daniel A. Wecht, MD, MSc
David S. Zorub, MD

• Clinical Associate Professors:
Or Cohen-Inbar, MD PhD
Vincent J. Miele, MD
Michael J. Rutigliano, MD, MBA

Faculty and residents at 2024 resident graduation reception and dinner held at Pittsburgh Golf Club, June 22, 2024.

• Clinical Assistant Professors:
Robert L. Bailey, MD
J. Brad Bellotte, MD
Lindsay Bhandari, MD
Bryan Bolinger, DO
John A. Braca III, MD
Kathryn Hoes, MD
David L. Kaufmann, MD
Benjamin B. Lee, MD, PhD
Vinayak Narayan, MD
Jeremy G. Stone, MD
Fadi Sweiss, MD
Bart Thaci, MD
Sheela Vivekanandan, MD

• Research Associate Professor:
Yue-Fang Chang, PhD

• Research Assistant Professors:
Shawn R. Eagle, PhD
Esther Jane, PhD

Residents
• PGY-7:
Hussam Abou-Al-Shaar, MD
Ricardo Fernández-de Thomas, MD
Arka N. Mallela, MD
Gautam Nayar, MD

• Chief Residents:
Ali A. Alattar, MD
Hansen Deng, MD
Daryl P. Fields II, MD, PhD
Joseph Scott Hudson, MD
Andrew D. Legarreta, MD

• PGY-5:
Prateek Agarwal, MD
Jeffrey R. Head, MD
Rachel C. Jacobs, MD
David J. McCarthy, MD

• PGY-4:
Sharath K. Anand, MD
Andrew M. Faramand, MD
Sakibul Huq, MD
Anthony J. Schulien, MD

• PGY-3:
Joe H. Garcia, MD
Willman H. Shuman, MD
James S. Yoon, MD

• PGY-2:
Hussein H. Abdallah, MD
Stephanie M. Casillo, MD
Albin A. John, MD
Eric M. Nturibi, MD
Oliver Y. Tang, MD

• PGY-1
Madi Remick, MD
Jessica Ryvlin, MD
Nikhil Sharma, MD
Gina Watanabe, MD

Advanced Practice Providers
Michelle Acosta, DPAS, PA-C
Alicia Bergell PA-C
Lauren Carroll, PA-C
Shannon Casey, CRNP
Kayla Churman, PA-C
Annette Clements, CRNP
Theodora Constantine, MPAS, PA-C
Alissa Conway, PA-C
Amanda Costanza, PA-C
Abigail Crum, MPAS, PA-C
Kassandra Deane, PA-C
Jada Dooley, CRNP
Amanda Driscoll, PA-C
Julia Freyer, PA-C
Amanda Gans, PA-C
Nicole Gray, PA-C
Nicholas Grice, PA-C
Samantha Gulick, PA-C
Chrisanne Hennicke, PA-C
Danielle Hudak, PA-C
Cecilia Jewell, PA-C
Stephanie Johnson, CRNP
Kelly Jones, PA-C
Sarah Kwiatkowski, FNP-C
Lucille Lewis, MPAS, PA-C
Kathleen Mannion, PA-C
Hope Maromonte, MPAS, PA-C
Kristin Mellon, PA-C
Kelsey Michenko, PA-C
Alexis Papay, PA-C
Anne Parisi, CRNP
Hailey Patsy, PA-C
Hannah Pierre, CRNP
Suzie Semroc, PA-C
Gina Shaffer, PA-C
Edward Shaffer, PA-C
Kaila Simcoviak, PA-C
Brianna Stuparitz, PA-C

Jessica Sullivan, PA-C
Sarah Tappe, CRNP
Brooke Testa, PA-C
Erin Thomson, PA-C
Svetlana Trofimova, PA-C
Jenna Turnley, PA-C
Louisa Urgo Shin, PA-C
Casey Weibel, PA-C
Nathan Winterburn, PA-C
Jennifer Wojcik, CRNP-BC
Rachel Wrigley, MPAS, PA-C

Department Administration

• Executive Administrator:
Stacey Lang

• Assistant Administrator:
Drake Watters

• Financial Administrator:
Tara Horr

• GME Academic Manager:
Melissa Lukehart

• Operations Director:
Patrick Nicholas

• Advanced Practice Director:
Michelle Acosta

Department Overview

Stuart Niles Rowe

Dorothy Klinke Nash

Sidney Goldring

Anthony F. Susen

History

Neurological surgery in the city of Pittsburgh began in 1936 with the arrival of Stuart Niles Rowe, a promising young surgeon trained under the auspices of Charles M. Frazier in Philadelphia. Rowe's arrival marked the birth of a dedicated neurosurgical division that would become a leader in the field. His move here was prompted by a letter from L.H. Landon, Sr., MD, the chief of general surgery at West Penn Hospital, emphasizing the need for a formally trained neurosurgeon in Pittsburgh. It is said that Rowe won a coin toss over William J. Gardner for the opportunity to migrate to the Pittsburgh area and set up practice. Gardner subsequently moved to the Cleveland area and developed his own neurosurgical center.

Rowe, a Michigan native, developed a strong clinical practice in Pittsburgh based on the many, loosely affiliated community hospitals in the area. His goal was to establish a strong neurosurgery service in Pittsburgh. He also had a strong interest in research and wrote several pioneering papers on the neurosurgical treatment of pain, brain abscess and cerebral trauma.

Rowe's plans were put on hold during World War II as he volunteered for military service, serving as an Army lieutenant colonel, treating casualties triaged to a southern England military hospital. Upon his return to Pittsburgh at the end of the war, he again led the neurosurgery service at the university, which was then a section under the Division of General Surgery. Rowe then restarted his mission to unify the neurosurgical service in the Pittsburgh area. He also began to train residents, a journey that would eventually produce one of the strongest neurosurgical training programs in the country.

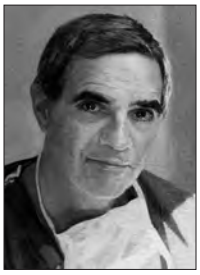
During this time, a landmark moment in the history of neurosurgery occurred with the hiring of Dorothy Klenke Nash, MD, the first woman to practice neurosurgery in the United States. A graduate of the elite Bryn Mawr (Pa.) College in 1921 and the Columbia College of Physicians and Surgeons in 1925, Nash received training in both neurology and neurosurgery under the guidance of Byron Stookey at Bellevue (N.Y.) Hospital in the late 1920s.
She moved to Pittsburgh in 1936, but did not gain a hospital appointment until a chance meeting with Morris Abel Slocum, MD, then chief of general surgery at St. Margaret Hospital. At the time, Nash was volunteering as a phlebotomist at a local blood bank. While donating blood, Slocum learned of Nash's background in neurosurgery and quickly appointed her acting chief of neurosurgery at St. Margaret. She later joined Rowe at Presbyterian University Hospital, paving the way for other women in the field. Rowe placed his service under Nash's care while he served during World War II.

Rowe began the first formal neurosurgery residency program at West Penn Hospital in 1949. Another program was also established at Mercy Hospital in the same year under the direction of Floyd Bragden, MD, who arrived in Pittsburgh three years after Rowe. The two programs were consolidated under the University of Pittsburgh at Presbyterian University Hospital in 1952, where it continues to this day.

With Rowe's own training firmly based in academic neurosurgery, he sought to acquire residents with a commitment to research, teaching and independent thought. Rowe believed that neurosurgery training should not only teach exceptional technique, but also the critical clinical decision-making skills necessary to succeed. He preached the underlying need for thorough literature review and independent research as a means for broadening clinical knowledge.

In 1964, Henry Bahnson, MD, the chair of General Surgery, appointed Sidney Goldring, MD, of St. Louis as the first chief of the Division of Neurological Surgery. After two years, Dr. Goldring returned to St. Louis where he was named professor and chair of neurosurgery at Washington University.

Upon Goldring's departure, Anthony F. Susen, MD, was named the second chief of the Division of Neurological Surgery. Susen—trained at Bowman Gray Medical School and Harvard—had joined the university in 1953 as a clinical instructor and worked with Rowe into the 1960s. He held the same belief as Rowe that residency training programs should stress thorough literature review and independent research as well as exceptional techniques. Susen was also the first pediatric neurosurgeon in the Pittsburgh area and, at the time, was the only pediatric-focused neurosurgeon between Chicago and New York. Under his direction, other facilities including Children's Hospital of Pittsburgh and the Veterans Administration Medical Center, became part of the service.



Peter Jannetta

In 1971, Peter Joseph Jannetta, MD, was appointed the first chair of the University of Pittsburgh Department of Neurological Surgery. Dr. Jannetta is universally known for his work in the treatment of cranial nerve disorders, developing a microvascular decompression procedure—widely known as the Jannetta Procedure—that offers trigeminal neuralgia patients an effective therapeutic alternative when medications fail. Although Dr. Jannetta's scientific and leadership contributions are significant, perhaps his greatest achievement is the legacy of outstanding international leaders he trained in neurosurgery. During his tenure, he trained 49 residents—including four future department chairmen—and was honored with an endowed professorship, appropriately named after Walter E. Dandy—considered one of the founding fathers of neurosurgery. In June of 2000, Dr. Jannetta retired from the University of Pittsburgh and, subsequently, took a position with Allegheny General Hospital.

L. Dade Lunsford

In 1997, L. Dade Lunsford, MD, was selected as the second department chair. In the ensuing decade, Dr. Lunsford guided the department to an elite position in the academic community. Under his guidance, the department established itself as one of the top academic neurosurgical departments in the country—continuing Dr. Jannetta's tradition of training strong, well-rounded residents—and developed into one the most extensive neurological research programs in the nation. Dr. Lunsford also established the department as one of the leading stereotactic radiosurgical programs in the world. In 1987, he was responsible for bringing the Gamma Knife to the University of Pittsburgh, the first center in the U.S. to offer this minimally invasive form of brain surgery. The department now has two such devices and is a world leader in Gamma Knife treatment and education, having treated nearly 18,000 patients.

Amin Kassam

In June of 2006, Dr. Lunsford announced his decision to step down as department chair in order to devote more time to his clinical work, clinical investigation, and resident and fellow training. University of Pittsburgh School of Medicine dean, Arthur S. Levine, MD, appointed Amin Kassam, MD, assistant professor of neurological surgery and co-director of the Minimally Invasive endoNeurosurgery Center, as interim chairman of the department. Dr. Kassam was subsequently appointed chair by Dr. Levine in May of 2007. In June of 2009, Dr. Kassam resigned as chairman and subsequently left the department.

Robert Friedlander

On June 1, 2010, Robert M. Friedlander, MD, a noted cerebrovascular and neuro-oncologic surgeon and researcher, became the fourth chair in the department's history. Dr. Friedlander carved a prominent career as a clinician and scientist at Harvard Medical School and Women's Hospital in Boston before coming to Pittsburgh. His strong leadership in both clinical and research areas has further established the University of Pittsburgh Department of Neurological Surgery as a world-leader in the academic neurosurgical field.

In June of 2011, the University of Pittsburgh Department of Neurological Surgery residency program was ranked as the most productive residency program in the nation in terms of graduates remaining and contributing in academic neurosurgery, according to a study published online in the *Journal of Neurosurgery*.

The study's authors sought to determine those programs that produce a high number of graduates remaining within academic programs and the contribution of these graduates to academic neurosurgery. In the study, 97 academic neurosurgery departments with 986 faculty members were analyzed. All data regarding training program and medical school education were compiled and analyzed according to the center from which each faculty member graduated. The neurosurgery training program at the University of Pittsburgh produced the highest number of academic neurosurgeons in this sample.

In another similar study published in the *Journal of Neurosurgery* in 2015, the department ranked among the top five neurosurgical residency programs in the country in terms of academic publishing output of faculty. In this comprehensive, five-year study, researchers used bibliometrics—the statistical analysis of written publications—to calculate the objective impact of academic papers. The results showed that the University of Pittsburgh Department of Neurological Surgery had the third highest score of 103 neurosurgical residency programs across the United States for papers published by its faculty from 2009 through 2013.

Goals/Mission

The Department of Neurological Surgery at the University of Pittsburgh began more than 75 years ago with a commitment to patient care, education and research. Today these goals are still paramount in our pursuit of excellence: first, to provide outstanding care to patients with neurological disease; second, to equip neurosurgeons of the future with state-of-the-art techniques and analytical skills to lead the field of neurosurgery; and third, to foster research designed to enhance the treatment of diverse diseases affecting the nervous system. Although the faculty has had a wide variety of interests over the years, their unity of vision has been remarkable in this regard.

Organization

A complete faculty list is available on page 4.

A complete resident list is available on page 5.

The main offices of the Department of Neurological Surgery at the University of Pittsburgh are housed on the fourth floor of UPMC Presbyterian in the Oakland section of the city of Pittsburgh. The current full-time faculty includes 14 professors, 13 associate professors and 16 assistant professors. In addition, there are 20 clinical faculty, three research faculty, 29 residents at various levels of training, and more than 50 advanced practice providers. The support staff includes more than 200 clinical coordinators, administrative assistants, nurses, technicians and other personnel.

The department has created a unique environment where "centers of excellence and focused programs" flourish. In this model, neurosurgical subspecialists devote time to research and patient care in focused programs. The use of centers of excellence has strengthened neurosurgery at the University of Pittsburgh and facilitated attainment of our mission.

Our Centers of Excellence

Brain and Spine Injury Program

The Brain and Spine Injury Program consists of a number of programs developed to better understand and treat the problems associated with traumatic injury to the central nervous system, brain and spinal cord, in both adults and children.

The department's adult clinical neurotrauma division, led by David Okonkwo, MD, PhD, remains a world leader in the treatment of and research into traumatic brain and spinal cord injury. The neurotrauma service works closely with integral colleagues from the Trauma Division, Critical Care Medicine, Neurophysiology, Neuroradiology, and Physical Medicine and Rehabilitation to provide the most sophisticated treatments available for brain and spinal cord injury patients.

The department collaborates with investigators worldwide to advance the evaluation, treatment and outcomes of patients suffering traumatic injuries of the spinal column and spinal cord. The Neurotrauma Clinical Trials Center (NCTC) provides the infrastructure necessary to carry out the large number of active research protocols ongoing within the program. Recent trials launched include the first stem cell trial for chronic spinal cord injury to be conducted in Pennsylvania.

Clinical efforts in traumatic brain injury are conducted in collaboration with research carried out through the Brain Trauma Research Center (BTRC) under the direction of C. Edward Dixon, PhD. Research conducted both at the center and at other brain injury research programs clearly demonstrates the potential for improving outcome using therapies designed to treat biochemical derangements that occur following impact to the brain. The BTRC has pioneered efforts using temperature manipulation and cerebral blood flow monitoring in the treatment of severe head injury and has conducted landmark investigations into the mechanisms of induction and recovery of head trauma and secondary injury.

Cerebrovascular Neurosurgery Center

The Comprehensive Center for Cerebrovascular Neurosurgery at the University of Pittsburgh Medical Center is a subspecialized multidisciplinary clinical unit that evaluates and treats all forms of vascular disorders of the brain and spinal cord. Given the high volume of cases managed by the center, it serves as a national and international resource for the management of patients with complex cerebrovascular disease, including aneurysms, arteriovenous malformations (AVMs), arteriovenous fistulas (AVFs), carotid disease, moyamoya disease, and cavernous malformations. With a group of highly subspecialized physicians, center faculty prospectively assess patients and provide broad state-of-the-art treatment options. Central to our mission is the belief that patients should have access to the entire spectrum of techniques. As such, our experts evaluate cases and provide recommendations with the goal of minimizing risks and maximizing long-term efficacy.

The center is directed by Michael J. Lang, MD, and also includes Robert Friedlander, MD, Paul A. Gardner, MD; Bradley A. Gross, MD; and Georgios Zenonos, MD. Dr. Gross also serves as director of endovascular neurosurgery for the center.

Challenging cases are reviewed prospectively in our weekly multidisciplinary cerebrovascular conference. Complex cases are analyzed systematically, in order to fully vet the microsurgical, endovascular, radiosurgical, and medical options for each case. Combined with assessment of patient clinical profiles by our dedicated multidisciplinary preoperative clinic, recommendations are made to prioritize long-term patient health and safety. This setting also provides exceptional educational opportunities for our fellows and residents as they advance their training.

The Cerebrovascular Center is proud to provide care for patients with hemorrhagic disease, such as aneurysms, arteriovenous malformations, and cavernous malformations, for some of the most complex and vulnerable patients in the country. Our endovascular neurosurgeons participate in nationwide clinical trials to evaluate developing technologies such as flow diverting stents and intra-saccular flow diversion. Dr. Gross is a contributor to a first-of-its-kind national consortium to advance the understanding of dural arteriovenous fistulas (dAVFs), a rare and uniquely challenging vascular malformation. Advanced imaging techniques developed at UPMC, such as high-density fiber tracking (HDFT), facilitate the safe resection of cavernous malformations in critical areas of the brain, such as the brainstem. Under Dr. Lang, the center has pioneered novel approaches to brain aneurysms by directly combining microsurgical and endovascular techniques. We have been able to offer definitive treatment to patients otherwise deemed incurable. As such, the Cerebrovascular Center is able to provide one of the busiest and fully immersive training programs in the country for our residents and fellows pursuing education in cerebrovascular surgery.

The Cerebrovascular Neurosurgery Center works in close collaboration with the UPMC Stroke Institute in the treatment of ischemic cerebrovascular disease—staffed by neurologists with additional training in vascular neurology. Our endovascular neurosurgeons and interventional neurologists perform acute interventions for ischemic strokes at one of the highest rates in the country and are involved in innumerable trials advancing the field. The Cerebrovascular Center provides comprehensive evaluation of patients with carotid stenosis. Patients are evaluated in multidisciplinary fashion to choose from an array of surgical options including carotid endarterectomy (CEA), carotid artery stenting (CAS), and transcarotid revascularization (TCAR). For patients with more complex, cerebral ischemic disease, Dr. Lang has developed one of the busiest cerebral revascularization practices in the country, offering cutting-edge cerebral bypass techniques, vascular transpositions, and other unique treatment options.

Ongoing research efforts at the Comprehensive Cerebrovascular Center continue to advance the field of vascular neurosurgery. Under Dr. Gross, UPMC served as one of the largest enrollers in the recently published EMBOLIZE trial, which has confirmed the benefits of treating chronic subdural hematomas (CDH) with endovascular embolization to reduce the need for surgical drainage and/or retreatment. We continue to participate in clinical trials to evaluate the most cutting edge treatments for brain aneurysms, and are helping to advance the use of neural stimulation to improve patient recovery after stroke.

Center for Clinical Neurophysiology

The Center for Clinical Neurophysiology (CCN) at UPMC was organized in 1981 to serve as an interdepartmental resource serving then-Presbyterian University Hospital, Montefiore Hospital and Children's Hospital of Pittsburgh. At that time, the CCN was composed of just a few clinicians providing diagnostic testing and intraoperative neurophysiological monitoring (IONM) services for only very specific surgeries in the neurosurgical and orthopedic disciplines.

The service has now grown to providing more than 9,000 IONM cases per year at all UPMC pavilions, as well as supporting UPP and non-UPP surgeons at non-UPMC hospitals. The use of IONM at UPMC reaches across many surgical disciplines and has proven to be an invaluable adjunct not only in adult and pediatric neurosurgical procedures but also in orthopedic, ENT, vascular, cardiothoracic and interventional neurological procedures.

The CCN and its highly trained and nationally renowned faculty and technical staff's primary goal is to provide high-quality service in a cost-efficient manner to the UPMC patient population. The center focuses on interdisciplinary research to improve the understanding and the value of IONM to predict and prevent neurological injury. In addition, CCN faculty have established two annual IONM courses and a formal, clinical training program at Carlow University. The first undergraduates in this program, graduated in May of 2020.

Parthasarathy Thirumala, MD, is director of the CCN and is joined by Jeffrey Balzer, PhD; Donald Crammond, PhD; Katherine Anetakis, MD; Benjamin B. Lee, MD, PhD, and Lindsay Bhandari MD.

The CCN is the largest and busiest academic IONM program in the country, offering and providing services at all UPMC hospitals including UPMC Hamot, Horizon, Altoona, Somerset, Susquehanna, Western Maryland and Pinnacle. In addition, the CCN provides professional and technical services at Excela Health System, Indiana Regional Hospital and Trinity Health System. The CCN faculty can achieve this service expansion to community hospitals through the use of telemedicine technology. Patients in community hospitals, more than 100 miles away, can receive the same quality care in real-time without having to travel to Pittsburgh.

Intraoperative multimodality monitoring at UPMC includes expertise in somatosensory evoked potentials (SSEP), brainstem auditory evoked potentials (BAEP), transcranial motor evoked potentials (TcMEP), direct cortical motor evoked potentials (dcsMEP) electroencephalography (EEG) and electromyography (EMG). Direct peripheral nerve recordings (CNAP and CMAP) are also performed, as well as single unit micro-electrode recordings (MER) and macrostimulation performed for subcortical mapping during placement of DBS electrodes in various subcortical structures. EEG is used to monitor cerebral function and ischemic risk during cerebral and peripheral vascular procedures, including cerebral aneurysm treatment, carotid endarterectomy and a variety of cardiothoracic procedures.

EEG recorded directly from the pial surface of the brain, or electrocorticography (ECoG), is used to help determine resection margins in epilepsy surgery, and to monitor for seizures during direct electrical stimulation of the brain surface carried out while mapping eloquent cortex in awake patients. In addition to providing IONM services, the CCN also performs diagnostic evoked potential testing, and transcranial Doppler studies.

The CCN is proud to provide a high-quality, high value service at a significantly low cost to patients, which it can achieve by constantly evaluating and improving clinical services through its various research initiatives and quality improvement programs. The center's cutting-edge research efforts—represented by multiple, peer-reviewed publications in high quality journals each year—have demonstrated the value of the application of multimodality intraoperative neurophysiological monitoring to improved patient safety during various peripheral and central nervous system operative procedures.

Complex Brain Surgery Program

The Complex Brain Surgery Program, under the direction of department chairman Robert Friedlander, MD, is devoted to the surgical treatment of lesions and tumors located in deep, eloquent or difficult-to-reach regions of the brain. The goal of the program is to provide gentle, accurate, and safe surgery for the most complex lesions and locations, often regarded as inaccessible or high-risk.

This program has its foundation on a precise and meticulous knowledge of microsurgical neuroanatomy and neurosurgical approaches, and is built upon extensive surgical experience at UPMC, and intense microsurgical learning and research conducted at the Surgical Neuroanatomy Lab and the Fiber Tractography Lab at the University of Pittsburgh.

Areas of surgical expertise include intrinsic tumors in eloquent brain areas and deep white matter, limbic/paralimbic tumors (insula, medial temporal lobe, cingulum), intraventricular and thalamic lesions, pineal and posterior tentorial incisura tumors, cerebellar and brainstem lesions.

A unique feature of this program is the application of sophisticated presurgical planning techniques, such as surgical simulation with crafted anatomical specimens and High-Definition Fiber Tractography (HDFT), to carefully develop the most effective and less invasive operative plan.

HDFT is an advanced MRI-based non-invasive imaging technique, with its surgical applications pioneered by Dr. Friedlander, to study the three-dimensional structure of the fiber tracts of patients with intrinsic brain lesions. HDFT provides a superior presurgical evaluation of the fiber tracts for patients with complex brain lesions, including benign, low grade, and high-grade tumors. The combination of HDFT with accurate neuroanatomical knowledge of the white matter tracts is the key to design the less invasive trajectory into a target lesion and apply more effectively intraoperative electrical mapping techniques for maximal and safe tumor resection in eloquent cortical and subcortical regions.

Center for Cranial Base Surgery

Cranial base surgery has a long tradition at the University of Pittsburgh. The UPMC Center for Cranial Base Surgery—under the current direction of Paul Gardner, MD, and Georgios Zenonos, MD, in the Department of Neurological Surgery, and Carl Snyderman, MD, MBA, Eric Wang, MD, and Garret W. Choby, MD, in the Department of Otolaryngology—is the first skull base center to be established in North America and has pioneered both transcranial microscopic and endoscopic endonasal approaches to the skull base and brain.

Neurotology expertise is currently provided by Philip Perez, MD, from the Department of Otolaryngology who will soon be joined by Peter Santa Maria, PhD, to lead the neuro-otology division to provide complex care for lateral skull base pathologies. Additional pediatric skull base expertise is provided by Michael McDowell, MD, in neurosurgery, and Amanda Stapleton, MD, in otolaryngology, in collaboration with other members of the center, at UPMC Children's Hospital of Pittsburgh, caring for all types of pituitary and skull base tumor in children. This combined team concept of adult skull base and pediatric surgeons provides a unique group expertise.

Finally, radiosurgery plays a key role in skull base disease, leading to regular collaboration with Costas Hadjipanayis, MD, PhD, director of the UPMC Center for Image-Guided Neurosurgery, Ajay Niranjan, MD, and L. Dade Lunsford, MD, who established the first Gamma Knife center in North America at UPMC in 1987 and was also the first to introduce radiosurgery for the non-operative treatment of skull base tumors.

Experts at the UPMC Center for Cranial Base Surgery continue to lead the field of minimally invasive brain surgery by developing new techniques, tools and approaches that have made it possible to access many tumors, regardless of size. Since 1997, more than 4,000 endonasal surgeries have been performed in adults and children, making UPMC one of the busiest centers in the world for the surgical treatment of tumors of the pituitary region and cranial base. By combining this innovative approach with other minimally invasive approaches, such as transorbital and endoscopic-assisted retromastoid and keyhole approaches, as well as the full complement of standard skull base approaches, the team at UPMC provides a full array of options for cutting-edge treatment of skull base disease. In addition, the Center for Cranial Base Surgery has also been designated as a Pituitary Tumor Center of Excellence by the UPMC Health Plan, setting the standard for pituitary tumor treatment in the region. This designation is based on high volume practice with regular metrics which uphold a high standard of care for the entire UPMC system.

Drs. Gardner, Snyderman, Zenonos, Wang and Choby, along with oculoplastic surgeon Tonya Stefko, MD, from the Department of Ophthalmology, and Drs. Santa Maria and Perez comprise a team of experts in cranial base surgery, advancing patient care through clinical outcomes studies, in-depth anatomical study, molecular science and genetics research and an international training program. Research activities are coordinated by Benita Valappil, MPH, clinical research director, and include participation in multicenter trials, banking of tumor tissue for genetic and molecular research, and maintenance of clinical research database. The UPMC Cranial Base Center continues to push the field of skull base surgery forward with a combination of clinical innovation and basic science research. Via collaboration with bench researcher at UPMC and other institutions, the center is developing new ways to understand and treat skull base tumors, using outcomes-based data combined with in depth molecular and genetic tumor sequencing to provide individualized care for skull base disease.

Supported by expert advanced practice practitioners Rachel Wrigley, Lucille Lewis, Jada Dooley, Shannon Casey and a highly experienced subspecialty nursing team, patients are evaluated and guided through even the most complex, multidisciplinary care, provided to patients throughout our region, across the United States and around the globe.

The concept of team surgery allows the center to select the best surgical approach for each tumor, with a surgical plan designed around the particular needs of the individual patient. Treatment is designed to offer the best surgical outcome with the least side effects and maximal preservation of function. A full array of transcranial approaches, minimally invasive keyhole approaches and endoscopic endonasal approaches are routinely applied with proven and studied success.

The UPMC Center for Cranial Base Surgery is also a major teaching and research destination for surgeons and other health care professionals looking to learn more about these techniques. Faculty teach three CME courses yearly at UPMC, featuring live surgery and hands-on laboratory work. They also travel the world teaching these procedures to the next generation of skull base surgeons.

The center has also been designated as a "Multidisciplinary Team of Distinction" by the North American Skull Base Society. This designation is based on meeting NASBS membership criteria for multidisciplinary participation.

Epilepsy, Movement Disorders and Psychiatry Surgical Program

The Epilepsy, Movement Disorders and Psychiatry Surgical Program, under the direction of Jorge A. González-Martínez, MD, PhD, at the University of Pittsburgh encompasses the treatment of medically intractable epilepsy, movement disorders and psychiatry disorders. These pathological neurological conditions are similar in that successful neurosurgical treatment requires an expert understanding of the involved brain networks and their potential for modulation by functional neurosurgical procedures, as well as multidisciplinary teams that deliver surgical care to these special groups of patients. Dr. González-Martínez has expertise in both adult and pediatric patients. Pediatric patients are treated at the UPMC Children's Hospital of Pittsburgh, one of the best pediatric hospitals in the country, as noted in *U.S. News and World Report*.

UPMC also houses the region's foremost centers for the comprehensive neurosurgical treatment of all types of adult and pediatric epilepsy, including epilepsy caused by lesions visible on MRI (mesial temporal sclerosis, cortical dysplasia, neurodevelopmental brain tumors, cavernous malformations, etc.) and epilepsy where the seizure onset location is not obvious and must be localized by intracranial monitoring, including stereo-electroencephalography (SEEG). Part of the University of Pittsburgh Comprehensive Epilepsy Center, the surgery program is one of the busiest—and most renowned—programs offering the latest less invasive, innovative and conventional surgical treatments, including responsive neurostimulation, laser thermal ablation, deep brain stimulation and incisionless endoscopic nasal resections in patients with temporal lobe epilepsy.

Dr. González-Martínez, co-director of the epilepsy center, has the country's largest experience in SEEG implantations, SEEG guided resections and neuromodulation surgeries, with more than 3,000 successful surgical procedures performed. In order to promote an optimal safety profile and seizure outcome, many procedures are performed under robotic guidance. In addition of developing and implementing the SEEG method in North America, Dr. González-Martínez is also a pioneer in robotic surgery, having performed more than 1,000 procedures using this technique. The University of Pittsburgh has the largest experience in robotic neurosurgery in the country and was one of the first institutions in adopting the novel technology.

In addition to clinical activities, The Epilepsy, Movement Disorders and Psychiatry Surgical Program is considered one the premier programs in the country regarding translational and basic science research, working in collaboration with the University of Pittsburgh Department of Neuroscience, Carnegie Mellon University Department of Biomedical Engineering, John Hopkins University and Aix Marseille University in France. The program's research activities are led by Dr.

González-Martínez and his research team and conducted through the University of Pittsburgh Cortical Systems Laboratory.

Human Neural Prosthetics Program
The Human Neural Prosthetics Program—under the surgical direction of Jorge A. González-Martínez, MD, PhD—is the result of a multidisciplinary effort to explore the utilization of brain computer interfaces for improving the lives of patients with motor disabilities. In 2007, a collaborative group was established—representing expertise in engineering, neuroscience and rehabilitation—to promote clinical trials using brain computer interfaces to control neural prosthetic devices.

Researchers obtained an initial grant to evaluate micro-ECoG grids in patients with spinal cord injury. Data from this study demonstrated that patients could utilize a brain computer interface to control a computer cursor. This grant served as the kick-start for two clinical trials.

In the first, quadriplegic patients are implanted with a custom-designed ECoG grid for up to 30 days. The first subject was able to obtain consistent three-dimensional cursor control using a 3D visual environment. He was also able to successfully control a robotic arm. Additional subjects have also successfully achieved cursor control in a 3D virtual environment and control of a robotic arm. The initial work was funded by the Cortical Control of a Dextrous Prosthetic Hand study funded by National Institute of Neurological Disorders and Stroke (NINDS) and Andrew B. Schwartz, PhD (Department of Neurobiology) was the principal investigator.

A second study utilizes microelectrode arrays that penetrate the surface of the brain. This study is funded by the Defense Advanced Research Projects Agency (DARPA) and is part of the Revolutionizing Prosthetics Program, Phase 3 study for which Michael L. Boninger, MD, former chairman of the Department of Physical Medicine & Rehabilitation, is the principal investigator. In the study, two 96-channel electrode arrays were implanted into the brain of a quadriplegic individual. This study participant was able to obtain control of up to 10 degrees of freedom. Using seven degrees of freedom, she has been able to utilize the robotic arm to perform standardized rehabilitation tasks, such as placing objects on a shelf. Once FDA approval was obtained, she was able to interact personally with the robotic arm and was able to grasp a food item and feed herself. As part of the Revolutionizing Prosthetics Program, Phase 3 study, investigators also obtained FDA approval to place stimulating arrays in conjunction with recording arrays in anticipation of adding sensory feedback to the control of the robotic arm. A second subject was implanted with two recording arrays in motor cortex and two stimulating arrays in sensory cortex. This subject was able to experience a natural-like sense of touch when the fingers of the robotic arm were stimulated by touch. In sensory tests, he was able to correctly identify which finger was touched while blindfolded.

The success of these early studies has led to additional collaborations. The first collaboration is funded by a $7 million NIH grant (Michael Boninger, MD, Physical Medicine and Rehabilitation) to expand our research team to include the University of Chicago. We join Sliman Bensmaia, PhD, and Nicholas Hatsopoulos, PhD, to expand our research efforts with the goal of restoring hand function in patients with paralysis. The second new collaboration is funded by a $1.2 million NIH award (Jennifer Collinger, PhD, Physical Medicine and Rehabilitation) to better understand the underlying neural activity of reaching and grasping. We will be collaborating with University of Pittsburgh researchers, Aaron Batista, PhD, and Patrick Loughlin, PhD, from the Swanson School of Engineering, and Carnegie Mellon researchers Steven Chase, PhD, and Byron Yu, PhD, from the College of Engineering.

Neuroprothetics and spinal cord stimulation expert Marco Capogrosso, PhD—director of the department's Spinal Cord Stimulation Laboratory—provides unparalleled support through his research efforts in spinal cord injury (SCI) and limb motor control.

In June of 2021, the program was awarded a $6.37 million National Institutes of Health grant to study how population dynamics in motor cortex change with behavioral context and how they are shaped by sensory feedback. Through this proposal, researchers hope to gain a better understanding of how motor cortical activity generalizes across static and dynamic behaviors as well as the potential to drive plasticity within cortical circuits that communicate sensorimotor information, which has relevance for understanding skill learning and improving rehabilitation after injury.

As research in spinal cord injury continues, Dr. Capogrosso is also working with Peter Gerszten, MD, and Robert Friedlander, MD, to verify if SCS should not only be seen as a therapy for SCI alone, but more generally as an intervention to tackle dysfunction of the corticospinal tract-motoneuron-sensory afferent circuit in the spinal cord, the building block of movement. They have subsequently started two parallel clinical trials: the first is to explore the effects and mechanisms of SCS for the recovery of upper limb motor control after stroke and the second trial is exploring the effects and mechanisms of SCS for the treatment of motor deficits in patients with spinal muscular atrophy, a genetic disease of the Ia-motoneuron system. The group recently reported the preliminary findings of their stroke trial demonstrating that SCS improved strength, dexterity, and motor control in the first two participants suffering from moderate and severe chronic stroke. While they continue to collect data on preliminary safety and efficacy in both trials, they are simultaneously conducting a battery of imaging and electrophysiology tests in order to study the mechanisms of SCS outside the application of SCI. Drs. Capogrosso, Friedlander and Gerszten hope to be able to show that SCS is a disease modifying intervention for dysfunctions of the spinal sensorimotor units and, therefore, could be applied to a variety of disorders of this simple but critical neural unit in motor control. Hopefully, this research program will contribute to the global efforts to defeat paralysis in all its forms.

Center for Image-Guided Neurosurgery

The Center for Image-Guided Neurosurgery (CIGNS) directed by Constantinos Hadjipanayis, MD, PhD, incorporates the expertise of individuals in neurosurgical oncology, Gamma Knife stereotactic radiosurgery, stereotactic and functional neurosurgery, neuro-oncology, radiation oncology, and neuroradiology. Ajay Niranjan, MD, MBA, is associate director of the center and L. Dade Lunsford, MD, is director emeritus. The goal of the center is to provide quality patient care using minimal access or minimally invasive stereotactic and radiosurgical technology, MRI-guided focused ultrasound, and image-guided brain tumor surgery that includes fluorescence-guided surgery, use of a robotic-assisted exoscope, and endoscopic colloid cyst removal.

The CIGNS is a leader in advanced imaging of the brain that incorporates magnetoencephalography (MEG). In 1981, the center was the first U.S. center to install a dedicated computed tomography (CT) scanner in a unique stereotactic operating room suite. The CIGNS was also the first North American center to initiate a clinical program for Gamma Knife stereotactic radiosurgery in 1987 and continues to be an international leader in this field. Currently, two Gamma Knife units are located at UPMC Presbyterian, one of the few clinical sites in the world with two clinical units. In 2024, the center upgraded one of its units to the latest generation Gamma Knife, Esprit, which incorporates advanced robotics, expands the role of radiosurgery to include cranial vertebral junction targets, provides greater patient access, and enhances patient safety. Both the existing ICON® Gamma Knife and the new Esprit system incorporate a cone beam CT imaging system to facilitate a mask stereotactic fixation system for selected patients.

Gamma Knife technology represents one of the most advanced and minimally invasive methods to treat patients with brain tumors, skull-based tumors, arteriovenous malformations (AVMs), and pain or movement disorders. Over 18,000 patients have undergone Gamma Knife stereotactic radiosurgery at UPMC Presbyterian since 1987. In addition, spinal radiosurgery using several radiosurgical systems is offered under the direction of neurosurgeon Peter Gerszten, MD, who serves as the Peter E. Sheptak Endowed Professor at the University of Pittsburgh.

In 2024, the CIGNS will incorporate a new therapeutic device to its armamentarium for disorders of the brain that incorporates focused ultrasound and use of a sophisticated new MRI. The minimally invasive and incisionless technology termed, ExAblate Neuro, will be the first focused ultrasound system in western Pennsylvania. This device represents the next generation of image-guided neurosurgery and is FDA-approved for lesional thalamotomy for essential tremor. The new focused ultrasound technology will also be used in research studies for patients with brain tumors in combination with novel therapeutic agents. The ExAblate Neuro system will be used in research studies with Alzheimer's and epilepsy patients as well. Jorge González-Martínez, MD, PhD, will be actively treating patients with the ExAblate Neuro system for essential tremor in addition to Drs. Hadjipanayis and Niranjan who will be engaged in research studies on brain tumors.

A major focus of the CIGNS is sophisticated imaging of the brain to localize important functions of the brain (speech, motor, vision, and sensory functions). In 2021, UPMC installed the new MEGIN TRIUX® Neo magnetoencephalography (MEG) unit to perform functional brain mapping in patients with brain tumors, epilepsy, trauma, and degenerative brain disorders. The MEG is routinely used in the CIGNS for presurgical planning and determination of important regions of the brain to avoid for safer surgery by our neurosurgical oncologists and epilepsy surgeons. Dr. Niranjan is the operations director of MEG and Andre Pereira is the lead technologist. He continues to pursue cutting edge MEG research that seeks to develop more specific paradigms to pinpoint the anatomic areas of speech, visual, motor, and sensory function.

The Center for Image-Guided Neurosurgery is an international training site for radiosurgery and minimally invasive neurosurgery, holding six week-long training courses per year. Over the last 20 years, more than 2,500 neurosurgeons, neuro-otologists, radiation oncologists, medical physicists, and nurses have trained at this center. These courses are among the highest rated post-graduate courses offered at the University of Pittsburgh. In 2015, the center opened a new state-of-the-art education and training facility equipped with the latest generation high-definition display systems. In July of 2020—during the early COVID pandemic—the center offered online Gamma Knife training courses. Course participants from around the world become "temporary" students at the University of Pittsburgh for one week. Instruction is possible using more than 35 lectures, videos, and course materials. Hands on training in collaboration with Elekta, Inc. allows students to turn their personal computers temporarily and remotely into radiosurgery planning workstations. Students can now study radiosurgery effectively, avoiding the transportation and housing costs involved with national or international travel.

CIGNS also participates in the training of selected fellows who compete for the Leksell Gamma Knife Society three-month fellowship in Pittsburgh. Finally, neurosurgery residents at UPMC spend a three-month dedicated block for study during their third year of training to complete certification in brain radiosurgery, typically participating in more than 150 cases during the rotation.

In addition, the center conducts numerous clinical, long-term outcome research projects (typically producing 20+ peer reviewed publications each year). CIGNS is the coordinating center for the International Radiosurgery Research Foundation (IRRF), a multi-institutional international clinical consortium of centers of excellence performing stereotactic radiosurgery. The IRRF currently has

members from the United States, Asia, Africa, Europe, and Asia. Multiple retrospective clinical trials have been published or are underway. More than 10,000 articles have now been published worldwide in the field of stereotactic radiosurgery. The University of Pittsburgh has the highest number of studies, having been cited more than 100 times.

Each year, more than 600 patients undergo Gamma Knife radiosurgery at the CIGNS, making it one of the busiest centers in the world. Each year, center faculty publish approximately 20 clinical research studies, now exceeding more than 700 combined peer reviewed publications and over 1,400 publications when book chapters and presentations are included.

In 2022, the third edition of *Intracranial Stereotactic Radiosurgery* was released by CRC Press, with Dr. Lunsford, and Jason Sheehan, MD, co-director of the Gamma Knife Center at the University of Virginia—and former fellow at the University of Pittsburgh—serving as editors.

More than 100 U.S. or international fellows have received training at this center since 1987. The center provides an opportunity for advanced training in image-guided stereotactic and functional surgery at the fellowship level. The CAST-approved fellowship has two tracks, one for candidates interested in a functional focus (movement disorders, pain, and epilepsy with study supervised by Dr. González-Martínez) and one for candidates focusing on neurosurgical oncology and radiosurgery (supervised by Drs. Hadjipanayis, Lunsford and Niranjan). The functional track includes epilepsy and movement disorder experience plus three months on the radiosurgery service. The radiosurgery track includes nine months on the radiosurgery service and three months on the functional service. Currently, all PGY-3 residents spend three months each on the Gamma Knife service each year. In addition, there is now a CAST-accredited neurosurgical oncology fellowship incorporates GK radiosurgery into the curriculum in addition to surgical resection of primary brain, skull-based, and spinal tumors at UPMC Presbyterian Shadyside.

The multidisciplinary Center for Image-Guided Neurosurgery includes the clinical and research efforts of radiation oncologists John Flickinger, MD; Serah Choi MD, PhD; Christopher Wilke, MD; Andrew Zureich, Yoshio Arai, MD; and Susan Rakfal, MD. The participating medical physics group consists of Greg Bednarz, PhD, and Kelin Wang, PhD. The APPs include Lana Trofimova, PAC, and Louisa Urgo Shin, PAC, who provide patient care assistance for the CIGNS program. Five full-time dedicated, and very talented, nurses headed by Miranda Crum, BSN, and assisted by RNs Mark Geminetti, Zarina Corwin, Kristen Jeannette, and Brenda Unghajer who provide pre, intra, and post radiosurgery care to more than 600 patients every year. They are all especially trained in conscious sedation techniques to provide comfort and attentive care to our patients.

Kelly Powell, Dana Adams, and Julie Martin are an extremely capable administrative team that ensures prompt patient approvals and care.

Neurosurgical Oncology Program

The University of Pittsburgh Department of Neurological Surgery Brain Tumor Program—led by Costas Hadjipanayis, MD, PhD; Kalil G. Abdullah, MD; James Bayley, MD; and Pascal Zinn, MD, PhD—is comprised of a multidisciplinary team of researchers, physicians, and healthcare professionals dedicated to conducting cutting-edge research, delivering state-of-the-art clinical care, and developing innovative treatments for brain tumor patients. The program is one of the largest clinical and most productive basic/translational brain tumor programs in the country, encompassing research across the adult and pediatric brain tumor science spectrum and supported heavily in funding from the National Institutes of Health and other generous foundations.

One of our program's key strengths lies in its collaborative approach. Researchers and clinicians from diverse fields, including neurosurgery, radiation oncology, neuro-oncology, neuropathol-

ogy, and neuroradiology, work together to tackle the complex challenges associated with brain tumors. This multidisciplinary collaboration fosters a comprehensive understanding of brain tumor biology, enables faster translation of discoveries into clinical practice, and ultimately improves patient care with clinical trials.

As an international referral program for adult brain tumors, the program ranks among the top programs in the nation. Faculty members provide consultation and guidance for local, national, and international referrals. Patients with both primary brain and spine tumors and metastatic tumors are seen in the UPMC Hillman Cancer Center multidisciplinary clinics that include representation from neurosurgery, medical neuro-oncology, and radiation oncology. A weekly multidisciplinary neuro-oncology tumor board is a forum for a team of specialists to review patient problems and to formulate management recommendations. The tumor board draws from the expertise of the neurosurgery, neurology, radiology, neuropathology, and radiation oncology faculty at UPMC. Similarly, there is a weekly skull base tumor board with involvement from otolaryngology/head and neck cancer specialists, neuro-ophthalmology, radiology, and adult neurosurgery. Education, support, and counseling for family members are important parts of our program.

Neurosurgical oncology care at the University of Pittsburgh Department of Neurological Surgery includes subspecialized neurosurgeons providing the best treatments available for patients with both benign and malignant tumors of the brain and spine. Neurosurgical oncologists are dedicated to discovering novel and effective therapies for these diseases through clinical trials and translational bench-to-bedside trials based on scientific breakthroughs developed in our laboratories.

Neurosurgical oncology at UPMC is one of the most robust and innovative programs in the world, with one of the largest volumes of patients treated on an annual basis. The program has been a leader in the implementation of cutting-edge technologies such as stereotactic radiosurgery (SRS) using the Gamma Knife, LINAC-based stereotactic radiosurgery, and image-guided brain tumor resection. Important new and innovative technologies such as the robotic-assisted surgical exoscope, MR-guided laser interstitial thermal therapy (LITT), and fluorescence-guided surgery (FGS) are routinely employed within our brain tumor program. The use of advanced imaging modalities, such as high-definition white matter fiber tract imaging (tractography) and magnetoencephalography (MEG), has also facilitated better outcomes for selected patients with tumors. In addition, awake craniotomy techniques with brain mapping tumor are routinely used to maximize safe removal of brain tumors.

An important multidisciplinary effort towards enhancing the workflow for complex awake brain tumor surgery at UPMC includes the addition of pre-, intra-, and postoperative neuropsychological testing by Natalie Sherry, PhD, and Luke Henry, PhD. Preoperative functional imaging, including magnetoencephalography (MEG), led by Ajay Niranjan, MD, director of the UPMC Brain Mapping Center, as well as intraoperative high-definition fiber tracking (HDFT) by Frank Yeh, PhD, director of the High-Definition Fiber Tractography Lab, have permitted the identification of important functional pathways in the brain to avoid during brain tumor surgery. The integration of our world class intraoperative neuromonitoring program led by Parthasarathy Thirumala, MD, along with, Jeffrey Balzer, MD, Katherine Anetakis, MD, and Donald Crammond, PhD, permits maximal safe removal of brain tumors.

Our medical neuro-oncology team is an important component of our patient care efforts and is comprised of four active neurooncologists led by Jan Drappatz, MD, and including Frank Lieberman, MD, Megan Mantica, MD, and Jeremy Rich, MD. This team provides outstanding care to our brain tumor patients, and has multiple clinical trials open to accrual at the UPMC Hillman Cancer

Center. The neuro-oncology team is also actively studying other neurological complications of systemic cancer and its treatment, including stroke, neurobehavioral disorders, neurological complications of chemotherapy and/or radiation therapy, and paraneoplastic neurological syndromes.

Our radiation oncology program, led by John Flickinger, MD, Christopher Wilke, MD, Andrew Zureick, MD, and Serah Choi, MD, provides comprehensive expertise in clinical care of a wide spectrum of benign and malignant diseases affecting the brain and spine. The leading-edge treatments used include Gamma Knife radiosurgery, LINAC based stereotactic radiosurgery, radiation therapy using a variety of technological treatment planning including 3D conformal radiation therapy and intensity modulated radiation therapy (IMRT). In collaboration with Peter Gerszten, MD, spine stereotactic body radiation therapy (SBRT) is used to treat patients with oligometastatic, and previously irradiated spinal metastases. This therapeutic approach offers a treatment option in situations where no viable options were previously available.

Another notable aspect of our brain tumor program is its commitment to education and training. The University of Pittsburgh provides robust training opportunities for aspiring neurosurgeons, neuro-oncologists, and researchers, fostering the development of the next generation of brain tumor specialists. A new CAST-approved neurosurgical oncology fellowship is now available for trainees. We also offer fellowship training in medical neuro-oncology. The fellowship is accredited through the United Council for Neurologic Subspecialties, directed by Megan Mantica, MD, and supported through a generous donation by the Karp family, in memory of Henry “Hank” Karp. It aims to inspire future neuro-oncologists to lead research and care innovations in the U.S. and around the world. This dedication to education helps to build a strong foundation for future advancements in brain tumor research and treatment.

Overall, the Brain Tumor Program at the University of Pittsburgh Department of Neurological Surgery has established itself as a leading center for brain tumor research and clinical care. Its multidisciplinary approach, ground breaking research, innovative treatments, and commitment to education make it a beacon of hope for patients and a driving force in advancing our understanding and management of brain tumors.

Pediatric Neurosurgery

The Pediatric Neurosurgery Division at UPMC Children’s Hospital of Pittsburgh (CHP) is led by Taylor Abel, MD, and also includes Ian Pollack, MD, Robert Kellogg, MD, Michael McDowell, MD, and Martin Piazza, MD. The division provides care for children with tumors, spinal and cranial deformities, vascular malformations, spasticity, epilepsy and peripheral nerve disorders. The division has gained international recognition for the treatment of pediatric brain tumors, epilepsy, neurovascular surgery, cerebral palsy and movement disorders, traumatic brain injury, and disorders of the skull base and cranio-cervical junction.

The center’s neurosurgeons work closely with specialists in pediatrics, surgery, radiation therapy, pediatric neuro-oncology, physical therapy, orthopedics, plastic surgery, otolaryngology, critical care, pediatric neurology and social services. Through its neuro-oncology program, the center provides comprehensive, multi-disciplinary care for patients with brain and spinal cord tumors, in collaboration with the oncology and radiation therapy programs. Patients may be eligible for treatment in one of many innovative research protocols at CHP. These protocols—several of which are unique to CHP or available at only a few centers throughout the country—provide CHP patients access to new treatments and promising studies.

The pediatric neurosurgery program is supported by five full-time advanced practice providers, which—along with an extensive telemedicine presence—has enabled expansion of the divi-

sion's outreach program to multiple communities beyond our immediate geographic area. Our research initiatives are also supported by four full-time research coordinators, allowing us to maintain a broad array of clinical studies to place our site on the cutting edge of pediatric neurosurgery patient care, while advancing the field in general.

• Pediatric Brain Tumor Program

Dr. Pollack is the institutional principal investigator and chair of the neurosurgery committee in the Pediatric Brain Tumor Consortium, supported by the National Cancer Institute to perform cutting-edge clinical trials in children with brain tumors, and serves as the principal investigator on several studies involving vaccine-based immunotherapy for children with challenging brain tumors. The clinical program at CHP has been enhanced by the completion of an intraoperative MRI suite, which facilitates the goal of achieving safer and more extensive resections in challenging childhood brain tumors and allowing immediate postoperative imaging without the need for a second anesthetic.

These clinical advances are coupled with a robust and rapidly growing research enterprise, encompassing a state-of-the-art pediatric brain tumor bank, as well as a series of eight NIH R01, P01, and R21-funded research projects, and a cadre of rising-star investigators, including Sameer Agnihotri, PhD, Gary Kohanbash, PhD, Baoli Hu, PhD, and Antony MichealRaj, PhD. These activities build upon the division's existing strength in experimental therapeutics and immunobiology, with a goal of developing the next generations of precision-medicine-based clinical trials.

• Pediatric Epilepsy Surgery Program

The Pediatric Epilepsy Surgery Program, led by Dr. Abel and William Pequignot Welch, MD, of the University of Pittsburgh Department of Pediatrics, is the only center in the region able to provide comprehensive epilepsy surgery evaluation and performs more than 120 epilepsy surgeries each year. A comprehensive pre-surgical evaluation, using state-of-the-art neuroimaging and electrophysiology resources, is performed to identify the specific site in the brain causing seizures and to determine its relationship to important functional areas of the brain. Patients with focal epilepsy can be treated with the full range of treatment options including lesionectomy, cortical resection, lobar resection, or hemispheric disconnection—with or without a period of direct cortical recordings (i.e., SEEG or subdural grid electrodes) to elucidate epileptic cortex. The surgical epilepsy program is equipped with both a ROSA robot and O-Arm intraoperative CT scanner, which enables frameless robot-assisted SEEG implantation. Approaches are tailored to minimize the use of craniotomies when possible. The program is one of the highest volume centers for both pediatric MR-guided laser ablation and pediatric responsive neural stimulation (RNS) in North America. For children with drug-resistant multi-focal or generalized epilepsy, all available treatment procedures are available, including MR-guided laser callosotomy, traditional callosotomy, vagus nerve stimulation, centromedian RNS, and deep brain stimulation. A multidisciplinary epilepsy surgery clinic provides streamlined, comprehensive evaluation of children with drug-resistant epilepsy for surgery.

Dr. Abel's basic research program focuses on understanding the neural basis of complex natural sound perception. This effort is funded by multiple federal grants, including funding from NINDS, NIDCD, and NSF. The epilepsy surgery program's clinical research efforts, also directed by Dr. Abel, focus on comparative effectiveness of different epilepsy surgery strategies, and is funded by both PCORI and industry.

• Pediatric Spasticity and Movement Disorder Program

The Pediatric Spasticity and Movement Disorder Program is involved in cutting edge clinical and basic research focused on developing and applying new and improved treatments for children with movement disorders. Dr. Kellogg manages this aspect of the practice and participates in

The Spasticity and Movement Disorders Clinic that is held weekly. This clinic is made up of a team of pediatric medical professionals who specialize in the comprehensive, multidisciplinary evaluation and treatment of children and young adults with spasticity and other movement disorders, such as cerebral palsy, spasticity, dystonia, chorea, athetosis and tremor. The purpose of the clinic is to determine whether a patient would benefit from treatment with oral medications, intrathecal baclofen, selective dorsal rhizotomy, intramuscular botox injection, deep brain stimulation, orthopedic procedures, or other therapies. Additionally, the division offers intraventricular baclofen pumps, which is a therapy pioneered at UPMC Children's Hospital of Pittsburgh by A. Leland Albright, MD, that has been revived with the addition of Dr. Kellogg. With the ROSA robot and O-Arm, asleep frameless stereotactic deep brain stimulation is available for children with dystonia and other movement disorders requiring neuromodulation.

• Craniofacial Program

The division is an integral collaborator in the Cleft-Palate and Craniofacial Center in the management of children with craniofacial disorders. Because children with complex craniosynostosis often require a staged approach to the treatment of their cranial, midfacial and lower facial deformities, close multidisciplinary follow-up is maintained throughout childhood to adolescence in order to optimize long-term functional and cosmetic outcome. The center offers a panoply of surgical options, ranging from innovative endoscopic techniques that have been refined at CHP, as well as a broad range of open approaches carefully tailored to the child's anatomy.

• Congenital Neurosurgery Program

In conjunction with a team of specialists at UPMC Magee-Womens Hospital, the division has established a program to treat babies with myelomeningocele, or open spina bifida, with in utero surgery here in Pittsburgh. Babies who are not candidates for in utero surgery undergo conventional closure of the defect within several days of birth. These children are seen throughout childhood by a multidisciplinary team of medical professionals in the Spina Bifida Clinic at Children's Hospital of Pittsburgh, one of the largest such clinics in the country. Expectant mothers are referred by the Fetal Diagnosis and Treatment Center at UPMC Magee-Womens Hospital for counseling in the pediatric neurosurgery clinic if prenatal imaging reveals a potential neurosurgical abnormality. The division collaborates with maternal-fetal medicine experts at UPMC Magee-Womens Hospital as co-PI on multiple grants to study in utero treatment of congenital aqueductal stenosis, a common cause of hydrocephalus.

The Brachial Plexus Birth Injury Clinic—run through the division of pediatric plastic surgery—manages infants with birth injuries to the brachial plexus in a collaborative fashion with specialists from neurosurgery, plastic surgery, orthopedic surgery, and physical and occupational therapy. UPMC Children's Hospital of Pittsburgh is one of a handful of centers in the country that have a dedicated multidisciplinary clinic for these patients and is the only such program in the region. Older patients with peripheral nerve tumors or injuries are seen outside of the Brachial Plexus program.

UPMC Children's Hospital of Pittsburgh is a member of the Hydrocephalus Clinical Research Network, a group of 11 premier pediatric neurosurgical departments in North America that are dedicated to designing and undertaking field-changing prospective research into pediatric hydrocephalus. In addition, CHP is also a member institution in the Park-Reeves Syringomyelia Research Consortium, a group dedicated to solving important clinical problems within the realm of Chiari malformation and syringomyelia. These efforts have led to dozens of publications that have helped to advance the field in collaboration with other consortium sites.

• Skull Base Surgery Program

More recently, the division has added Dr. McDowell to our team, who brings particular expertise in the management of cranial base anomalies, after completing both endoscopic cranial base and pediatric neurosurgical fellowships. With this unique combination of skill sets, he is joined by the other members of the internationally acclaimed UPMC Center for Cranial Base Surgery in proving unmatchable care for disorders of the pituitary gland, skull base, and cranio-cervical junction. Dr. McDowell also brings research expertise in near infrared spectroscopy (NIRS) as a noninvasive way of monitoring brain function and intracranial pressure. He recently received the 2021 Hydrocephalus Association Award for his ground breaking work that may soon have wide-reaching applications for disorders of intracranial pressure include trauma, Chiari malformation, craniosynostosis, and hydrocephalus. A large-scale clinical trial is underway to validate this technology in children and adults with neurosurgical conditions.

• National and International Leadership in Pediatric Neuroscience

Finally, our division members maintain an active role in organized neurosurgery and allied fields. In addition to his consortium involvement, Dr. Pollack serves as chair of the American Board of Pediatric Neurosurgery, a director on the Accreditation Council for Pediatric Neurosurgical Fellowships, and a principal investigator with the Children's Brain Tumor Network. Dr. Abel serves on the board of directors for the Pediatric Epilepsy Alliance. Dr. Abel also serves on board of directors of the American Epilepsy Society where he is chair of the American Epilepsy Society membership council. Dr. Abel serves on multiple committees in the American Epilepsy Society and AANS/CNS Section on Pediatric Neurosurgery, including the AES Membership Council, the AES Neurosurgery Task Force, and is the founding chair of the AES Early Career Committee. Dr. Abel also serves on the AANS/CNS Joint Guidelines Committee. Dr. McDowell is the chair of the Young Neurosurgeons Committee of the AANS/CNS Section on Pediatric Neurosurgery and the course director of the acclaimed "Brain and Blade" course for pre-clinical medical students, for which he was awarded the 2021 University of Pittsburgh Dean's Distinguished Teaching Award.

Pituitary Center

Over the past two decades, there has been a dramatic shift in the standard of care for pituitary surgery with the introduction of endoscopic techniques. The UPMC Center for Skull Base Surgery has been a pioneer and leader in the development of these techniques and has performed over 4,000 endoscopic endonasal skull base procedures. As part of this effort, since the introduction of the endoscopic endonasal approach, more than 1,600 pituitary surgeries have been performed at the UPMC Pituitary Center, and our surgical team, consisting of Paul Gardner, MD, and Georgios Zenonos, MD, from neurosurgery, and Carl Snyderman, MD, MBA, and Eric Wang, MD, from otolaryngology, currently performs more than 100 operations for pituitary tumors every year. The Pituitary Center of Excellence is led by a dedicated neuro-endocrinology team of Pouneh K. Fazeli, MD, (director), Hussain Mahmud, MD, and Esra Karslioglu-French, MD who specialize in the medical treatment of patients with pituitary tumors and pituitary-related hormone deficiencies or over-production.

Numerous studies now show better outcomes and lower complication rates in centers with more experienced pituitary surgeons. This experience–outcome effect is likely more pronounced in complex cases such as invasive adenomas, reoperations for recurrent adenomas, giant pituitary adenomas, Cushing's disease, and acromegaly.

As a result, the Pituitary Society has proposed consensus criteria for pituitary centers of excellence (PCOEs), including a baseline requirement of 50 surgical cases per year. In addition, multidisciplinary care via a center of excellence model has been espoused and its advantages well described, even leading to a call for accreditation for PCOEs. Based on the above, combined with UPMC's long-standing expertise and major role in the development of endoscopic pituitary

surgery, it is logical that UPMC create a system-wide pathway of care for pituitary tumors. This has led to formation of official pituitary center of excellence criteria within UPMC and recognition of COE status for our skull base center surgeons. The Pituitary Center of Excellence tracks and maintains specific criteria for clinical care, ensuring low complication rates and excellent overall outcomes. In addition, in conjunction with co-surgeon/pediatric neurosurgeons, the Center for Skull Base Surgery is the only group with expertise in pediatric skull base surgery and performs pediatric pituitary surgeries at UPMC Children's Hospital of Pittsburgh in collaboration with pediatric neurosurgical tumor specialist, Michael McDowell, MD.

All physicians on the current pituitary COE team are subspecialty trained. The UPMC Pituitary Center is a multidisciplinary team which includes: neurosurgery, endocrinology, otolaryngology, neuro-ophthalmology, neuroradiology/head and neck radiology, endovascular neurosurgery, radiation oncology (including Gamma Knife radiosurgery), neuroanesthesia, neuro-oncology, and neuropathology. As one of the leading centers for pituitary tumors worldwide, our triple mission is to provide comprehensive care and support to patients with pituitary disorders; to provide residency and fellowship training, as well as continuing medical education in the management of pituitary and neuroendocrine disease; and to contribute to basic science and clinical research in pituitary disorders. As a result of this collaboration, UPMC has become a regional, national and international center for referral.

Spine Services Division

The Neurosurgical Spine Services Division at the University of Pittsburgh is a multidisciplinary organization composed of specialists in the fields of physical therapy, physical medicine and rehabilitation, interventional neuroradiology and neurological spine surgery. Specialists from these fields work together as a unified group to provide the highest quality care for patients and athletes who have spine injuries, painful disc conditions, neck, arm, back or leg pain.

D. Kojo Hamilton, MD, is the director of the Neurosurgical Spine Services Division and chief of spine at UPMC Presbyterian. David O. Okonkwo, MD, PhD, leads the spine trauma and spinal deformity program and Dr. Hamilton provides specialty care in the treatment of cervical misalignment and spinal deformity. Peter C. Gerszten, MD, MPH, leads the percutaneous and spine radiosurgery programs. Thomas J. Buell, MD, joined the division in 2022 with an expertise in complex spine deformity cases and spine oncological surgery. Nitin Agarwal, MD, joined the division in 2023 and leads the division's minimally invasive spine and robotics surgery program.

The Neurosurgical Spine Services Division offers comprehensive care for all types of spinal disorders, including degenerative, traumatic, and oncologic conditions. The initial treatment approach is typically non-surgical, with surgical options reserved for patients with recurrent or disabling symptoms and/or progressive deficits. Complete diagnostic testing of all spinal and nerve disorders is available through the center.

The spinal deformity program, led by Dr. Okonkwo, offers full-scale analysis, longitudinal tracking and treatment interventions for patients with scoliosis and thoracolumbar spinal deformity. The team of deformity practitioners continues to push the surgical envelope and combines unique skill sets to provide each and every patient with the least invasive yet maximally effective treatment options.

Dr. Hamilton correspondingly treats complex cervical deformity, such as swan neck and chin-on-chest disorders, in addition to thoracolumbar scoliosis, oncologic and degenerative spine conditions. Dr. Buell, who completed advanced training in complex spine surgery at the University of Virginia and Duke University, is a prolific academician poised to make significant contributions to this subspecialty.

The spine radiosurgery program, led by Dr. Gerszten, is one of the most experienced centers in the world in treating a wide variety of benign and malignant spine and paraspinal tumors that has proven highly effective, safe, and painless, and avoids many of the risks associated with open surgery.

Within the division is the Center for Surgical Pain Management led by John J. Moossy, MD. This program provides a variety of surgical options for the management of medically intractable pain syndromes. The range of treatment varies from neuroaugmentation (i.e., spinal cord stimulation and intrathecal opioids) to surgical decompression (with or without spinal fusion) to ablative neurosurgery.

The Neurosurgical Spine Services Division works together as a unified team, utilizing a multidisciplinary approach to maximize patient care and outcomes. An array of research studies and protocols are employed to deliver unsurpassed treatment strategies, ensuring that patients receive the best state-of-the-art care in the country.

Additionally, the division hosts a quarterly Spine and Scoliosis Patient Support Group meeting designed to offer a supportive and educational environment for patients and their families facing the challenges brought on by spinal disorders. The meetings feature specialists from neurosurgery, orthopedics, physical therapy, pain management, psychiatry, and community partners, enabling patients and their loved ones to inquire about their conditions and their psychological and physical implications.

Accomplishments and Highlights for Fiscal Year 2023-24

July 2023

- Medical education program coordinator Melissa Lukehart was recognized as UPMC GME Well-Being Champion of the Year. The award recognizes Lukehart as a role model in promoting a healthy work culture and showing enthusiasm for improving the work environment.

- An article discussing telemedicine and the evolution of real-time remote intraoperative neurophysiological monitoring co-authored by Jeffrey Balzer, PhD, Julia Caviness and Don Krieger was selected for the cover of the journal *Computer.*
- Work by Kalil Abdullah, MD, and colleagues—discussing the potential of targeting nucleotides, the building blocks of cancer cells—was selected for the cover for *Trends in Cancer*.
- A patient who suffered a life-threatening stroke and underwent lifesaving surgery by Bart Thaci, MD, was featured on abc27-TV (Harrisburg, Pa.).

August 2023

- Taylor Abel, MD, and David Zorub, MD, were named winners of UPMC's Excellence in Patient Experience Award.
- D. Kojo Hamilton, MD, was named recipient of the 2023 UPMC Physician Excellence Award: UPMC Physician Excellence in Leadership.
- Nitin Agarwal, MD, was awarded the Scoliosis Research Society's 2023 Emerging Technologies Fellowship. The fellowship allows a surgeon to spend 2 to 3 weeks participating in a spine traveling program.
- Marco Capogrosso, PhD, and Peter Gerszten, MD were featured in *PittMed Magazine* for spinal cord stimulation research in restoring hand and arm function after paralysis.

September 2023

- The University of Pittsburgh Departments of Neurology and Neurological Surgery and the Division of Neuropathology were awarded a five-year NIH NINDS R25 Research Education Grant to help advance academic research careers in the neuroscience fields. The grant will fund the Neurology, Neurosurgery, and Neuropathology Pittsburgh Research Education Program (N3-PREP) training the next generation of physician-neuroscientists in basic science, translational science, data science, and patient-oriented research through a closely mentored approach.
- The University of Pittsburgh neurological surgery residency program was ranked #7 in the country for best clinical training in a recent survey of 30,000 U.S. physicians conducted by Doximity, a national physician network created to help healthcare professionals grow and collaborate.

- Marco Capogrosso, PhD, was the featured speaker at the University of Pittsburgh's popular Senior Vice Chancellor's *12@12 Research Seminar Series* providing a talk on "Paralysis, Spinal Circuits, and Restoration of Motor Control."

October 2023

- Marco Capogrosso, PhD, received the 2023 Young Investigator Award from the Society of Neuroscience.

- Anthony Schulien, MD, took home the best resident presentation award at the 17th Annual Stuart Rowe Society Lectureship and Resident Research Day. Hansen Deng, MD, received runner-up honors.

November 2023

- Taylor Abel, MD, was interviewed on WDTV-TV (Bridgeport, W.Va.) talking about the advanced epilepsy care available at UPMC Children's Hospital of Pittsburgh.
- Joseph Maroon, MD, was a guest on KATU-TV's (Portland, Ore.) *Afternoon Live* discussing migraine headache treatment options.
- Marco Capogrosso, PhD, and Peter Gerszten, MD, were featured in the *Pittsburgh Tribune-Review* discussing the encouraging results in their pilot spine stimulation stroke study.

January 2024

- Costas G. Hadjipanayis, MD, PhD, was conferred as the inaugural incumbent of the L. Dade Lunsford Endowed Chair at the University of Pittsburgh. The chair is named after the world-renowned expert in stereotactic radiosurgery, L. Dade Lunsford, MD, who brought the first Gamma Knife in North America to the University of Pittsburgh in 1987 and established the university as an international leader for stereotactic radiosurgery treatment, education and research for over 40 years.

February 2024

- Daryl Pinion Fields II, MD, PhD, was appointed to the board of trustees at Point Park University. He was also featured in a *Pittsburgh Post-Gazette* article detailing his journey from firefighter to medic to neurosurgeon to trustee while helping a new generation of students get through their college years.
- A new era began at UPMC and the University of Pittsburgh as the Center for Image-Guided Neurosurgery treated their first patient with the new state-of-the-art Esprit Gamma Knife.
- A first-of-its-kind clinical trial in the United States to treat glioblastoma was launched at UPMC and the UPMC Hillman Cancer Center, combining intraoperative photodynamic therapy (PDT) with the drug Pentalafen® and the new laser device Heliance®. Costas G. Hadjipanayis, MD, PhD, is a co-investigator on the trial.

- Taylor Abel, MD, was appointed chief of pediatric neurosurgery at UPMC Children's Hospital of Pittsburgh, succeeding long-time chief Ian Pollack, MD.
- Nitin Agarwal, MD, received the 2024 Young Investigator Research Grant Award from AO Spine North America.

March 2024

- Fourteen University of Pittsburgh neurosurgeons were named among the top doctors in the field of neurological surgery in a national survey conducted by Castle Connolly. The list included Brad Bellotte, MD; Matt El-Kadi, MD, PhD; Robert M. Friedlander, MD; Paul A. Gardner, MD; Peter C. Gerszten, MD; Jorge A. González-Martínez, MD, PhD; Costas G. Hadjipanayis, MD, PhD; D. Kojo Hamilton, MD; L. Dade Lunsford, MD; Vincent J. Miele, MD; David O. Okonkwo, MD, PhD; Ian F. Pollack, MD; Daniel A. Wecht, MD, MSc; and Pascal Zinn, MD, PhD.
- Marco Capogrosso, PhD, was featured on the *American Medicine Today* podcast talking about his revolutionary research giving hope to stroke victims in restoring movement in their limbs.

- Research fellow Othman Bin-Alamer, MD, was named the Lunsford & Leksell Radiosurgery Award winner by the American Association of Neurological Surgeons.

- Michael McDowell, MD, and Nitin Agarwal, MD, were named to the University of Pittsburgh School of Medicine curriculum committee.

- Paul Gardner, MD, article describing feasibility and surgical exposure of the anteromedial petrous (Gardner's) triangle as a novel corridor to the petrous apex and petroclival region was the cover article for March issue of *Operative Neurosurgery*.

- UPMC launched a new spine care program in central Pennsylvania with a multi-disciplinary team of experts—featuring Department of Neurological Surgery physicians—evaluating and treating a variety of conditions, including spine tumors, scoliosis, back pain, and weakness/numbness in the arms and legs.

April 2024

- A Pascal Zinn, MD, PhD/Hansen Deng, MD, patient with a massive—almost inoperable—spine tumor was featured on WTAE-TV (Pittsburgh) talking about her successful recovery.

- Daryl Pinion Fields II, MD, PhD, was the keynote speaker at Point Park University's commencement ceremony.

- Paul Gardner, MD, was a guest on the *CNS Journal Club* podcast discussing lower cranial nerve schwannomas.

- David Okonkwo, MD, PhD, was interviewed on WPXI-TV (Pittsburgh) talking about a ground breaking, FDA-approved portable blood test—developed at the University of Pittsburgh—that can help detect traumatic brain injuries. Dr. Okonkwo and the revolutionary device also received extensive media coverage across the nation.

- Former Pittsburgh Steeler Ryan Shazier and David Okonkwo, MD, PhD, were guests on *The Athlete Spine* podcast discussing Shazier's traumatic spinal cord injury and the pathology and treatments that led to his incredible recovery.

- A startup team featuring neurosurgeons Michael McDowell, MD, and Ricardo Fernández-de Thomas, MD, as well as medical students Adi Mittal, Benjamin Leslie, Rohita Mantena and Amna Imran, captured the grand prize at the 2024 University of Pittsburgh *Big Idea Competition* for their product, the Malleous, a novel surgical instrument designed to help reduce surgical time. The group had previously been awarded a $25,000 grant from University of Pittsburgh's Center for Medical Innovation (CMI) to help refine and commercialize their device.

- Taylor Abel, MD, was awarded the Philip Troen Excellence in Medical Student Research Mentoring Award from the University of Pittsburgh School of Medicine.

- *The Washington Post* reported on a 'smart' mouthguard, co-developed by Vincent Miele, MD, and colleagues from the Cleveland Clinic, that sends a signal from a player on the field to a physician on the sideline—in real-time—warning of possible head trauma that may change the landscape for in-game concussion protocols.

May 2024

- Joseph Maroon, MD, was featured in a Dow Jones *Market Watch* article that talked about his approach to life and health.

- Taylor Abel, MD, was awarded the 2024 Excellence in Teaching Award from the University of Pittsburgh's Institute for Clinical Research Education, given to a faculty member who has the most impact on students.

- Costas G. Hadjipanayis, MD, PhD, was elected as the new chair of the AANS/CNS Section on Tumors, the largest organized group of neurosurgical oncologists in the world.

- Jeffrey Balzer, PhD, was awarded the Richard Brown Lifetime Achievement Award from the American Society of Neurophysiological Monitoring. The award is the highest honor the ASNM bestows and represents outstanding achievement during the recipient's career supporting and advancing the field through education, research and service.

- Taylor Abel, MD, was a guest panelist on a *U. S. New & World Report* webinar that discussed the advances in diagnosis and treatment for pediatric epilepsy patients.

- Bart Thaci, MD, was a guest on WHP-580 News Radio's (Harrisburg, Pa.) *Taking Care of Business with Michael Parks* discussing the causes of strokes, how they are treated and how to prevent them.

June 2024

- Joseph Hudson, MD, was a guest on the *CNS Journal Club* podcast discusses a *Neuotrauma* journal article investigating the accuracy of AI-generated answers to standard patient questions regarding neurosurgical procedures.

- Helexva—a UPMC Enterprises portfolio company founded by Robert Friedlander, MD—was one of 10 companies to receive 'Startups to Watch' designation by the *Pittsburgh Business Times* based on its exceptional potential.

- The *New England Journal of Medicine* published an in-depth review article, authored by Robert Friedlander, MD, on the signs, symptoms, classification and treatment strategies for Chiari malformation.

- Joseph Maroon, MD, wrote an opinion piece in the *Pittsburgh Post-Gazette* sharing information on the damaging effects marijuana has on the human brain, especially on the developing brains of our youth.

Education Programs

The Department of Neurological Surgery provides medical education in a wide variety of forums at UPMC and the University of Pittsburgh. The faculty contributes to undergraduate and graduate-level education at many sites and to the continuing education of their professional colleagues.

Undergraduate Level
Selected faculty of the Department of Neurological Surgery participate in several undergraduate courses at the University of Pittsburgh. In addition, undergraduate students are offered shadowing opportunities with various faculty members while they evaluate and operate on patients at UPMC. To qualify, an undergraduate student must obtain faculty permission and complete online training courses related to patient confidentiality. Medical students often round with the evening-on-call neurosurgery resident at UPMC Presbyterian in order to get real-life observations of the types of clinical problems encountered, as well as insights into the life of a neurosurgery resident.

Medical Students
Department faculty participate in teaching clinical neuroscience and neuroanatomy to first- and second-year medical students. Several Pitt medical students spend elective time doing clinical research with faculty members from various centers in the department. During their surgery core clerkship, third-year medical students may elect to take a two-week introductory subspecialty experience in neurosurgery.

Selective fourth-year medical students at the University of Pittsburgh, as well as visiting medical students from other schools, may elect to take a four-week clinical subinternship on the neurosurgery services at UPMC, during which they participate in all phases of the training program as well as in supervised patient care services. Typically, each four-week rotation includes experience on cranial, spinal and pediatric neurosurgery.

• Visiting Medical Students
The Department of Neurological Surgery at the University of Pittsburgh Medical Center offers a clinical elective that is open to enrolled fourth-year medical students in good academic standing at any U.S. medical school. Students who have completed their core clinical training and will be in the fourth year of medical education at their LCME- or AOA-accredited home institution in North America may apply for an elective through the Visiting Student Learning Opportunities (VSLO) program. Elective rotations (subinternships) are four weeks in length.

• Clerkships
One-month clerkships offered to senior medical students from other medical schools attract 10-20 students each year. In their senior year selective students may participate in ongoing research projects in the Department of Neurological Surgery under the supervision of an advisor. This experience trains students in basic or clinical neurosurgical research techniques and procedures and offers in-depth education in basic neurosciences. Other medical students seek a more formal and longitudinal exposure to neurosurgical investigation, and complete an approved scholarly project. Pitt medical students often use this educational opportunity as the base for their required graduation scholarly project.

• Pitt Med Neurosurgery Interest Group
The Neurosurgery Interest Group (NSIG) at the University of Pittsburgh School of Medicine is devoted to fostering an interest in the exciting field of neurological surgery. The group connects medical students to key resources in the Department of Neurological Surgery and provides opportunities to shadow, conduct cutting-edge research, and network with the department. Mentoring from several senior residents in our program helps to stimulate interest in the field.

Under the direction of senior residents and participating faculty, the department offers focused lectures and demonstrations on neurosurgical topics to Pitt medical students. The goal is to provide a background of the current advances in neurosurgery to prospective students interested in a neurosurgical career.

Residency Program

The UPMC Department of Neurological Surgery offers a seven-year (PGY 1-7) residency program that is internationally renowned as a training ground for exceptional neurosurgeons. Accredited by the UPMC Graduate Medical Education Council, as well as the Accreditation Council on Graduate Medical Education (ACGME), the program is currently approved to train 28 residents, four each year (29 residents until June 30, 2025). The goal of the program is to provide exceptional clinical and scientific education to top-notch graduates of medical schools who wish to be future leaders in the field of neurological surgery. The program focuses on training to maximize medical knowledge, build patient care skills, and provide for practice based and systems-based learning. The department stresses professionalism as well as interpersonal and communication skills, and relies heavily on both inpatient and outpatient use of informatics.

The University of Pittsburgh Department of Neurological Surgery—which can trace its roots to 1936 and has offered a residency training program dating back to the late 1940s—has always stressed a strong commitment to patient care, education and research. Today, the department is the largest neurosurgical academic provider in the United States, performing over 9,000 major procedures annually system-wide, the majority of which are performed at our academic hospitals of UPMC Presbyterian, UPMC Shadyside, UPMC Mercy, UPMC Children's Hospital of Pittsburgh and the VA Pittsburgh Healthcare System, University Drive.

An article published in *USA Today* in February of 2018, ranked the University of Pittsburgh neurological surgery residency program as one of the top five programs in the country, citing the "advanced technology and focus on innovation" available here. In a ranking published in Becker's Spine Review in August of 2018, our program was ranked among the top five in the country based on a peer-rated, review-based survey.

A 2015 study published in the *Journal of Neurosurgery* showed that our department ranked among the top five neurosurgical residency programs in the country in terms of academic publishing output of faculty. Another Journal of Neurosurgery article showed that our department ranked as the most productive residency program in the nation in terms of graduates remaining and contributing to academic neurosurgery.

In 2018, the department completed a 50-year retrospective assessment of training at our program, published in the *Journal of Neurosurgery*. In each decade, beginning in 1971, we looked at admitted residents and finishing residents, tracking any changes in professional or behavioral events during training. We surveyed 98 graduates and analyzed the data in 76% who completed the survey. This study does not indicate that residents have changed in any significant way over these 50 years. The vast majority of resident graduates express satisfaction with their career choice and its overall positive impact on their families.

More than eighty years at the forefront of neurosurgical care have demonstrated that we are a proven international leader in patient care, research and training. Resident performance and tracking is performed twice per year using the ACGME Milestones project.

• PGY-1

Residency training at the department begins with the first-year experience. PGY-1 residents who enter the field as novices in neurosurgery will rotate on the neurosurgical, critical care medicine,

and neuropathology services. The first year of training is critically evaluated to optimize the introductory experience in neurosurgery. It is designed to optimize performance for the next year, when full integration into patient care teams is accomplished. The United States Medical Licensing Examination Step 3 is expected to be completed during the PGY-1 year. Residents may also have the opportunity to participate in a practice run of the written board examination (American Board of Neurological Surgery) during the PGY-1 to PGY-3 years.

• PGY-2

The PGY-2 year represents an in-depth introductory year to clinical neurosurgery and emphasizes critical care, basic operative techniques, and initial clinical decision making. The department emphasizes the importance of the flow of information and communication between residents, senior residents and responsible faculty. PGY-2 residents routinely spend a block of three months on the cranial service, three months at UPMC Mercy, three months on the neurooncology service (UPMC Shadyside), and three months on the trauma service.

Most junior residents participate in more than 250 neurosurgical procedures during their first year. PGY-2 residents will complete basic training in many procedures, such as lumbar puncture, external ventricular drain placement, intracranial pressure monitor insertions and placement of cerebral blood flow technologies such as Licox tissue oxygenation monitors. Initial case experience includes the selection and identification of patients who will undergo craniotomy, routine spinal procedures and trauma cases.

Clinical judgment is enhanced by spending an average of one day per week in the physician outpatient office. Numerous mid-level providers, including physician assistants and nurse practitioners, provide support both on the hospital floors and in the outpatient clinics.

• PGY-3

The PGY-3 year emphasizes clinical experience in brain and spinal surgery including vascular neurosurgery (an initial intro to endovascular and open vascular techniques), image-guided surgery, functional neurosurgery, and pediatric service (UPMC Children's Hospital of Pittsburgh).

Attendance at a training course in stereotactic radiosurgery, as well as initial experience in movement disorder, pain surgery and neuro-oncological surgery are obtained during this year. Each fall, PGY-3 residents also attend the annual Research Update in Neuroscience for Neurosurgeons (RUNN) course at Woods Hole, Mass. This course provides an update on exciting developments in neuroscience and is intended to catalyze residents to pursue neuroscience basic or clinical research.

• PGY-4

In the PGY-4 year, senior residents in neurological surgery will gain additional critical experience in multiple cranial and spinal cases in order to reach the next set of milestones in their education. Consolidation of medical knowledge, enhanced patient care skills and intense practice-based learning will occur in this year. During this time, residents take the ABNS written board examination for self-assessment/or credit. PGY-4 residents spend a significant portion of their time in the operating room. Increasingly difficult procedures are assigned to senior residents and include complex spinal procedures with instrumentation, craniotomies for intra-axial tumors, meningiomas and posterior fossa surgery. Residents spend nine months on the adult service and three months as senior resident on the pediatric service. Typically, a senior resident participates in between 400 and 500 cases per year.

• PGY-5

The PGY-5 block provides a total of nine months of focused career development opportunities for senior residents. During this time, residents will spend three months as the chief resident at the VA Pittsburgh Healthcare System where they will gain additional surgical and service management skills. During this time, residents take the ABNS training exam for credit. All residents must pass the exam in order to graduate. The departmental target goal is a performance on the written boards at or above the 50th percentile.

The remaining time is flexibly designed for residents to actively pursue clinical or research-focused subspecialty training, along with investigations on topics that will eventually foster their subsequent career and provide benefit to the future course of neurosurgery. There are two paths for trainees in the PGY-5 block: the Clinical Investigator Path and the Surgeon Scientist Investigator Path:

Clinical Investigator Path:

The clinical investigator path includes a 21-month period of time during the PGY-5 and PGY-6 or PGY-7 years (i.e., residents will complete their chief residency year in PGY-6 or PGY-7 depending on enfolded fellowship plans) for subspecialty training. Residents will identify a primary mentor by the PGY-4 year. The resident in this path must have identified a clinical subspecialty focus that will supplement career development and submit an internal funding grant request (Copeland Grant) on a clinical topic. The resident must complete and submit four to six publications in peer-reviewed journals during this interval of time. Residents also will participate in the Clinical and Translational Science Institute (CTSI) Seminar Series. Residents are expected to present at the AANS (American Association of Neurological Surgeons), CNS (Congress of Neurological Surgeons) or subsection meetings relative to their clinical or scientific work.

Surgeon Scientist Investigator Path:

During this interval of time, residents have 21 months to further develop a preclinical and academic research career working in a functional and dedicated laboratory. Some residents choose to enter one of two NIH T32 postdoctoral research fellowship programs available through the University of Pittsburgh's Department of Anesthesia and Department of Surgery as well as the university's Physician Scientist Incubator Program. This program is designed to train the highest quality biomedical physician investigators, focusing on those with MD degrees with PhD doctoral training, seeking careers involving pre-clinical research.

Residents will identify a primary mentor by their PGY-4 year. Residents in this path are able to submit for national grants using existing mechanisms from the AANS, CNS, NIH, and industry. Residents are expected to submit four to six peer-reviewed journal articles during this time. Residents also will have the opportunity to gain a master of science degree but must begin this process one year in advance. Selected residents who wish to obtain a PhD will be fully evaluated for this opportunity but must dedicate additional blocks of training time after they complete the residency training in order to complete such an advanced degree. All residents are expected to present their work at one or more national scientific meetings. During their PGY-6 year, residents are freed from responsibility from both outpatient and operating room coverage, except for elective and approved moonlighting performed on the UPMC Presbyterian neurological surgery service.

The University of Pittsburgh provides a wide spectrum of faculty mentors and opportunities for research in neurosurgery, neurology, neuroscience, psychiatry, physical medicine and rehabili-

tation, neuro-imaging, neuropathology, bioengineering, public health, and regenerative medicine (McGowan Institute of Regenerative Medicine). Research may be funded from numerous sources, including the Walter Copeland Fund of the department (which is administered by The Pittsburgh Foundation). Residents in the department's program have competed successfully for AANS, CNS and American College of Surgeons grants. All residents are expected to write scientific papers and to supplement this with additional book chapters. Residents are expected to learn the principals of investigation under the supervision of faculty mentors.

Residents at all levels are expected to attend the departmental teaching conferences, which are mandatory. Neurosurgical knowledge is gauged by performance on written boards, as well as by semi-annual written evaluations and meetings. Each year a promotion to the next level of training is determined by the departmental competency review committee.

• PGY-6

PGY-6 residents return to the service as residents on the clinical services at UPMC Presbyterian, UPMC Shadyside, UPMC Mercy, and in selected cases at UPMC Children's Hospital of Pittsburgh. Coverage responsibilities include chief of the cranial service, the spinal service and the trauma service. On average, chief residents perform 400-500 major cases during PGY-6, such as clipping of aneurysms, skull-based tumors, complex spine surgery, and posterior fossa surgery. As future practitioners of neurosurgery, they also learn responsibilities of clinical oversight of the service that they are leading. They serve as primary instructors to the younger residents. By the time of their completion of the chief year, residents often have performed more than 1500 neurosurgical procedures as monitored by the ACGME online Accreditation Data System (ADS) database.

• PGY-7

Completing the case log requirements and skill set acquisition in the PGY-6 year allows residents to pursue subspecialty clinical or research training in their last year of clinical neurosurgery before final graduation in June. Selected enfolded fellowship opportunities exist in spine (CAST approved), skull base, endovascular (CAST approved), and stereotactic-functional (CAST approved) training. For selected residents pursuing the surgeon scientist pathway, further research opportunities as well as mentoring for grant submission can be pursued.

• General

Residents in this program have a particularly unique experience in microneurosurgery, pediatric, endoscopic, image-guided neurosurgery including radiosurgery, and open/endovascular surgery, including a large volume of complex vascular bypass cases. In addition to daily teaching rounds, led by individual members of the department faculty, the department holds a series of weekly resident conferences and review lectures to discuss specific neurosurgical concepts, techniques, problems and solutions. Both faculty and residents are regular participants in these programs, many of which include formal didactic presentations. The training program includes the following faculty/resident conference:

Multidisciplinary Brain Tumor Board (weekly)
Chairman's Conference (twice monthly)
Faculty Teaching Conference (weekly)
Image-Guided/Radiosurgery Conference (weekly)
Written Boards Preparation Conference
Patient Care Conference (weekly)
Pediatric Neurosurgical Conference (twice weekly)
Pituitary Conference (quarterly)
Skull Base Conference (weekly)
Spine Conference (weekly)

Residents' Conference (weekly)
Visiting Professor Series (four to six per year)

The chief residents present the weekly patient care conference. Each resident also presents one or more annual 30-minute lectures on basic neurosurgical topics or recent research. To teach the skills required for the oral boards, several conferences use a board-simulated approach to those cases presented. The visiting professor also reviews interesting cases with the residents and attends a journal club.

Trainees have been extremely productive during their clinical and non-clinical years. They commonly have 10 or more publications in refereed journals and multiple presentations at national meetings by the completion of their residency.

Since 1980, residents in the department have been awarded three Congress of Neurological Surgeons Preuss Awards for brain tumor research, two CNS clinical fellowships, American College of Surgeons research scholarships, the CNS Margot Anderson Foundation Fellowship in Brain Restoration Research, and two CNS Wilder Penfield Clinical Investigation Fellowships. Six University of Pittsburgh residents have received the Van Wagenen Fellowship, a prestigious award given annually by the American Association of Neurological Surgeons to a North American neurosurgical resident who is graduating that year. At each annual meeting, residents and faculty often receive named awards for their abstract presentations.

Despite the extensive experience in all aspects of brain, spine, and peripheral nerve surgery, some residents elect to complete post-residency fellowships with other prestigious mentors. In particular, residents who wish to have a career focus in pediatric neurosurgery obtain prestigious fellowships at other institutions prior to beginning their neurosurgical careers.

Although the program's focus is on training academic neurosurgeons interested in clinical and basic science research, it has produced many outstanding private practice neurosurgeons as well. Half of the department's graduates in the last 25 years serve as full-time academic faculty members, and 25 percent have clinical affiliations with academic institutions.

• Neurosurgery Residency Research Opportunities

Comprehensive programs in basic science and clinical research are conducted by department faculty along with investigators throughout the university community. Current research projects include:

Animal Models of Epilepsy
Brain Tumor Research
Clinical and Basic Science Head Injury Program
Clinical Outcomes of Radiosurgery
Computer-Image Integration into Surgical Planning
Intracranial Blood Flow and Saccular Aneurysm Formation
Research in Spinal Tumors and Spine Biomechanics
Spasticity
Stem Cells
Studies on Cranial Nerve Disorders
Teleradiography
Viral Vectors in Tumor Management

Basic science and clinical research projects are an integral part of department faculty and trainee activities. Most residents spend 18-24 months working on such projects. Local, regional

and national peer-reviewed funding resources continue to grow and support productive basic and clinical research. Internal funding from the Walter Copeland Fund provides seed money for many unique and fascinating projects undertaken by residents and faculty. In many cases these projects subsequently receive extramural research funding.

• Neurosurgery Residency Special Features

The Department of Neurological Surgery at the University of Pittsburgh has created a unique environment where centers of excellence flourish. The goals are to provide outstanding neurosurgical patient care, to promote education, and to perform clinical and basic science research. This group of dedicated individuals, including faculty, residents, and staff, is one of the most productive departments in the world.

These accomplishments in both patient care and research have resulted in numerous publications. Each year, more than 200 refereed articles, abstracts, proceedings, book chapters, and books are published by this department. The department supports the largest number of neurosurgeons with federally-sponsored funding. Special features include:

Clinical and Laboratory Program for the Surgery of Cranial Nerve Disorders
Comprehensive Spine Surgery Center
Endoscopic Endonasal and Skull Base Surgery
Frameless Stereotactic Equipment (multiple technologies)
Magnetic Resonance Spectroscopy
Microsurgical Laboratory
Microelectrode Recording System
Laboratory for the Development and Evaluation of New Surgical Techniques
Two Gamma Knife Radiosurgical Suites
Spinal Radiosurgery
State-of-the-Art Neuroimaging:
- CT and MRI angiography
- High Definition Fiber Tractography
- Functional MRI, MRS
- Magnetoencephalography
- PET
- MR Research Center

Intraoperative CT Imaging (Dedicated OR Suite)

The coordinator of the department's medical education program is Melissa Lukehart. D. Kojo Hamilton, MD, is the department's residency director. Nitin Agarwal, MD, and L. Dade Lunsford, MD, are associate residency directors.

Teaching Awards

Annual departmental teaching awards are given to the best faculty teacher (selected by the residents) and to the best resident teacher (selected by faculty). For 2023-24, the faculty award was given to Edward Andrews, MD, (top). The resident honor was awarded to chief resident David T. Fernandes Cabral, MD (bottom).

N3-PREP

The Neurology, Neurosurgery, and Neuropathology Pittsburgh Research Education Program (N3-PREP) is intended to help advance academic research careers of residents and fellows in the neuroscience fields. Developed in coordination with the University of Pittsburgh Department of Neurological Surgery, the Department of Neurology and the Division of Neuropathology—and funded by a five-year NIH NINDS R25 Research Education Grant—the overarching and long-term

goal of the program is to train the next generation of physician-neuroscientists in basic science, translational science, data science, and clinical (patient-oriented) research through a closely mentored approach, in an environment ripe with physical and faculty resources across the translational spectrum of neuro-focused research.

Key components of N3-PREP include a well-defined pathway for each trainee to be paired with a primary mentor and a mentoring committee, a core curriculum, internal study sections for grant reviews, progress tracking for both the trainee and mentor, and continued support for the trainee's progress toward an NIH K mentored-career development award or equivalent. A longitudinal track beginning in the PGY-1 year will increase the interest of the matriculating residents across participating departments, transform the culture, and ultimately increase a diverse pool of residents well-prepared to receive the most from the benefits of direct R25 funding.

The core curriculum of N3-PREP includes formal training in experimental design and scientific rigor, statistical methodology, grant writing, presentation skills, DEI principles, and the responsible conduct of research. Led by multi-principal investigators Constantinos G. Hadjipanayis, MD, PhD, executive vice-chair of the Department of Neurological Surgery; Page B. Pennell, MD, Henry B. Higman Chair of the Department of Neurology; and Julia K. Kofler, MD, director of the Division of Neuropathology, along with an advisory committee, N3-PREP is well-supported by commitments from 87 research mentors across 16 University of Pittsburgh/UPMC departments.

Physician-neuroscientists are essential for converting the discoveries from the laboratory to diagnostic and therapeutic strategies for persons burdened by neurologic diseases that include neuro-oncology. Integration of research training during clinical training years (residency and fellowship) is pivotal to fostering the next generation of physician-neuroscientists, essential to bringing the neuro-based discoveries to the bedside.

Biomedical research is a high priority at the University of Pittsburgh with faculty across more than 20 departments and institutes performing a wide variety of cutting-edge research. Ultimately, researchers believe that N3-PREP will increase the number of well-prepared neuro-focused physician-scientists from the University of Pittsburgh who will progress to the forefront of guiding innovative neuroscience research.

Fellowships

The University of Pittsburgh Department of Neurological Surgery has several fellowships including AO Spine and CAST (Committee on Advanced Subspecialty Training) approved fellowships. These fellowships offer advanced training in skull base surgery, endovascular surgery, pediatric neurosurgery, spine neurosurgery, stereotactic radiosurgery, intraoperative neuromonitoring and neurotrauma.

• Complex and Minimally Invasive Spine Deformity Fellowship

Complex and minimally invasive spine fellows are trained for all spinal diseases, degenerative, deformity, oncology and trauma spinal pathologies, with a special emphasis placed on open and minimally invasive techniques to treat adult spinal deformity and complex reconstructive spine surgery. Experience in all disorders of the craniocervical, cervical, thoracic, lumbar and sacral spine is available. The option for additional training in peripheral nerve, sports medicine and spinal stereotactic radiosurgery is available as well.

• Endoscopic and Open Skull Base Fellowship

The skull base fellowship is primarily focused on endoscopic and open skull base work surgery. About half of these cases are endoscopic endonasal surgeries and are performed in conjunction with their otolaryngology colleagues. The remaining cases are various open skull base cases,

including lateral skull base approaches with neurotology, vascular and brain tumor procedures, minimally invasive transorbital approaches and some general cranial surgery.

• Endovascular Neurosurgery Fellowship
The endovascular neurosurgery fellowship at UPMC provides exceptional training in the management of complex cerebrovascular disease, with robust endovascular volumes totaling over 2,000 cases per year including over 300 stroke thrombectomies and over 150 aneurysm treatments. Fellows engage in innumerable multicenter ischemic and hemorrhagic disease trials gaining direct exposure and experience.

• Intraoperative Neuromonitoring Fellowship
The intraoperative neuromonitoring fellowship provides exceptional training in interpreting evoked potentials, electroencephalography, electromyography, as well as electrocorticography and cortical mapping during awake craniotomies. Fellows will have opportunities for clinical and translational research and will be well-prepared for careers in intraoperative neuromonitoring

• Neurocritical Care Fellowship
Neurocritical care fellows are part of the intensive care unit's patient care team that also includes Critical Care Medicine faculty, anesthesia and surgical residents and medical students. This collaborative team then develops a single treatment plan based on current evidence-based guidelines and local consensus-based protocols. As the fellows progress through the program, they are expected to take on more of a leadership role in the ICU, leading rounds and making decisions regarding patient care. This culminates in the junior attending rotation, during which faculty allow the fellow significant autonomy and provide feedback on leadership and decision-making skills.

• Neurosurgical Oncology Fellowship
The neurosurgical oncology fellowship is primarily focused on the surgical management of primary and metastatic brain tumors incorporating skull base tumors and spinal oncology. Fellows will have the opportunity to treat brain tumor patients with important technologies such as Gamma Knife stereotactic radiosurgery (SRS) and focused ultrasound. They will also be exposed to novel surgical approaches/treatments that include fluorescence-guided surgery (FGS), laser interstitial thermal therapy (LITT), tumor-related epilepsy surgery, photodynamic therapy, and robotic-assisted exoscope neurosurgery. Awake craniotomy and intraoperative brain mapping techniques (direct and subcortical stimulation) will be an important component of the fellowship.

• Neurotrauma Fellowship
The UPMC neurotrauma fellowship provides advanced training in surgical and medical management of traumatic brain and spinal cord injuries. The goal is to train the next generation of neurotraumatologists by providing a comprehensive and supervised educational experience. Fellows are incorporated into all aspects of service leadership and engage with colleagues in Trauma Surgery, Critical Care, Neurology, Neuroradiology and other disciplines to master multidisciplinary management of the neurotrauma population. Progressive independence in patient evaluation and management and service leadership is encouraged during the course of the fellowship.

• Pediatric Fellowship
The ACPNF-accredited pediatric neurosurgery fellowship at UPMC Children's Hospital of Pittsburgh focuses on an overall training philosophy that covers the full gamut of the field with cutting edge approaches to brain tumors, epilepsy, movement disorders, vascular lesions, spinal cord malformations, and cranial base surgery, among other areas. We follow a graded responsi-

bility model that provides increasing independence in the management of an extensive array of pediatric neurosurgery cases in one of the most picturesque pediatric hospitals in the country, supported by a panoply of state-of-the-art instrumentation.

• Spine/Trauma Fellowship
Fellows in the spine and neurotrauma track receive advanced training across all aspects of spinal disorders, with a special emphasis on management of acute neurosurgical emergencies. Fellows are integrated into the UPMC neurotrauma service and have the opportunity to pursue additional training in sports neurosurgery, including concussion evaluation and management and care of sports-related spine and peripheral nerve injuries. Spine/trauma fellows can shadow program faculty with professional and collegiate sports teams in Pittsburgh.

• Sports Fellowship
The Joseph Maroon Sports Fellowship provides an excellent opportunity for interested residents to spend a dedicated period of their training with neurosurgeons working with Pittsburgh area professional and collegiate sports teams. Residents also have the opportunity to rotate with other specialties such as neuropsychology, orthopedics, and athletic training. These rotations would allow the participant to experience how these specialties approach mutual pathologies that we treat as a team

• Stereotactic Radiosurgery & Functional Fellowship
Stereotactic radiosurgery and functional fellows participate in all patient care activities at the UPMC Center for Image-Guided Neurosurgery including evaluation and management leading to decision making, participation in procedures designed to increase learning in the field, and pre- and post-operative care. Fellows participate in educational activities that improve clinical skill acquisition, prepare outcomes research, and publish in the clinical or basic science research arena. This fellowship has two tracks: Track A reflects a nine-month focus on the spectrum of indications, use and outcomes of Gamma Knife stereotactic radiosurgery. It includes three months experience in functional and epilepsy surgery under the direction of Jorge González-Martínez, MD, PhD. Track B reflects a nine-month focus on modern functional neurosurgery for movement disorders and the surgical management of epilepsy. The emerging role of HIFU and LIFU will be explored. The remaining time will include experience with the use of Gamma knife stereotactic radiosurgery.

Professional Courses
Principles and Practice of Gamma Knife Surgery, detailing the practical aspects of stereotactic radiosurgery using the Leksell Gamma Knife, is co-directed by Costas G. Hadjipanayis, MD, PhD; Ajay Niranjan, MD; and L. Dade Lunsford, MD. Principles of medical physics and radiobiology as they apply to single-session, focused, small-volume irradiation are covered. Patient selection techniques, didactic course presentations, and hands on computer skills are provided. More than 2,500 professionals from across the world have been trained in more than 120 courses during the past 20+ years. Course graduates are able to create radiosurgery dose plans for brain tumors, vascular malformations and trigeminal neuralgia. The week-long course is offered six times per year. For the past two years, the course has been offered in a hybrid method as registrants become online “Pitt students” for one week during the course. All registrants are also invited to participate in-person for several days to observe cases and practice dose planning skills beyond the hands-on methods available on line.

Comprehensive Endoscopic Endonasal Surgery of the Skull Base, co-directed by Carl Snyderman, MD, MBA; Paul Gardner, MD; and Eric Wang, MD, demonstrates minimally invasive techniques for endoscopic endonasal surgery of the ventral skull base. The anatomical and technical aspects of this procedure—along with the risks, benefits and outcomes—are presented via didactic

lectures, prosections, hands-on anatomical dissection, and live demonstration surgeries. This four-day course is designed for neurosurgeons, otolaryngologists, head and neck surgeons, and senior level residents, and is presented twice a year.

Complex Endoscopic Endonasal Surgery of the Skull Base, co-directed by Carl Snyderman, MD, MBA, Paul Gardner, MD, and Eric Wang, MD, highlights both surgical decision-making and advanced techniques in endoscopic endonasal skull base surgery (training levels 3-5). Course directors lead interactive case-based discussions, prosections, and hands-on anatomical dissection on the indications, limitations and technical nuances of these approaches by anatomical site. This three-day course is offered once a year and is designed for experienced endoscopic skull base teams.

Principles and Practice of Intraoperative Neuromonitoring, co-directed by Partha Thirumala, MD, and Jeffrey Balzer, PhD, is designed for advanced professionals who perform or support intraoperative neuromonitoring (IONM) procedures. The course highlights practice specifications, multimodality protocols, recent advances in the field, pre-/post-operative neurological evaluation, and telemedicine in IONM.

Peter J. Jannetta Lectureship

The Peter J. Jannetta Lecture—focusing on innovations in the field of neurosurgery—is held annually in honor of the former, long-time chair of the University of Pittsburgh Department of Neurological Surgery. Dr. Jannetta was internationally acclaimed for his development of microvascular decompression (MVD), an innovative procedure that moved blood vessels away from the trigeminal nerve, alleviating chronic pain and spasms in facial muscles. The procedure became commonly known as the 'Jannetta Procedure' around the world and brought relief to thousands.

Michael T. Lawton, MD—the Robert F. Spetzler Endowed Chair for Neurosciences and chair of neurosurgery at the Barrow Neurological Institute in Phoenix, Arizona—was the Jannetta Lecturer for 2023-24, presenting a talk on "Seven Bypasses" on May 1, 2024.

Michael Lawton, MD, addresses faculty and residents at 2024 Peter J. Jannetta Lectureship.

Stuart Rowe Society Lectureship and Research Day

The Stuart Rowe Society Lectureship and Resident Research Day showcases research activities in the field of neurological surgery and provides a forum for discussion. During this day, a series of talks are presented by department residents, each spotlighting a topical research issue relevant in the field. These talks are followed by discussion moderated by a special honored guest prominent in the field of neurosurgery. The honored guest will follow this discussion with a special lecture. The honored guest will also select a "Best Presentation" award presented at a special reception held in their honor later in the evening.

This spotlight on research was a principle first emphasized by Stuart Niles Rowe, MD, the first formally trained neurosurgeon to practice in Pittsburgh. Rowe is widely considered the founding figure of neurosurgery training in the city, establishing the base of what would later become the University of Pittsburgh Department of Neurological Surgery. Rowe believed that neurosurgery training should not only teach exceptional technique, but also the critical clinical decision-making skills necessary to succeed. He preached the underlying need for thorough literature review and independent research as a means for broadening clinical knowledge.

Issam Awad, MD—John Harper Seeley Professor of Neurological Surgery at The University of Chicago Medicine—was the Rowe Lecturer for 2023-24, presenting a lecture on "Cavernous Angiomas as a Paradigm Disease: What They Tell Us About Brain Bleeding" on October 18, 2023.

Anthony Schulien, MD, received the best resident presentation award at this year's Rowe Day for his talk, "Targeting Kv2.1 as a Neuroprotective Strategy Against Cerebral Ischemia." Hansen Deng, MD, took home runner-up honors for his presentation, "Time to Follow Commands in Severe Traumatic Brain Injury Survivors with Favorable Recovery at 2 Years."

Department chair Robert Friedlander, MD, (left) and Stuart Rowe honored guest Issam Awad, MD, (right) present best presentation award to Anthony Schulien, MD.

Dorothy Klenke Nash Lectureship

The Dorothy Klenke Nash Lecture is a celebration of the first female neurosurgeon to practice in the United States, working at the University of Pittsburgh and local area hospitals from the 1940s through the 1960s.

A graduate of the Columbia College (N.Y.) of Physicians and Surgeons and the Neurologic Institute of New York, Dr. Nash moved to Pittsburgh in 1936 and later became a senior surgeon at St. Margaret's Hospital in 1942. Shortly thereafter, she joined Stuart Niles Rowe, MD—widely considered to be the founding figure of neurosurgery in Pittsburgh—at Presbyterian University Hospital and the University of Pittsburgh School of Medicine.

A big advocate of women in medicine, Dr. Nash actively encouraged women to pursue careers in the field, providing vocational lectures aimed toward female students at the University of Pittsburgh. She was also extensively involved in volunteer activities in a number of areas including cerebral palsy and mental illness.

Aviva Abosch, MD, PhD—Nancy A. Keegan and Donald R. Voelte Jr. Chair in Neurosurgery at the University of Nebraska School of Medicine—was the Nash Lecturer for 2023-24 presenting a lecture on "Sleep in Parkinson's Disease: Clinical and Research Implications," on February 28, 2024.

Dorothy Klenke Nash honored guest lecturer Aviva Abosch, MD, PhD, receives plaque from department chair Robert Friedlander, MD.

Neurocirugía en UPMC

The Department of Neurological Surgery maintains a Spanish-language website at upmc.com/Services/neurosurgery/spanish/Pages/default.aspx to serve, educate and provide important information for Spanish-speaking visitors.

Faculty Biographies

Kalil G. Abdullah, MD

Associate Professor
Director, Translational Neuro-Oncology

Kalil G. Abdullah, MD, MSc, is a neurosurgeon specializing in the treatment of adult brain tumors and is the director of Translational Neuro-Oncology Laboratory at the UPMC Hillman Cancer Center.

Dr. Abdullah treats brain tumors using open, endoscopic and tubular approaches, intraoperative fluorescence, laser therapy, and stereotactic radiosurgery to provide minimally invasive surgery options to his patients.

Dr. Abdullah is an NIH-funded investigator developing new drug and treatment targets for brain cancers. He has been an investigator for numerous clinical trials for glioma and is actively involved in bringing promising brain tumor drugs from the laboratory to early-stage clinical trials. He has published more than 100 research articles including key neuro oncology advances in journals such as *Neuro-Oncology, Cancer Cell, Clinical Cancer Research, Nature Medicine,* and *Nature*.

Dr. Abdullah earned his medical degree at the Cleveland Clinic Lerner College of Medicine, where he was a National Institutes of Health Howard Hughes Medical Institute Scholar. He completed a residency in neurological surgery at the University of Pennsylvania and then received advanced training in neurosurgical oncology through a fellowship at the Wellington Hospital in New Zealand. He completed an additional postdoctoral research fellowship in stem cell biology at the University of Pennsylvania, and holds a master's degree from the London School of Economics.

Specialized Areas of Interest
Brain tumors, hydrocephalus.

Board Certifications
Diplomate, American Board of Neurological Surgeons

Hospital Privileges
UPMC Presbyterian
UPMC Shadyside

Professional Organization Membership
American Association of Neurological Surgeons
Congress of Neurological Surgeons
Pennsylvania Neurosurgical Society
Society for Neuro-Oncology

Professional Activities
Tissue and Biospecimen Steering Committee, Glioma Therapeutics Network, NCI
Co-Chair, Scientific Session of the AANS/CNS Brain Tumor Section
Children's Brain Tumor Network Scientific Committee
Oligodendroglioma Proteomics Analysis Working Group, CPTAC/NCI
Reviewer, Center for Scientific Review, NIH

Education & Training
MD, Cleveland Clinic, 2012
Postdoc Fellow, University of Pennsylvania, 2017

Kalil G. Abdullah, MD

Clinical Fellow, Wellington Regional Hospital, New Zealand, 2018
MSc, Health Economics, Policy, and Management, London School of Economics, 2019
Neurosurgery Residency, University of Pennsylvania, 2012-19

Honors & Awards
Eugene P. Frenkel Scholar in Clinical Medicine, UT Southwestern, 2021
Early Clinical Investigator Award, Cancer Prevention and Research Institute of Texas, 2021
Emerging Investigator Award, Academy of Neurological Surgeons, 2020
Rising Star Award, Texas Super Doctors, 2019, 2020
Howard Hughes Medical Institute Scholar, National Institutes of Health, 2008

Publications: 2023-24
• Refereed Articles:
Casillo SM, Gatesman TA, Chilukuri A, Varadharajan S, Johnson BJ, David Premkumar DR, Jane EP, Plute TJ, Koncar RF, Stanton AJ, Biagi-Junior CAO, Barber CS, Halbert ME, Golbourn BJ, Halligan K, Cruz AF, Mansi NM, Cheney A, Mullett SJ, Land CV, Perez JL, Myers MI, Agrawal N, Michel JJ, Chang YF, Vaske OM, MichaelRaj A, Lieberman FS, Felker J, Shiva S, Bertrand KC, Amankulor N, Hadjipanayis CG, Abdullah KG, Zinn PO, Friedlander RM, Abel TJ, Nazarian J, Venneti S, Filbin MG, Gelhaus SL, Mack SC, Pollack IF, Agnihotri S. An ERK5-PFKFB3 axis regulates glycolysis and represents a therapeutic vulnerability in pediatric diffuse midline glioma. *Cell Rep* 43(1):113557, 2024.

Abdullah KG. Classifying glioma via liquid biopsy--progress towards an unmet clinical need. Cl*in Cancer Res* [Online ahead of print], 2024.

Hicks WH, Gattie LC, Traylor JI, Davar D, Najjar YG, Richardson DO TE, McBrayer SK, Abdullah KG. Matched three-dimensional organoids and two-dimensional cell lines of melanoma brain metastases mirror response to targeted molecular therapy. *bioRxiv* [Preprint]. 2024.

Richardson TE, Yokoda RT, Rashidipour O, Vij M, Snuderl M, Brem S, Hatanpaa KJ, McBrayer SK, Abdullah KG, Umphlett M, Walker JM, Tsankova NM. Mismatch repair protein mutations in isocitrate dehydrogenase (IDH)-mutant astrocytoma and IDH-wild-type glioblastoma. *Neurooncol Adv* 5(1):vdad085, 2023.

Research Activities
The focus of Dr. Abdullah's Translational Neuro Oncology Laboratory is to identify new targets for the treatment of malignant brain tumors. He focuses on brain tumor metabolism, or the way in which tumor cells use nutrients to grow and spread. By identifying critical metabolites, researchers can develop drugs to stop or slow the spread of brain cancer. To do this, research is conducted on sophisticated models of the brain, with the goal to move promising drugs to clinical trial.

Taylor J. Abel, MD

Associate Professor
Chief, Pediatric Neurosurgery
Chief, Pediatric Epilepsy Surgery
Surgical Director, Pediatric Epilepsy Surgery Program

Taylor Abel, MD, is chief of pediatric neurosurgery and surgical director of the Pediatric Epilepsy Surgery Program at UPMC Children's Hospital of Pittsburgh. He is an American Board of Neurological Surgery and American Board of Pediatric Neurological Surgery certified pediatric neurosurgeon specializing in epilepsy surgery.

Taylor J. Abel, MD

Dr. Abel is from Seattle, Washington and completed his undergraduate and medical education at the University of Washington. After his medical education in Seattle, Dr. Abel completed neurosurgery residency at the University of Iowa, where he received specialized training in epilepsy surgery and brain mapping techniques. At Iowa, Dr. Abel completed an NIH-funded postdoctoral fellowship—receiving the Ruth L. Kirschstein National Research Service Award—focusing on electrophysiologic mechanisms of face and voice identification in the temporal lobe. Dr. Abel subsequently completed subspecialty fellowship training in both pediatric neurosurgery (Hospital for Sick Children, Toronto) and epilepsy surgery (Grenoble, France).

Dr. Abel's clinical practice focuses on caring for children drug-resistant epilepsy and general pediatric neurosurgery. He founded and co-directs the UPMC Children's Hospital of Pittsburgh Multi-Disciplinary Pediatric Epilepsy Surgery Clinic, which focuses on providing comprehensive care to children with drug-resistant epilepsy. He performs traditional open epilepsy surgery, stereotactic and minimally invasive epilepsy surgery, and all forms of neuromodulation.

Dr. Abel is chair of the American Epilepsy Society membership council and serves on the board of directors for both the American Epilepsy Society (ex-officio) and Pediatric Epilepsy Surgery Alliance.

Specialized Areas of Interest
Pediatric epilepsy surgery; pediatric stereotactic and functional neurosurgery; general pediatric neurosurgery.

Board Certifications
American Board of Neurological Surgery
American Board of Pediatric Neurological Surgery

Hospital Privileges
UPMC Children's Hospital of Pittsburgh
UPMC Harrisburg
UPMC Magee-Womens Hospital
UPMC Presbyterian

Professional Organization Membership
American Association of Neurological Surgeons
American Epilepsy Society
Congress of Neurological Surgeons
International League Against Epilepsy
Joint Section on Pediatric Neurosurgery (AANS/CNS)
Society for Neurobiology of Language
International Society of Pediatric Neurosurgery
International Epilepsy Surgery Society

Professional Activities
Chair, Membership Council, American Epilepsy Society
Board of Directors (ex officio), American Epilepsy Society
Board of Directors, Pediatric Epilepsy Surgery Alliance
Co-Chair, Research Subcommittee, AANS/CNS Joint Section on Pediatric Neurosurgery

Education & Training
BS, Neurobiology, University of Washington, 2005
MD, University of Washington School of Medicine, 2010

Taylor J. Abel, MD

Residency, University of Iowa Hospitals and Clinics, 2016
Fellowship, University of Iowa Hospitals and Clinics, 2016
Fellowship, Epilepsy Surgery, Centre Hospitalier Grenoble, Grenoble, France, 2017
Fellowship, Pediatric Neurosurgery, Hospital for Sick Children, Toronto, Canada, 2018
Certificate, Health Leadership and Business Fundamentals, University of Pittsburgh, 2022

Honors & Awards
ICRE Excellence in Teaching Award, University of Pittsburgh, 2024
The Philip Troen, MD, Excellence in Medical Student Research, University of Pittsburgh, 2024
The Donald S. Fraley Award for Outstanding Medical Student Mentorship, 2023
Pediatric Epilepsy Surgery Alliance Relentless Service Award, 2022
40 under 40, *Pittsburgh Magazine*, 2021
Robin and Judith Humphreys Fellowship in Pediatric Neurosurgery, 2017-18
NIH Clinical Research LRP Award, 2014-16
NIH Ruth L. Kirschstein National Research Service Award, 2014
Neurosurgery Resident Award, AANS/CNS Section on Stereotactic and Functional, 2014
Mary Gates Research Scholar, 2005

News Media Appearances: 2023-24
"New Treatment Options Open Up for Young People With Epilepsy," usnews.com, May 16, 2024.

Publications: 2023-24
• Refereed Articles:
Joshi CN, Karakas C, Eschbach K, Samanta D, Auguste K, Desai V, Singh R, McGoldrick P, Wolf S, Abel TJ, Novotny E, Oluigbo C, Reddy SB, Alexander A, Price A, Reeders P, Mcnamara N, Romanowski EF, Mutchnick I, Ostendorf AP, Shaikhouni A, Knox A, Aungaroon G, Olaya J, Muh CR. Pediatric neuromodulation for drug-resistant epilepsy: Survey of current practices, techniques, and outcomes across US epilepsy centers. *Epilepsia Open* 9(2):785-792, 2024.

Nascimento MA, Biagiotti S, Herranz-Pérez V, Santiago S, Bueno R, Ye CJ, Abel TJ, Zhang Z, Rubio-Moll JS, Kriegstein AR, Yang Z, Garcia-Verdugo JM, Huang EJ, Alvarez-Buylla A, Sorrells SF. Protracted neuronal recruitment in the temporal lobes of young children. *Nature* 626(8001):1056-1065, 2024.

Casillo SM, Gatesman TA, Chilukuri A, Varadharajan S, Johnson BJ, David Premkumar DR, Jane EP, Plute TJ, Koncar RF, Stanton AJ, Biagi-Junior CAO, Barber CS, Halbert ME, Golbourn BJ, Halligan K, Cruz AF, Mansi NM, Cheney A, Mullett SJ, Land CV, Perez JL, Myers MI, Agrawal N, Michel JJ, Chang YF, Vaske OM, MichaelRaj A, Lieberman FS, Felker J, Shiva S, Bertrand KC, Amankulor N, Hadjipanayis CG, Abdullah KG, Zinn PO, Friedlander RM, Abel TJ, Nazarian J, Venneti S, Filbin MG, Gelhaus SL, Mack SC, Pollack IF, Agnihotri S. An ERK5-PFKFB3 axis regulates glycolysis and represents a therapeutic vulnerability in pediatric diffuse midline glioma. *Cell Rep* 43(1):113557, 2024.

Gatesman TA, Hect JL, Phillips HW, Johnson BJ, Wald AI, McClung C, Nikiforova MN, Skaugen JM, Pollack IF, Abel TJ, Agnihotri S. Characterization of low-grade epilepsy-associated tumor from implanted stereoelectroencephalography electrodes. *Epilepsia Open* 9(1):409-416, 2024.

Phillips HW, Hect JL, Harford E, Pan E, Abel TJ. Comparison of magnetic resonance-guided laser interstitial thermal therapy corpus callosum ablation to open microsurgical corpus callosotomy: A single-center retrospective cohort study. *Epilepsia Open* 9(1):96-105, 2024.

Muthiah N, Abel TJ. Letter to the Editor. The importance of vagus nerve stimulation for young children. *J Neurosurg Pediatr* 32(4):522-523, 2023.

Taylor J. Abel, MD

Muthiah N, Rothenberger S, Abel TJ. Socioeconomic status and healthcare utilization disparities among children with epilepsy in the United States: Results from a nationally representative sample. *Sci Rep* 13(1):21776, 2023.

Hect JL, Harford E, Maroufi SF, Klem ML, Mansouri A, Abel TJ. Clinical outcomes of MR-guided laser interstitial thermal therapy corpus callosum ablation in drug-resistant epilepsy: a systematic review and meta-analysis. *J Neurosurg Pediatr* 33(1):12-21, 2023.

Fields DP 2nd, Lavadi RS, Hudson JS, McCarthy DJ, Hect J, Wawrose R, Capuk O, Agarwal N, McDowell MM, Simon D, Abel TJ, Greene S. Patterns in Follow-Up Imaging Usage for Pediatric Patients with Whiplash-Associated Disorder. *World Neurosurg* 180:e786-e790, 2023.

Piazza MG, Smith KJ, Abel TJ. Influence of New Technologies on the Cost-Effectiveness of Invasive Monitoring in Epilepsy Surgery. *World Neurosurg* 180:231-232, 2023.

Phillips HW, Miller TA, Liu HY, Abel TJ, McDowell MM. Utility of minimally invasive endoscopic skull base approaches for the treatment of drug-resistant mesial temporal lobe epilepsy: a review of current techniques and trends. *J Neurosurg* 139(6):1604-1612, 2023.

Research Activities
Dr. Abel's NIH- and NSF-funded research investigates how the human brain transforms natural sounds from a complex acoustic signal into behaviorally relevant auditory categories using a combination of clinical brain recordings and advanced modeling approaches like encoding models and deep neural network (DNN) models. His clinical research investigates the comparative effectiveness of epilepsy surgery treatments using decision analytic modeling, comparative effectiveness, and other approaches.

Nitin Agarwal, MD

Associate Professor
Director, Minimally Invasive Spine and Robotics Surgery
Associate Program Director, Neurological Surgery Residency
Co-Director, Complex and Minimally Invasive Spine Deformity Fellowship

Nitin Agarwal, MD, is an associate professor in the University of Pittsburgh Department of Neurological Surgery with a secondary appointment in the University of Pittsburgh Department of Bioengineering. As part of his educational mission, he is the associate program director of the UPMC/University of Pittsburgh neurological surgery residency program and co-director of the department's Complex and Minimally Invasive Spine Deformity Fellowship. On the clinical front, he is the director of the department's Minimally Invasive Spine and Robotics Surgery program.

Dr. Agarwal received his medical degree from Rutgers New Jersey Medical School. Afterward, he completed his neurological surgery residency at the University of Pittsburgh. During this time, he also completed an enfolded fellowship in sports medicine and in minimally invasive and complex spine surgery. He then completed an AO Spine and Committee on Advanced Subspecialty Training (CAST) approved minimally invasive and complex spine surgery fellowship at the University of California, San Francisco, with dual training from orthopedic and neurosurgical mentors. Before joining the University of Pittsburgh, Dr. Agarwal served as the director of neurotrauma at the Washington University School of Medicine in St. Louis with a clinical focus on spinal deformity surgery.

Dr. Agarwal also serves as a director for the Spine Computational Outcomes Learning Institute (SCOLI), a hub for cutting-edge clinical and translational science that enhances neurosurgical pa-

Nitin Agarwal, MD

tient care. SCOLI has funded investigations in four main domains: neurotrauma outcomes, spine outcomes, socioeconomic research, and patient education.

To date, Dr. Agarwal has published over 300 peer-reviewed articles and has spoken at several regional and national conferences with over 350 oral and poster presentations. His health literacy research has been published in several high-impact factor journals, including *JAMA Internal Medicine*, and he has also been featured by prominent healthcare-oriented news outlets such as Reuters Health. In addition, he is an editor for the following books: *Neurosurgery Fundamentals, Surviving Neurosurgery: Vignettes of Resilience, The Evolution of Health Literacy: Empowering Patients through Improved Education,* and *Pre-Medicine: The Complete Guide for Aspiring Doctors*.

Dr. Agarwal also actively participates in organized neurosurgery advocating for medical student and patient education. Locally, under the SCOLI umbrella, he runs a weekly education and research conference for trainees. He also runs a quarterly patient support group focused on spine and scoliosis. Moreover, he has pledged his commitment to advancing neurosurgery as a member of the Neurosurgery Research and Education Foundation Cushing Circle of Giving.

Outside of neurological surgery, Dr. Agarwal has been deeply dedicated to martial arts, specifically Taekwondo, Krav Maga, and Jiu-Jitsu. For over a decade, he served as a certified instructor, national judge, and school owner. Dr. Agarwal credits martial arts with providing mental and physical discipline as well as adherence to a strict honor code.

Specialized Areas of Interest
Minimally invasive spine surgery; artificial disc replacement; robotic spine surgery; navigation-assisted surgery; endoscopic spine surgery; awake outpatient surgery; brain and spine trauma; sports medicine; cervical deformity; scoliosis surgery.

Hospital Privileges
Pittsburgh Veterans Affairs Medical Center
UPMC Presbyterian

Professional Organization Membership
American Association of Neurological Surgeons
American Association of South Asian Neurosurgeons
American Medical Association
AO Spine
Association of Veterans Affairs Surgeons
Cervical Spine Research Society
Congress of Neurological Surgeons
Council of State Neurosurgical Societies
Lumbar Spine Research Society
North American Spine Society
Scoliosis Research Society

Professional Activities
Member-at-Large, AANS Neurosurgery, PAC Board of Directors
Vice Chair, Congress of Neurological Surgeons Caucus, CSNS
Website Chair, CSNS Communication and Education Committee
UPMC Spine Value Analysis Committee
UPMC Graduate Medical Education Committee
UPSOM Curriculum Committee Executive Subcommittee

Nitin Agarwal, MD

Education & Training

BS, Biology, The College of New Jersey, 2010
MD, Rutgers, The State University of New Jersey, 2014
Enfolded Fellowship, Sports Medicine, UPMC, 2019-20
Enfolded Fellowship, Minimally Invasive and Complex Spine Surgery, UPMC, 2018-20
Neurological Surgery Residency, UPMC, 2014-21
Fellowship, Minimally Invasive and Complex Spine Surgery, AO Spine/CAST Fellowship, University of California, San Francisco, 2021-22

Honors & Awards

Emerging Technologies Fellowship, Scoliosis Research Society, 2023
Faculty Teaching Award, University of Pittsburgh Department of Neurological Surgery, 2023
Young Surgeon Travel Grant, UPMC Department of Neurological Surgery, 2023
SpineLine 5th Annual 20 under 40 Class, North American Spine Society, 2022
Young Surgeon Grant and Educational Track, Society for Minimally Invasive Spine Surgery Annual Forum, 2022
Young Clinician Investigator Award, NREF and the Academy of Neurological Surgeons, 2022
Thomas A. Zdeblick Best Paper Award, Lumbar Spine Research Society, 2022
Harold Rosegay Award, San Francisco Neurological Society, 2022
Educator of the Year Award, Congress of Neurological Surgeons, 2021
CSRS Resident and Fellow Scholarship, Cervical Spine Research Society Annual Meeting, 2021
Young Surgeon Grant and Educational Track, Society for Minimally Invasive Spine Surgery Annual Forum, 2021
Resident Teaching Award, University of Pittsburgh Department of Neurological Surgery, 2021
Branch Research Award, AANS/CNS Joint Section on Disorders of the Spine and Peripheral Nerves, 2021
SRS North American Meeting Scholarship for Residents and Fellows, Scoliosis Research Society, 2021
Young Surgeon Grant, International Society for the Advancement of Spine Surgery Annual Conference, 2021
AO Spine North America Fellowship Award, University of California, San Francisco, Department of Neurological Surgery, 2021
Distinguished Junior Mentor Award, University of Pittsburgh School of Medicine, 2020
Neurosurgery Research and Education Foundation Travel Grant, European Association of Neurosurgical Societies Spine Training Course, 2020
Young Surgeon Grant, Society for Minimally Invasive Spine Surgery Annual Forum, 2019
Young Investigator Award, 12th Annual Society of Lateral Access Surgery Meeting, 2019
First Place History E-poster Award, 87th American Association of Neurological Surgeons Annual Scientific Meeting, 2019
Young Surgeon Travel Grant, 16th Annual Meeting: State of Surgery Think Tank, 2019
Socioeconomics, Health Policy, & Law NEUROSURGERY® Publications Top Paper of the Year, Annual Congress of Neurological Surgeons Meeting, 2018
Journalistic and Academic Neurosurgical Excellence (J.A.N.E.) Award, 34th Spine Summit, 2018
First Place Socioeconomic E-poster Award, 85th American Association of Neurological Surgeons Annual Scientific Meeting, 2017
Charlie Kuntz IV Scholar Award, 32nd Spine Summit, 2016
Peter W. Carmel, MD, Award in Neurological Surgery, Outstanding Academic Achievement, 2014
Kenneth G. Swan, MD, Memorial Award, NJMS Student Affairs, 2014
Class of 1979 Scholarship, NJMS Alumni Association Grant, 2011
Armstrong Engineering Scholarship Award, Scholastic Merit-Based Grant, 2007
Oval Society Award, Community Service Distinction, 2007

Nitin Agarwal, MD

News Media Appearances: 2023-24

"Spine Surgeons Younger than 45 to Know," *Becker's Spine Review*, September 13, 2023.

"Transition to Practice: Taking the Next Step, Pearls and Pitfalls," AANS/CNS Spine Section Early Career Neurosurgeons Committee Webinar Series, August 21, 2023.

Publications: 2023-24

• Refereed Articles:

Anand SK, Lavadi RS, Johnston BR, Chalif JI, Scanlon JM, Wang W, Agarwal N, Hamilton DK, Fields DP, Van't Land CW. *Synapse* 78(3):e22291, 2024.

Alan N, Zenkin S, Lavadi RS, Legarreta AD, Hudson JS, Fields DP, Agarwal N, Mamindla P, Ak M, Peddagangireddy V, Puccio L, Buell TJ, Hamilton DK, Kanter AS, Okonkwo DO, Zinn PO, Colen RR. Associating T1-Weighted and T2-Weighted Magnetic Resonance Imaging Radiomic Signatures With Preoperative Symptom Severity in Patients With Cervical Spondylotic Myelopathy. *World Neurosurg* 184:e137-e143, 2024.

Agarwal N, DiGiorgio A, Michalopoulos GD, Letchuman V, Chan AK, Shabani S, Lavadi RS, Lu DC, Wang MY, Haid RW, Knightly JJ, Sherrod BA, Gottfried ON, Shaffrey CI, Goldberg JL, Virk MS, Hussain I, Glassman SD, Shaffrey ME, Park P, Foley KT, Pennicooke B, Coric D, Upadhyaya C, Potts EA, Tumialán LM, Fu KG, Asher AL, Bisson EF, Chou D, Bydon M, Mummaneni PV. Impact of Educational Background on Preoperative Disease Severity and Postoperative Outcomes Among Patients With Cervical Spondylotic Myelopathy. *Clin Spine Surg* 37(3):E137-E146, 2024.

Agarwal N, DiGiorgio A, Michalopoulos GD, Letchuman V, Chan AK, Shabani S, Lavadi RS, Lu DC, Wang MY, Haid RW, Knightly JJ, Sherrod BA, Gottfried ON, Shaffrey CI, Goldberg JL, Virk MS, Hussain I, Glassman SD, Shaffrey ME, Park P, Foley KT, Pennicooke B, Coric D, Upadhyaya C, Potts EA, Tumialán LM, Fu KG, Asher AL, Bisson EF, Chou D, Bydon M, Mummaneni PV. Impact of Educational Background on Preoperative Disease Severity and Postoperative Outcomes Among Patients With Cervical Spondylotic Myelopathy. *Clin Spine Surg* 37(3):E137-E146, 2024.

Dietz N, Alkin V, Agarwal N, Sharma M, Oxford BG, Wang D, Ugiliweneza B, Mettille J, Boakye M, Drazin D. Cannabis Use Disorder Trends and Health Care Utilization After Cervical and Lumbar Spine Fusions. *Spine* (Phila Pa 1976) 49(4):E28-E45, 2024.

Agarwal N, Letchuman V, Lavadi RS, Le VP, Aabedi AA, Shabani S, Chan AK, Park P, Uribe JS, Turner JD, Eastlack RK, Fessler RG, Fu KM, Wang MY, Kanter AS, Okonkwo DO, Nunley PD, Anand N, Mundis GM, Passias PG, Bess S, Shaffrey CI, Chou D, Mummaneni PV. What is the effect of preoperative depression on outcomes after minimally invasive surgery for adult spinal deformity? A prospective cohort analysis. *J Neurosurg Spine* 40(5):602-610, 2024.

Agarwal N, Johnson SE, Bydon M, Bisson EF, Chan AK, Shabani S, Letchuman V, Michalopoulos GD, Lu DC, Wang MY, Lavadi RS, Haid RW, Knightly JJ, Sherrod BA, Gottfried ON, Shaffrey CI, Goldberg JL, Virk MS, Hussain I, Glassman SD, Shaffrey ME, Park P, Foley KT, Pennicooke B, Coric D, Slotkin JR, Upadhyaya C, Potts EA, Tumialán LM, Chou D, Fu KG, Asher AL, Mummaneni PV. Cervical spondylotic myelopathy and driving abilities: defining the prevalence and long-term postoperative outcomes using the Quality Outcomes Database. *J Neurosurg Spine* 40(5):630-641, 2024.

Bin-Alamer O, Qedair J, Abou-Al-Shaar H, Mallela AN, Balasubramanian K, Alnefaie N, Abou Al-Shaar AR, Plute T, Lu VM, McCarthy DJ, Fields DP, Agarwal N, Gerszten PC, Hamilton DK. Surgical intervention ≤ 24 hours versus > 24 hours after injury for the management of acute traumatic central cord syndrome: a systematic review and meta-analysis. *J Neurosurg Spine* 40(5):653-661, 2024.

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Algattas H, Mitha R, Agarwal N, Lang MJ. Bow Hunter Syndrome: An Illustrative Case and Operative Management. *World Neurosurg* 182:135, 2024.

Park C, Shaffrey CI, Than KD, Bisson EF, Sherrod BA, Asher AL, Coric D, Potts EA, Foley KT, Wang MY, Fu KM, Virk MS, Knightly JJ, Meyer S, Park P, Upadhyaya C, Shaffrey ME, Buchholz AL, Tumialán LM, Turner JD, Agarwal N, Chan AK, Chou D, Chaudhry NS, Haid RW, Mummaneni PV, Michalopoulos GD, Bydon M, Gottfried ON. Does the number of social factors affect long-term patient-reported outcomes and satisfaction in those with cervical myelopathy? A QOD study. *J Neurosurg Spine* 40(4):428-438, 2024.

Mitha R, Colan JA, Hernandez-Rovira MA, Jawad-Makki MH, Patel RP, Elsayed GA, Shaw JD, Okonkwo DO, Buell TJ, Hamilton DK, Agarwal N. Topical tranexamic acid (TXA) is non-inferior to intravenous TXA in adult spine surgery: a meta-analysis. *Neurosurg Rev* 47(1):48, 2024.

Adida S, Legarreta AD, Hudson JS, McCarthy D, Andrews E, Shanahan R, Taori S, Lavadi RS, Buell TJ, Hamilton DK, Agarwal N, Gerszten PC. Machine Learning in Spine Surgery: A Narrative Review. *Neurosurgery* 94(1):53-64, 2024.

Gajjar AA, Patel SV, Lavadi RS, Mitha R, Kumar RP, Taylor T, Elsayed GA, Hamilton DK, Agarwal N. Art and Neurosurgery: The Importance of Medical Illustration. *World Neurosurg* 181:82-89, 2024.

Chan AK, Park C, Shaffrey CI, Gottfried ON, Than KD, Bisson EF, Bydon M, Asher AL, Coric D, Potts EA, Foley KT, Wang MY, Fu KM, Virk MS, Knightly JJ, Meyer S, Park P, Upadhyaya CD, Shaffrey ME, Buchholz AL, Tumialán LM, Turner JD, Michalopoulos G, Sherrod BA, Agarwal N, Chou D, Haid RW, Mummaneni PV. What predicts the best 24-month outcomes following surgery for cervical spondylotic myelopathy? A QOD prospective registry study. *J Neurosurg Spine* 40(4):453-464, 2024.

Fields DP 2nd, Lavadi RS, Hudson JS, McCarthy DJ, Hect J, Wawrose R, Capuk O, Agarwal N, McDowell MM, Simon D, Abel TJ, Greene S. Patterns in Follow-Up Imaging Usage for Pediatric Patients with Whiplash-Associated Disorder. *World Neurosurg* 180:e786-e790, 2023.

Mooney J, Nathani KR, Zeitouni D, Michalopoulos GD, Wang MY, Coric D, Chan AK, Lu DC, Sherrod BA, Gottfried ON, Shaffrey CI, Than KD, Goldberg JL, Hussain I, Virk MS, Agarwal N, Glassman SD, Shaffrey ME, Park P, Foley KT, Chou D, Slotkin JR, Tumialán LM, Upadhyaya CD, Potts EA, Fu KG, Haid RW, Knightly JJ, Mummaneni PV, Bisson EF, Asher AL, Bydon M. Does diabetes affect outcome or reoperation rate after lumbar decompression or arthrodesis? A matched analysis of the Quality Outcomes Database data set. *J Neurosurg Spine* 40(3):331-342, 2023.

Adida S, Legarreta A, Hudson JS, Kumar RP, Kass NM, Agarwal N, Gerszten PC, Andrews EG. Application of Machine Learning for Automatic Segmentation of Paraspinal Musculature. *World Neurosurg* 180:228-230, 2023.

Park C, Shaffrey CI, Than KD, Michalopoulos GD, El Sammak S, Chan AK, Bisson EF, Sherrod BA, Asher AL, Coric D, Potts EA, Foley KT, Wang MY, Fu KM, Virk MS, Knightly JJ, Meyer S, Park P, Upadhyaya C, Shaffrey ME, Buchholz AL, Tumialán LM, Turner J, Agarwal N, Chou D, Chaudhry NS, Haid RW, Mummaneni PV, Bydon M, Gottfried ON. What factors influence surgical decision-making in anterior versus posterior surgery for cervical myelopathy? A QOD analysis. *J Neurosurg Spine* 40(2):206-215, 2023.

Pugazenthi S, Hernandez-Rovira MA, Mitha R, Rogers JL, Lavadi RS, Kann MR, Cardozo MR, Hardi A, Elsayed GA, Joseph J, Housley SN, Agarwal N. Evaluating the state of non-invasive imaging biomarkers for traumatic brain injury. *Neurosurg Rev* 46(1):232, 2023.

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Gajjar AA, Le AHD, Lavadi RS, Boddeti U, Barpujari A, Abou-Al-Shaar H, Agarwal N. Evolution of Robotics in Neurosurgery: A Historical Perspective. *Interdisciplinary Neurosurgery* 33:101721, 2023.

Gajjar AA, Le AHD, Jacobs R, Mooney JH, Lavadi RS, Kumar RP, White MD, Elsayed GA, Agarwal N. Patient perception of spinal cord injury through social media: An analysis of 703 Instagram and 117 Twitter posts. *J Craniovertebr Junction Spine* 14(3):288-291, 2023.

Barpujari A, Gajjar AA, Lavadi RS, Agarwal N, Chan AK, Mummaneni PV. Neurosurgery Residency Rankings: An Assessment of Doximity's Survey-Based Data and Objective Program Characteristics. *Interdisciplinary Neurosurgery* 33:101784, 2023.

Agarwal N, Roy S, Lavadi RS, Alan N, Ozpinar A, Buell TJ, Hamilton DK, Kanter AS, Okonkwo DO. Durability of stand-alone anterolateral interbody fusion in staged minimally invasive circumferential scoliosis surgery with delayed posterior instrumentation due to medical necessity. *Spine Deform* 11(6):1495-1501, 2023.

Muzyka L, Pugazenthi S, Lavadi RS, Shah D, Patel A, Rangwalla T, Javeed S, Elsayed G, Greenberg JK, Pennicooke B, Agarwal N. Geographic Distribution in Training and Practice of Academic Neurological and Orthopedic Spine Surgeons in the United States. *World Neurosurg* 176:e281-e288, 2023.

Yang E, Mummaneni PV, Chou D, Bydon M, Bisson EF, Shaffrey CI, Gottfried ON, Asher AL, Coric D, Potts EA, Foley KT, Wang MY, Fu KM, Virk MS, Knightly JJ, Meyer S, Park P, Upadhyaya CD, Shaffrey ME, Buchholz AL, Tumialán LM, Turner JD, Michalopoulos GD, Sherrod BA, Agarwal N, Haid RW, Chan AK. Cervical laminoplasty versus laminectomy and posterior cervical fusion for cervical myelopathy: propensity-matched analysis of 24-month outcomes from the Quality Outcomes Database. *J Neurosurg Spine* 39(5):671-681, 2023.

Hussain O, Kaushal M, Agarwal N, Kurpad S, Shabani S. The Role of Magnetic Resonance Imaging and Computed Tomography in Spinal Cord Injury. *Life* (Basel) 13(8):1680, 2023.

Agarwal N, Roy S, Lavadi RS, Patel KP, Ozpinar A, Alan N, Buell TJ, Hamilton DK. The 'candy cane' technique for construct augmentation and correction of severe angular chin-on-chest kyphoscoliosis. *Spine Deform* 11(4):1027-1030, 2023.

Agarwal N, White MD, Roy S, Ozpinar A, Alan N, Lavadi RS, Okonkwo DO, Hamilton DK, Kanter AS. Long-Term Durability of Stand-Alone Lateral Lumbar Interbody Fusion. *Neurosurgery* 93(1):60-65, 2023.

Lavadi RS, Gajjar AA, Elsayed GA, Desai RR, Mitha R, Puram SV, Agarwal N. Removal of a Floating and Migrated Plate Screw in a Patient with a Failed Anterior Cervical Discectomy and Fusion. *World Neurosurg* 175:98-101, 2023.

Research Activities

The Spine Computational Outcomes Learning Institute (SCOLI) has explored several advanced technologies and methodologies in 2023-24. Among its notable projects is the development of intelligent metamaterial implants in collaboration with Amir Alavi, PhD. These are designed to overcome common surgical complications such as failed fusion.

Additionally, SCOLI employs advanced neuroimaging to detect occult neurotrauma that standard imaging techniques might miss, in collaboration with Sheng-Kwei Song, PhD. This paves the way for early intervention and better patient outcomes.

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The laboratory also investigates molecular signaling mechanisms within the musculoskeletal system, focusing on tailored therapeutics for elderly patients with degenerative conditions, enhancing procedural success and long-term recovery.

Sameer Agnihotri, PhD

Associate Professor
Director, Brain Tumor Biology and Therapy Lab

Sameer Agnihotri, PhD, joined the faculty of the Department of Neurological Surgery at UPMC Children's Hospital of Pittsburgh in November of 2016.

Dr. Agnihotri graduated from the University of Toronto in 2005 with a bachelor of science honors degree in biology, specializing in genetics. He earned his PhD in medical biophysics in 2011 from the University of Toronto where he used genetic screens to identify novel drivers of glioblastoma, an incurable brain tumor. He subsequently completed his post-doctoral fellowship at the Arthur and Sonia Labatt Brain Tumor Research Centre at the Hospital for Sick Children, in Toronto, and the Princess Margaret Cancer Centre, Division of Neuro-oncology Research, also in Toronto.

Specialized Areas of Interest
Pediatric and adult high-grade gliomas.

Professional Organization Membership
Children's Brain Tumor Consortium
Society of Neuro-Oncology

Professional Activities
Scientific Committee, Children's Brain Tumor Tissue Consortium
Membership Committee, Society of Neuro-oncology

Education & Training
BSc, Biology, University of Toronto, 2005
PhD, Medical Biophysics, University of Toronto, 2011
Fellowship, Hospital for Sick Children, Toronto, 2016
Fellowship, Princess Margaret Cancer Centre, Toronto, 2016

Honors & Awards
Sontag Distinguished Scientist Award, Sontag Foundation, 2022
Junior Scholar Award in Clinical/Translational Cancer Research, UPMC Hillman Cancer Center, 2022
Children's Trust and Children's Hospital of Pittsburgh Young Investigator Award, 2017
Marlene Reimer Brain Star Award, 2016
Post-Doctoral Scholarship, Canadian Institute of Health Resources (CIHR), 2013-16
Trainee of the Year, Hospital for Sick Children, 2014
Young Investigator Award in Basic/Translational Research, Canadian Neuro-Oncology, 2014
Lucien J. Rubinstein Award, American Brain Tumor Association, 2013
Wolfgang Vogel Memorial Award, University of Toronto, 2013
Young Investigator Travel Award, Society of Neuro-Oncology, 2012
Graduate Student Scholarship, Ontario Institute for Cancer Research, 2009
Young Investigator Award in Pediatric Brain Tumour Research, Pediatric Brain Tumor Research Foundation, 2007

Edward Andrews, MD

Assistant Professor

Edward G. Andrews, MD, joined the University of Pittsburgh Department of Neurological Surgery in July of 2023 after completing his seven-year residency at the University of Pittsburgh.

Dr. Andrews attended the University of Pennsylvania, graduating summa cum laude in 2009 with a degree in neuroscience and ancient Egyptian studies. He subsequently earned his medical degree from Sidney Kimmel Medical College at Thomas Jefferson University in 2016, graduating magna cum laude.

During his medical school career, he directed the Future Docs High School Program, a pipeline program aimed at exposing underrepresented minority high school juniors and seniors to different career choices in healthcare fields. He also organized and participated in the primary tutoring services on campus, helping medical students struggling with course material and clinical rotations.

Specialized Areas of Interest
Neuro-oncologic neurosurgery; technology innovation in neurosurgery.

Professional Organization Membership
Alpha Omega Alpha
American Association of Neurological Surgeons
American Board of Neurological Surgery
American Medical Association
Congress of Neurological Surgeons
Gold Humanism Honor Society

Professional Activities
Executive Director, Surreality Lab, University of Pittsburgh

Education & Training
BA, University of Pennsylvania, 2005-09
MD, Sidney Kimmel Medical College, 2012-16
Residency, Neurological Surgery, University of Pittsburgh, 2023

Honors & Awards
Joseph Maroon Aequanimitas Award, University of Pittsburgh, 2023
e-Poster Award, Pediatric Neurosurgery, AANS Annual Meeting, 2018
Physician Champion of Nursing Award, University of Pittsburgh, 2018
Magna Cum Laude, Sidney Kimmel Medical College, 2016
William F. Keller Prize, Sidney Kimmel Medical College, 2016
Gold Humanism Honor Society Inductee, Sidney Kimmel Medical College, 2016
McClellan Surgical Honor Society, Sidney Kimmel Medical College, 2016
Alpha Omega Alpha (Junior Inductee), Sidney Kimmel Medical College, 2015
Summa Cum Laude, University of Pennsylvania, 2009
Dean's List, University of Pennsylvania, 2006-09

Katherine M. Anetakis, MD

Assistant Professor

Katherine M. Anetakis, MD joined the University of Pittsburgh Center of Clinical Neurophysiology in July of 2017. She specializes in intraoperative neurophysiological monitoring for adult and pediatric neurosurgical, orthopedic, ENT, vascular, and interventional neuroradiology procedures, as well as motor and language mapping during awake craniotomies. Dr. Anetakis also has an integral role in microelectrode recording and subcortical mapping for the Movement Disorder Surgery Program at UPMC.

Dr. Anetakis competed her pediatric neurology residency and clinical neurophysiology fellowship at UPMC Children's Hospital of Pittsburgh. Her fellowship concentrations included pediatric epilepsy as well as intraoperative neuromonitoring. In 2021, she was named fellowship director of the non-ACGME track IONM fellowship at UPMC.

Specialized Areas of Interest
Intraoperative neurophysiological monitoring; perioperative stroke; post-operative outcomes.

Board Certifications
American Board of Psychiatry and Neurology
American Board of Psychiatry and Neurology: Subspecialty in Clinical Neurophysiology

Hospital Privileges
JC Blair Memorial Hospital
Excela Health Hospital System
Indiana Regional Medical Center
Monongahela Valley Hospital
Trinity Health System
UPMC Altoona
UPMC Bedford
UPMC Children's Hospital of Pittsburgh
UPMC Cranberry
UPMC East
UPMC Greenville
UPMC Hamot
UPMC Harrisburg
UPMC Horizon
UPMC Jameson
UPMC Magee-Womens Hospital
UPMC McKeesport
UPMC Mercy
UPMC Northwest
UPMC Passavant
UPMC Presbyterian
UPMC St. Margaret
UPMC Shadyside
UPMC Shenango
UPMC Somerset
UPMC Susquehanna

Professional Organization Membership
American Academy of Neurology
American Clinical Neurophysiology Society

Katherine M. Anetakis, MD

Professional Activities
Course Lecturer, Principles and Practice of Intraoperative Monitoring, UPMC
Course Lecturer, Cardiovascular Neuromonitoring, UPMC
Course Lecturer, ACNS, Annual Meeting

Education & Training
BS, Human Physiology, Michigan State University, 2007
MD, University of Pittsburgh School of Medicine, 2011
Residency, Pediatric Neurology, Children's Hospital of Pittsburgh, 2016
Fellowship, Clinical Neurophysiology, UPMC, 2017

Publications: 2023-24
• Refereed Articles:
Al-Qudah AM, Sivaguru S, Anetakis K, Crammond DJ, Balzer JR, Thirumala PD, Subramaniam K, Sadhasivam S, Shandal V. Role of Intraoperative Electroencephalography in Predicting Postoperative Delirium in Patients Undergoing Cardiovascular Surgeries. *Clin Neurophysiol* 164:40-46, 2024.

Al-Qudah AM, Thirumala PD, Anetakis KM, Crammond DJ, Algarni SA, AlMajali M, Shandal V, Gross BA, Lang M, Bhatt NR, Al-Bayati AR, Nogueira RG, Balzer JR. Intraoperative neuromonitoring as real-time diagnostic for cerebral ischemia in endovascular treatment of ruptured brain aneurysms. Clin Neurophysiol 161:69-79.PMID, 2024.

Gorijala VK, Reddy RP, Anetakis KM, Balzer J, Crammond DJ, Shandal V, Shaw JD, Christie MR, Thirumala PD. Diagnostic utility of different types of somatosensory evoked potential changes in pediatric idiopathic scoliosis correction surgery. *Eur Spine J* 33(4):1644-1656, 2024.

Jimenez JE, Omar M, Adams GM, Costacou T, Thirumala PD, Crammond DJ, Anetakis KM, Balzer JR, Shandal V, Snyderman CH, Gardner PA, Zenonos GA, Wang EW. Electromyographic predictors of abducens nerve palsy after endoscopic skull base surgery. *J Neurosurg* 140(6):1584-1590, 2023.

Reddy RP, Singh-Varma A, Chang R, Vedire A, Anetakis KM, Balzer JR, Crammond DJ, Shandal V, Lee JY, Shaw JD, Thirumala PD. Transcranial Motor Evoked Potentials as a Predictive Modality for Postoperative Deficit in Cervical Spine Decompression Surgery - A Systematic Review and Meta-Analysis. *Global Spine J* 14(5):1609-1628, 2024.

Al-Qudah AM, Ta'ani OA, Thirumala PD, Sultan I, Visweswaran S, Nadkarni N, Kiselevskaya V, Crammond DJ, Balzer J, Anetakis KM, Shandal V, Subramaniam K, Subramanium B, Sadhasivam S. Role of Intraoperative Neuromonitoring to Predict Postoperative Delirium in Cardiovascular Surgery. *J Cardiothorac Vasc Anesth* 38(2):526-533, 2024.

Reddy RP, Gorijala VK, Kaithi VR, Shandal V, Anetakis KM, Balzer JR, Crammond DJ, Shaw JD, Lee JY, Thirumala PD. Utility of transcranial motor-evoked potential changes in predicting postoperative deficit in lumbar decompression and fusion surgery: a systematic review and meta-analysis. *Eur Spine J* 32(10):3321-3332, 2023.

Research Activities
Dr. Anetakis is co-investigator of a study using on-lid visual evoked potential device to characterize flash visual evoked potential changes and improve vision outcomes after skull base surgery.

Robert L. Bailey, MD

Clinical Assistant Professor

Robert L. Bailey, MD—an ABNS board-certified neurosurgeon—joined the University of Pittsburgh Department of Neurological Surgery in January of 2019 as a clinical assistant professor. He received his medical degree from the University of Pennsylvania and completed his residency training at the University of Pennsylvania. He completed fellowship training at Wellington Regional Hospital in Wellington, New Zealand.

Dr. Bailey specializes in the surgical management of degenerative spine disease of the cervical, thoracic and lumbar spine, utilizing both traditional methods as well as the latest minimally invasive approaches. In addition, he has expertise in robotic spine surgery to assist in ensuring a less invasive surgical approach whenever deemed appropriate. He also specializes in the surgical removal of both primary and secondary tumors of the spine. Dr. Bailey works with primary care physicians, neurologists, pain management specialists and other clinicians to formulate an individualized treatment plan for his patients. He provides spine care in the Wexford area of Pittsburgh and also participates in community based clinics in outlying communities including Butler and Sewickley in southwestern Pennsylvania.

Specialized Areas of Interest
Back and spine care; minimally invasive spine surgery; robotic spine surgery.

Board Certifications
American Board of Neurological Surgery

Hospital Privileges
UPMC Mercy
UPMC Passavant
UPMC Presbyterian
UPMC Shadyside

Professional Organization Membership
American Association of Neurological Surgeons
American Medical Association
Congress of Neurological Surgeons
Pennsylvania Neurological Society

Professional Activities
Credentialing Committee, UPMC Passavant
Surgical Outcome Committee, UPMC

Education & Training
BA, Brigham Young University, 2004
MD, University of Pennsylvania, 2009
Fellowship, Wellington Regional Hospital, New Zealand, 2014
Residency, University of Pennsylvania, 2016

Jeffrey Balzer, PhD

Associate Professor
Director, Clinical Services, Center for Clinical Neurophysiology
Director, Cerebral Blood Flow Laboratory

Jeffrey Balzer, PhD, is director of clinical operations and staff clinical neurophysiologist at the Center for Clinical Neurophysiology and director of the Cerebral Blood Flow Laboratory at the University of Pittsburgh Medical Center.

His current research interests range from refining language testing during awake craniotomy procedures to the utilization of signal processing analysis during cerebrovascular procedures. Dr. Balzer received his undergraduate education at the University of Pittsburgh, where he also pursued a graduate education and a PhD in behavioral neuroscience.

He is also the secretary/treasurer of the American Board of Neurophysiological Monitoring and is on the board of directors of the American Society of Neurophysiological Monitoring. He has published 130 refereed articles and 19 book chapters.

Specialized Areas of Interest
Intraoperative neurophysiological monitoring, subarachnoid hemorrhage, cerebral blood flow and SCS for restoration of function after stroke.

Board Certifications
American Board of Neurophysiological Monitoring

Hospital Privileges
Indiana Regional Medical Center
UPMC Altoona
UPMC Children's Hospital of Pittsburgh
UPMC Horizon
UPMC Jameson
UPMC McKeesport
UPMC Mercy
UPMC Passavant
UPMC Harrisburg
UPMC Lititz
UPMC West Shore
UPMC Carlisle
UPMC Hanover
UPMC Memorial
UPMC Presbyterian
UPMC St. Margaret's
UPMC Shadyside
UPMC Susquehanna
UPMC Western Maryland

Professional Organization Membership
American Clinical Neurophysiology Society
American Society for Neurophysiological Monitoring (Fellow)
Pittsburgh Neuroscience Society

Jeffrey Balzer, PhD

Professional Activities

Co-Course Director, Principles and Practice of Intraoperative Monitoring, UPMC
Secretary/Treasurer, American Board of Neurophysiologic Monitoring
Board of Directors, American Society of Neurophysiological Monitoring
Co-Editor, *The Neurodiagnostic Journal*

Education & Training

BS, Behavioral Neuroscience, University of Pittsburgh, 1984
MS, Behavioral Neuroscience, University of Pittsburgh, 1989
PhD, Behavioral Neuroscience, University of Pittsburgh, 1994
Fellowship, Neurophysiology, University of Pittsburgh, 1994

Honors & Awards

2024 Richard Brown Life Time Achievement Award in Intraoperative Neuromonitoring, American Society of Neurophysiologic Monitoring

Publications: 2023-24

• Refereed Articles:

Reddy RP, Singh-Varma A, Chang R, Vedire A, Anetakis KM, Balzer JR, Crammond DJ, Shandal V, Lee JY, Shaw JD, Thirumala PD. 2023. Transcranial motor evoked potentials as a predictive modality for postoperative deficit in cervical spine decompression surgery - A systematic review and meta-analysis. *Global Spine J* 14(5):1609-1628 2024.

Al-Qudah A, Ta'ani O, Thirumala PD, Sultan I, Visweswaran S, Nadkarni N, Kiselevskaya V, Crammond DJ, Balzer JR, Anetakis KM, Shandal V, Subramanium K, Subramanium B, Sadhasivam S. Role of intraopeative neuromonitoring to predict postoperative delirium in cardiovascular surgery. *J Cardio Vasc Anesth* 38(2):526-533 2024.

Jain B, Rahim FO, Thirumala PD, McGarvey ML, Balzer J, Nogueira RG, van der Goes DN, de Havenon A, Sultan I, Ney J. Cost-benefit analysis of intraoperative neuromonitoring for cardiac surgery. *J Stroke Cerebrovasc Dis* 33(3):107576 2024.

Jain U, Jain B, Brown J, Sultan IB, Thoma F, Anetakis KM, Balzer JR, Subramaniam K, Yousef S, Wang Y, Nogueira R, Thirumala PD. Outcomes after Perioperative Transient Ischemic Attack Following Cardiac Surgery. *J Cardiovasc Dev Dis* 11(1):27, 2024.

Gorijala VK, Reddy RP, Anetakis KM, Balzer J, Crammond DJ, Shandal V, Shaw JD, Christie MR, Thirumala PD. 2024. Diagnostic utility of different types of somatosensory evoked potential changes in pediatric idiopathic scoliosis correction surgery. *Eur Spine J* 33(4):1644-1656 2024.

Al-Qudah A, Thirumala PD, Anetakis KM, Crammond DJ, Algarni SA, Al Majali M, Shandal V, Gross BA, Lang M, Bhatt NR, AlBayati AR, Nogueira RG, Balzer JR. Intraoperative Neuromonitoring as Real-Time Diagnostic for Cerebral Ischemia in Endovascular Treatment of Ruptured Brain Aneurysms. *Clin Neurophys* 161:69-79 2024.

Jimenez JE, Omar M, Adams GM, Costacou T, Thirumala PD, Crammond DJ, Anetakis KM, Balzer JR, Shandal V, Snyderman CH, Gardner PA, Zenonos GA, Wang EW. Electromyographic predictors of abducens nerve palsy after endoscopic skull base surgery. *J Neurosurg* 140(6):1584-1590 2023.

Bata A, Al Qudah A, Algarni S, Al Ta'ani O, Balzer JR, Crammond DJ, Shandal V, Gross BA, Lang MJ, Anetakis KM, Narayanan S, Mina A, Thirumala PD. Diagnostic accuracy of somatosensory evoked potentials and EEG during endovascular treatment of unruptured cerebral aneurysms. *World Neurosurg* [Online ahead of print], 2023.

Jeffrey Balzer, PhD

Reddy RP, Gorijala VK, Kaithi VR, Shandal V, Anetakis KM, Balzer JR, Crammond DJ, Shaw JD, Lee JY, Thirumala PD. Utility of transcranial motor-evoked potential changes in predicting postoperative deficit in lumbar decompression and fusion surgery: a systematic review and meta-analysis. *Eur Spine J* 32(10):3321-3332 2023.

James Cushing Bayley, MD

Assistant Professor

James Cushing Bayley, MD joined the University of Pittsburgh Department of Neurological Surgery in 2023 as an assistant professor specializing in spinal oncology and peripheral nerve disorders. A native of Boston, he attended Harvard College, earning a degree in applied mathematics, and received his medical degree from the University of Cincinnati College of Medicine

Dr. Bayley completed his residency in neurological surgery at Baylor College of Medicine in 2023. During residency, he completed subspecialty training in neurosurgical oncology at MD Anderson Cancer Center with a focus on spinal oncology. Based on his experiences at MD Anderson, Dr. Bayley is building a multidisciplinary center at UPMC, including practitioners from orthopaedic oncology, surgical oncology, radiation oncology, medical oncology, and pain management, dedicated to providing comprehensive care for patients with spinal tumors. Additionally, he received specialized training on peripheral nerve tumors and surgical techniques for nerve reconstruction in cases of injury by trauma or tumors. As with spine tumors, Dr. Bayley provides comprehensive, multidisciplinary care for peripheral nerve disorders at UPMC with his colleagues from neurology, neurophysiology and rehab medicine.

During residency, Dr. Bayley performed NIH-funded research in meningiomas, the most common primary tumor of the brain and spine. Utilizing next-generation sequencing techniques, he identified molecular groups to advance our knowledge of the behavior and biology of these tumors. His research interest include using computational techniques to advance our understanding of spinal tumors (particularly chordoma), clinical outcomes in the treatment of spine and peripheral nerve tumors, as well as utilization of novel techniques in the treatment of challenging spinal tumors, including laser ablation.

Outside of neurosurgery, Dr. Bayley is an accomplished oarsman, earning second-team All-Ivy honors during college and subsequently winning a U.S. Rowing Club National Championship in the single scull. His wife, Erin Bayley, MD, is a breast surgical oncologist at UPMC and together they have three young children.

Specialized Areas of Interest
Spine tumors, both primary and metastatic; minimally invasive spine surgery; peripheral nerve tumors; peripheral nerve injuries; nerve reconstruction.

Hospital Privileges
Excela Health
UPMC Mercy
UPMC Passavant
UPMC Presbyterian
UPMC Shadyside

Professional Organization Membership
Alpha Omega Alpha
American Association of Neurological Surgeons
Congress of Neurological Surgeons

James Cushing Bayley, MD

Pennsylvania Neurosurgical Society
Society for Neuro-Oncology

Education & Training
AB, Applied Mathematics, Harvard College, 2009
MD, University of Cincinnati College of Medicine, 2016
Residency, Baylor College of Medicine and MD Anderson Cancer Center, 2023

Honors & Awards
Kinjiro Iwata Award for Academic Achievement, Baylor College of Medicine, 2022
Best Scientific Paper, Texas Association of Neurological Surgeons, 2021
Alpha Omega Alpha, University of Cincinnati College of Medicine, 2016
Richard Harris Gottesman Award, Harvard College, 2016

Publications: 2023-24
• Refereed Articles:
Huang-Hobbs E, Cheng YT, Ko Y, Luna-Figueroa E, Lozzi B, Taylor KR, McDonald M, He P, Chen HC, Yang Y, Maleki E, Lee ZF, Murali S, Williamson MR, Choi D, Curry R, Bayley J, Woo J, Jalali A, Monje M, Noebels JL, Harmanci AS, Rao G, Deneen B. Remote neuronal activity drives glioma progression through SEMA4F. *Nature* 619(7971):844-850, 2023.

Chen WC, Choudhury A, Youngblood MW, Polley MC, Lucas CG, Mirchia K, Maas SLN, Suwala AK, Won M, Bayley JC, Harmanci AS, Harmanci AO, Klisch TJ, Nguyen MP, Vasudevan HN, McCortney K, Yu TJ, Bhave V, Lam TC, Pu JK, Li LF, Leung GK, Chan JW, Perlow HK, Palmer JD, Haberler C, Berghoff AS, Preusser M, Nicolaides TP, Mawrin C, Agnihotri S, Resnick A, Rood BR, Chew J, Young JS, Boreta L, Braunstein SE, Schulte J, Butowski N, Santagata S, Spetzler D, Bush NAO, Villanueva-Meyer JE, Chandler JP, Solomon DA, Rogers CL, Pugh SL, Mehta MP, Sneed PK, Berger MS, Horbinski CM, McDermott MW, Perry A, Bi WL, Patel AJ, Sahm F, Magill ST, Raleigh DR. Targeted gene expression profiling predicts meningioma outcomes and radiotherapy responses. *Nat Med* 29(12):3067-3076, 2023.

J. Brad Bellotte, MD

Clinical Assistant Professor
Chief, Neurosurgery, UPMC Hamot

J. Brad Bellotte, MD, is chief of neurosurgery at UPMC Hamot in Erie, Pa. He joined the University of Pittsburgh Department of Neurosurgery as a clinical assistant professor in July of 2011. Dr. Bellotte is a leading expert in complex spine surgery, including minimally invasive surgeries.

He earned his medical degree from West Virginia University School of Medicine and completed an internship in general surgery and a residency in neurosurgery at Allegheny General Hospital in Pittsburgh.

Specialized Areas of Interest
Complex spine surgery; brain surgery.

Board Certifications
American Board of Neurological Surgery

Hospital Privileges
UPMC Hamot

J. Brad Bellotte, MD

Professional Organization Membership
American Association of Neurological Surgeons
Congress of Neurological Surgeons
North American Spine Society
Pennsylvania State Neurosurgical Society

Education & Training
MD, West Virginia University, 1999
Residency, Neurosurgery, Allegheny General Hospital, 2005

Honors & Awards
Orthopedic Teaching Award, UPMC Hamot, 2011-12

Lindsay Bhandari, MD

Clinical Assistant Professor

Lindsay Bhandari, MD, is a neurologist certified by the American Board of Psychiatry and Neurology. She joined the University of Pittsburgh Center of Clinical Neurophysiology in January 2024. She completed her pediatric neurology residency and epilepsy fellowship at Johns Hopkins Hospital, followed by an intraoperative neurophysiologic monitoring fellowship at UPMC Presbyterian in Pittsburgh. Prior to residency, she received her medical degree from the Virginia Commonwealth University School of Medicine.

Dr. Bhandari's clinical interests include intraoperative neurophysiological monitoring in adult and pediatric neurosurgical, orthopedic, ENT, vascular, and interventional neuroradiology procedures, as well as motor and language mapping during awake craniotomies.

Specialized Areas of Interest
Intraoperative neurophysiological monitoring, electroencephalography, transcranial motor evoked potentials, subcortical mapping with microelectrode recording.

Board Certifications
American Board of Psychiatry and Neurology

Hospital Privileges
Excela Health Hospital System
Indiana Regional Medical Center
Trinity Health System
UPMC Altoona
UPMC Bedford
UPMC Children's Hospital of Pittsburgh
UPMC Cole
UPMC East
UPMC Hamot
UPMC Horizon
UPMC McKeesport
UPMC Mercy
UPMC Muncy
UPMC Northwest
UPMC Passavant
UPMC Pinnacle
UPMC Presbyterian

Lindsay Bhandari, MD

UPMC St. Margaret
UPMC Shadyside
UPMC Shenango
UPMC Somerset
UPMC Susquehanna
UPMC Western Maryland

Professional Organization Membership
American Academy of Neurology

Education & Training
BS, Neuroscience, The College of William and Mary, 2013
MD, Virginia Commonwealth University School of Medicine, 2017
Residency, Pediatric Neurology, Johns Hopkins Hospital, 2022
Fellowship, Epilepsy (ACGME), Johns Hopkins Hospital, 2023
Fellowship, Intraoperative Neuromonitoring (non-ACGME), University of Pittsburgh, 2024

Bryan Bolinger, DO

Clinical Assistant Professor

Bryan Bolinger, DO, received a bachelor's degree in neuroscience from the University of Pittsburgh in 2001. During his undergraduate years, he also participated in clinical and bench research at the Brain Trauma Research Center and the Safar Center for Resuscitation Research. Dr. Bolinger obtained his medical degree from the Philadelphia College of Osteopathic Medicine in 2007 and completed his neurosurgical residency through the Philadelphia College of Osteopathic Medicine Consortium of Hospitals in 2013.

Dr. Bolinger returned to the University of Pittsburgh Medical Center in 2013 to complete fellowship training in complex spine surgery under the direction of Adam Kanter, MD; David Okonkwo, MD, PhD, and Peter Gerszten, MD. Board certified in neurosurgery, and after years of practice in Pennsylvania, Dr. Bolinger joined the University of Pittsburgh Department of Neurological Surgery in April of 2020 as a clinical assistant professor.

Specialized Areas of Interest
Minimally invasive spine surgery; lateral access spine surgery; artificial disc technology; spinal cord stimulation; spinal cord injury; spine trauma; traumatic brain injury.

Board Certifications
American Osteopathic Board of Surgery – Neurosurgical Discipline

Hospital Privileges
UPMC Carlisle
UPMC Community Osteopathic
UPMC Hanover
UPMC Harrisburg
UPMC Lititz
UPMC Memorial
UPMC West Shore
UPMC Williamsport

Professional Organization Membership
American Association of Neurological Surgeons

Bryan Bolinger, DO

American College of Osteopathic Surgeons
American Osteopathic Association
North American Spine Society

Education & Training
BS, Neuroscience, University of Pittsburgh, 2001
DO, Philadelphia College of Osteopathic Medicine, 2007
Neurosurgical Residency, Philadelphia College of Osteopathic Medicine, 2013
Fellowship, Complex Spine Surgery, University of Pittsburgh Medical Center, 2014

News Media Appearances: 2023-24
"UPMC in Central Pa. offers team approach to spine care," Central Penn Business Journal, April 1, 2024
"UPMC launches new spine care program in Central Pa.,"WHTM-TV.com (Harrisburg, Pa.), March 25, 2024

John A. Braca III, MD

Clinical Assistant Professor
Chief of Neurosurgery, UPMC Central & North Central Pa. Regions

John A. Braca III, MD, joined the University of Pittsburgh Department of Neurological Surgery as the chief of neurosurgery for central and north central Pennsylvania in October of 2023. He oversees clinical operations in the eight Neurological Institute locations that serve Annville, Carlisle, Harrisburg, Hershey, Lancaster, Mechanicsburg, Spring Grove and Williamsport.

Dr. Braca received his medical degree from New York Medical College in Valhalla, New York and completed his undergraduate training with a degree in biological sciences and chemistry at Fordham University in New York. He completed his residency training in neurological surgery at Loyola University Medical Center in Maywood, Illinois and his post residency, CAST-accredited fellowship training in endovascular and cerebrovascular surgery with Goodman Campbell Brain and Spine at Indiana University in Indianapolis. In addition, Dr. Braca completed an enfolded complex spine surgery, intra-residency fellowship with the Loyola University Medical Center.

Dr. Braca is board-certified by the American Board of Neurological Surgery and is a fellow of the American Association of Neurological Surgeons. He specializes in treating patients with intracranial aneurysms, cerebral and spinal arteriovenous malformations (AVMs), carotid endarterectomy, carotid artery stenting, ischemic stroke intervention, endoscopic minimally invasive skull base surgery, pituitary tumors, brain tumors, spine tumors, degenerative spine disease, cervical myelopathy, motion preservation spine surgery and trigeminal neuralgia/facial pain syndromes.

Prior to joining UPMC, Dr. Braca served as an endovascular neurosurgeon with Tower Health in Reading, Pennsylvania where he also held an academic position of assistant professor with the department of neurosurgery at the Drexel College of Medicine in Philadelphia.

Specialized Areas of Interest
Intracranial aneurysms, cerebral and spinal arteriovenous malformations, dural arteriovenous fistulas, cerebral cavernous malformations, brain tumors, spine tumors, carotid stenosis, intracranial stenosis, ischemic stroke, mechanical thrombectomy.

Board Certifications
American Board of Neurological Surgeons

John A. Braca III, MD

Hospital Privileges
UPMC Carlisle
UPMC Community General
UPMC Hanover
UPMC Harrisburg
UPMC Lititz
UPMC Memorial
UPMC West Shore
UPMC Williamsport

Professional Organization Membership
American Association of Neurological Surgeons
Congress of Neurological Surgeons
Subcortical Surgery Group
Pennsylvania Neurosurgical Society

Education & Training
BS, Biological Sciences and Chemistry, Fordham University, 1999
Masters of Medical Science, Drexel College of Medicine, 2003
MD (Upper Quintile), New York Medical College, 2007
Intra-Residency Complex Spine Focused Training, Loyola University Medical Center, 2013
Neurosurgery Residency, Loyola University Medical Center, 2014
Endovascular Neurosurgery Fellowship, Goodman Campbell Brain & Spine, Indiana University, 2015
Cerebrovascular Fellowship, Goodman Campbell Brain and Spine, Indiana University, 2016

Honors & Awards
Cor et Manus Award, New York Medical College, 2007
William Cullen Bryant Award, New York Medical College, 2007
Neurosurgery Department Award, New York Medical College, 2007
Alumni Endowed Scholarship, New York Medical College, 2007
Loyola University Medical Center Magis Award, 2008-14

News Media Appearances: 2023-24
"UPMC in Central Pa. offers team approach to spine care," *Central Penn Business Journal*, April 1, 2024
"UPMC launches new spine care program in Central Pa.,"WHTM-TV.com (Harrisburg, Pa.), March 25, 2024.
"Local man suffers strokes after roller coaster ride: A rare but critical warning from doctors," WHP-TV 21 (Harrisburg, Pa.), November 8, 2023.

Thomas J. Buell, MD

Assistant Professor

Thomas J. Buell, MD, joined the University of Pittsburgh Department of Neurological Surgery in January of 2022. A native of Texas, he attended the University of Texas at Austin where he earned a Bachelor of Science degree in electrical engineering, graduating with high honors and earning the W. C. Dusty and Doris Duesterhoeft Endowed Presidential Scholarship. His early engineering research focused on designing algorithms to advance parallel and distributed processing. After graduation, he worked as an electrical engineer before attending Baylor College of Medicine, earning his medical degree in 2013.

Thomas J. Buell, MD

He completed his neurological surgery residency at the University of Virginia in 2020. There he completed an enfolded CAST-accredited complex spine fellowship under Justin Smith, MD, an enfolded CAST-accredited endovascular fellowship, and an international fellowship at Auckland City Hospital in Auckland, New Zealand. He then attended Duke University for a combined orthopedic and neurosurgical AO Spine adult and pediatric complex spine and oncology fellowship training program under Isaac Karikari, MD, and Christopher Shaffrey, MD.

Dr. Buell specializes in complex spinal reconstructive surgery for treatment of all spinal deformities of the cervical, thoracic, and lumbar regions. He is a high-volume surgeon, performing over 300 operations per year. His clinical philosophy is conservative believing, in many cases, non-operative treatment options improve patient symptoms. He provides individualized, patient-engaged, compassionate care and focuses on maximizing outcomes with the least invasive approach.

Dr. Buell has been actively engaged in clinical research, both prospectively and retrospectively, to evaluate which treatments provide greatest clinical benefit while minimizing complications. His research interests focus on clinical outcomes after spinal surgery. He is a prolific academician, having published over 110 papers in peer-reviewed journals such as *Neurology, Neurosurgery, Journal of Neurosurgery, JNS Spine, Spine Deformity,* and *Stroke*. He is also an assistant editor for *Operative Neurosurgery* and *Spine Deformity*. He has authored and edited over 20 textbook chapters.

Dr. Buell is a new member of the International Spine Study Group, a multi-center non-profit research foundation that studies clinical and economic outcomes resulting in best practice guidelines for adult patients with spinal deformities. This is a consortium of spinal deformity specialists and researchers at over 20 top academic centers in the United States and Canada with collaborators in Europe and Japan. Since the inception in 2009, the International Spine Study Group has presented over 2000 scientific abstracts and has published over 300 peer reviewed manuscripts.

Specialized Areas of Interest
Spinal deformity (cervical, thoracic, lumbar); traditional, open, complex deformity surgery; minimally invasive deformity surgery

Hospital Privileges
UPMC Children's Hospital of Pittsburgh
UPMC Mercy
UPMC Passavant
UPMC Presbyterian
UPMC Shadyside

Professional Organization Membership
American Association of Neurological Surgeons
AO Spine
Congress of Neurological Surgeons
International Spine Study Group Foundation
North American Spine Society
Scoliosis Research Society
Society for Minimally Invasive Spine Surgery

Thomas J. Buell, MD

Professional Activities
Assistant Editor, *Operative Neurosurgery*
Editorial Board, *Spine Deformity*

Education & Training
BS, Electrical Engineering, University of Texas at Austin, 2005
MD, Baylor College of Medicine, 2013
Neurosurgery Residency, University of Virginia, 2020
Neuroendovascular Surgery Fellowship, University of Virginia Health System, 2017
Senior Registrar, Auckland Public Hospital in Auckland, New Zealand, 2019
Enfolded Fellowship, Adult & Pediatric Spine Deformity Surgery, University of Virginia, 2020
Clinical Associate, Fellow, Duke University, 2022

Honors & Awards
State of Spine Grant Recipient, State of Spine Surgery Think Tank, 2024
Early-Career Spine Surgeon Grant, Masters in Spine Surgery Seminar, 2024
Resident & Fellow Research Award, North American Spine Society, 2020-21
Whitecloud Award for Best Clinical Abstract, International Meeting on Advanced Spine Techniques (IMAST). 2020
Best Presentation Abstract Award, AANS/CNS Joint Spine Section, Spine Summit, 2018
John A. Jane, Sr. Neuroanatomy Award, University of Virginia, 2017
Crutchfield, Cage, and Thomson Award, 2nd Place Clinical Research, Neurosurgical Society of the Virginias, 2017
Crutchfield, Cage, and Thomson Award, 1st Place Basic Science, Neurosurgical Society of the Virginias, 2014
Mission Connect Neurotrauma Research Award, Institute for Rehabilitation and Research Foundation, 2011
Medical Student Research Scholarship, Baylor College of Medicine, 2004
Distinguished College Scholar, University of Texas at Austin, 2004
W. C. Dusty and Doris Duesterhoeft Endowed Presidential Scholarship, University of Texas at Austin, 2003-2005

Publications: 2023-24
• Refereed Articles:
Balmaceno-Criss M, Lafage R, Alsoof D, Daher M, Hamilton DK, Smith JS, Eastlack RK, Fessler RG, Gum JL, Gupta MC, Hostin R, Kebaish KM, Klineberg EO, Lewis SJ, Line BG, Nunley PD, Mundis GM, Passias PG, Protopsaltis TS, Buell T, Scheer JK, Mullin JP, Soroceanu A, Ames CP, Lenke LG, Bess S, Shaffrey CI, Schwab FJ, Lafage V, Burton DC, Diebo BG, Daniels AH; International Spine Study Group (ISSG). Impact of Hip and Knee Osteoarthritis on Full Body Sagittal Alignment and Compensation for Sagittal Spinal Deformity. *Spine* (Phila Pa 1976) 49(11):743-751, 2024.

Mohanty S, Hassan FM, Lenke LG, Lewerenz E, Passias PG, Klineberg EO, Lafage V, Smith JS, Hamilton DK, Gum JL, Lafage R, Mullin J, Diebo B, Buell TJ, Kim HJ, Kebaish K, Eastlack R, Daniels AH, Mundis G, Hostin R, Protopsaltis TS, Hart RA, Gupta M, Schwab FJ, Shaffrey CI, Ames CP, Burton D, Bess S; International Spine Study Group. Machine learning clustering of adult spinal deformity patients identifies four prognostic phenotypes: a multicenter prospective cohort analysis with single surgeon external validation. *Spine J* 24(6):1095-1108, 2024.

Alan N, Zenkin S, Lavadi RS, Legarreta AD, Hudson JS, Fields DP, Agarwal N, Mamindla P, Ak M, Peddagangireddy V, Puccio L, Buell TJ, Hamilton DK, Kanter AS, Okonkwo DO, Zinn PO, Colen RR. Associating T1-Weighted and T2-Weighted Magnetic Resonance Imaging Radiomic Signatures With Preoperative Symptom Severity in Patients With Cervical Spondylotic Myelopathy. *World Neurosurg* 184:e137-e143, 2024.

Thomas J. Buell, MD

Mitha R, Colan JA, Hernandez-Rovira MA, Jawad-Makki MH, Patel RP, Elsayed GA,Shaw JD, Okonkwo DO, Buell TJ, Hamilton DK, Agarwal N. Topical tranexamic acid (TXA) is non-inferior to intravenous TXA in adult spine surgery: a metaanalysis. *Neurosurg Rev* 47(1):48, 2024.

Dave P, Lafage R, Smith JS, Line BG, Tretiakov PS, Mir J, Diebo B, Daniels AH, Gum JL, Hamilton DK, Buell T, Than KD, Fu KM, Scheer JK, Eastlack R, Mullin JP, Mundis G, Hosogane N, Yagi M, Nunley P, Chou D, Mummaneni PV, Klineberg EO, Kebaish KM, Lewis S, Hostin RA, Gupta MC, Kim HJ, Ames CP, Hart RA, Lenke LG, Shaffrey CI, Bess S, Schwab FJ, Lafage V, Burton DC, Passias PG. Predictors of pelvic tilt normalization: a multicenter study on the impact of regional and lower-extremity compensation on pelvic alignment after complex adult spinal deformity surgery. *J Neurosurg Spine* 40(4):505-512, 2024.

Daniels AH, Daher M, Singh M, Balmaceno-Criss M, Lafage R, Diebo BG, Hamilton DK, Smith JS, Eastlack RK, Fessler RG, Gum JL, Gupta MC, Hostin R, Kebaish KM, Klineberg EO, Lewis SJ, Line BG, Nunley PD, Mundis GM, Passias PG, Protopsaltis TS, Buell T, Scheer JK, Mullin JP, Soroceanu A, Ames CP, Lenke LG, Bess S, Shaffrey CI, Burton DC, Lafage V, Schwab FJ; International Spine Study Group. The Case for Operative Efficiency in Adult Spinal Deformity Surgery: Impact of Operative Time on Complications, Length of Stay, Alignment, Fusion Rates, and Patient-Reported Outcomes. *Spine* (Phila Pa 1976) 49(5):313-320, 2024.

Buell T, Ding D, Chen CJ, Aljuboori Z, Liu K. Dynamic interaction between cerebrospinal fluid and sinovenous pressure in idiopathic intracranial hypertension: a case report. *Br J Neurosurg* 37(6):1812-1814 2024.

Adida S, Legarreta AD, Hudson JS, McCarthy D, Andrews E, Shanahan R, Taori S, Lavadi RS, Buell TJ, Hamilton DK, Agarwal N, Gerszten PC. Machine Learning in Spine Surgery: A Narrative Review. *Neurosurgery* 94(1):53-64, 2024.

Passias PG, Mir JM, Dave P, Smith JS, Lafage R, Gum J, Line BG, Diebo B, Daniels AH, Hamilton DK, Buell TJ, Scheer JK, Eastlack RK, Mullin JP, Mundis GM, Hosogane N, Yagi M, Schoenfeld AJ, Uribe JS, Anand N, Mummaneni PV, Chou D, Klineberg EO, Kebaish KM, Lewis SJ, Gupta MC, Kim HJ, Hart RA, Lenke LG, Ames CP, Shaffrey CI, Schwab FJ, Lafage V, Hostin RA Jr, Bess S, Burton DC, International Spine Study Group. Factors Associated with the Maintenance of Cost-Effectiveness at 5 Years in Adult Spinal Deformity Corrective Surgery. *Spine* (Phila Pa 1976) [Online ahead of print], 2024.

Mullin JP, Soliman MAR, Smith JS, Kelly MP, Buell TJ, Diebo B, Scheer JK, Line B, Lafage V, Lafage R, Klineberg E, Kim HJ, Passias PG, Gum JL, Kebaish K, Eastlack RK, Daniels AH, Soroceanu A, Mundis G, Hostin R, Protopsaltis TS, Hamilton DK, Gupta MC, Lewis SJ, Schwab FJ, Lenke LG, Shaffrey CI, Bess S, Ames CP, Burton D. Analysis of tranexamic acid usage in adult spinal deformity patients with relative contraindications: does it increase the risk of complications? *J Neurosurg Spine* [Online ahead of print], 2024.

Gajjar AA, Kumar RP, Paliwoda ED, Kuo CC, Adida S, Legarreta AD, Deng H, Anand SK, Hamilton DK, Buell TJ, Agarwal N, Gerszten PC, Hudson JS. Usefulness and Accuracy of Artificial Intelligence Chatbot Responses to Patient Questions for Neurosurgical Procedures. *Neurosurgery* [Online ahead of print], 2024.

Passias P, Tretiakov P, Mir J, Dave P, Lafage R, Smith J, Buell TJ; International Spine Study Group. Identifying tranexamic acid dosing predictive of decreased risk of intraoperative transfusion accounting for body mass index and surgical invasiveness in complex adult spinal deformity surgery. *Spine J* 23(9):S118-9, 2023.

Thomas J. Buell, MD

Diebo BG, Balmaceno-Criss M, Lafage R, Daher M, Singh M, Hamilton DK, Smith JS, Eastlack RK, Fessler R, Gum JL, Gupta MC, Hostin R, Kebaish KM, Lewis S, Line BG, Nunley PD, Mundis GM, Passias PG, Protopsaltis TS, Turner J, Buell T, Scheer JK, Mullin J, Soroceanu A, Ames CP, Bess S, Shaffrey CI, Lenke LG, Schwab FJ, Lafage V, Burton DC, Daniels AH; International Spine Study Group (ISSG). Lumbar Lordosis Redistribution and Segmental Correction in Adult Spinal Deformity (ASD): Does it Matter? *Spine* (Phila Pa 1976) [Online ahead of print], 2024.

Zhang H, Buell T, Baldwin III, E, Dalton T, Crutcher C, Abd-El-Barr MM, Erickson M. High Prevalence of Cervical Myelopathy among Hip Fracture Patients. Ope*rative Techniques in Orthopaedics* 33(4):101066, 2023.

Eagle SR, Mittal AM, Kellogg RT, Vargas J, Nwachuku E, Deng H, Buell TJ, Okonkwo DO, Pease M. Interaction of admission platelet count with current medications and the risk for chronic subdural recurrence. *Neurosurg Focus* 55(4):E4, 2023.

Gum J, Lafage R, Smith J, Bess S, Mullin J, Kelly M, Diebo B, Buell T, Scheer J, Line B, Lafage V. P94. Massive variation exists in intraoperative IV fluid management and this correlates with complications, ICU, and LOS: a call for standardization. *Spine J* 23(9):S152-3, 2023.

Mir J, Passias P, Lafage R, Smith J, Tretiakov P, Dave P, Buell TJ; International Spine Study Group. What degree of malalignment justifies performance of three-column osteotomy in revision lumbar spinal fusion? *Spine J* 23(9): S163-S164, 2023.

Passias PG, Ahmad W, Dave P, Lafage R, Lafage V, Mir J, Klineberg EO, Kabeish KM, Gum JL, Line BG, Hart R, Burton D, Smith JS, Ames CP, Shaffrey CI, Schwab F, Hostin R, Buell T, Hamilton DK, Bess S. Economic burden of nonoperative treatment of adult spinal deformity. *J Neurosurg Spine* 39(6):751-756, 2023.

Sarthak M, Hassan F, Lenke L, Lewerenz E, Smith J, Bess S, Buell TJ, Scheer J, Line B, Lafage V, Lafage R, Klineberg E, Kim HJ, Passias P, Gum J, Kebaish K, Eastlack R, Daniels A, Soroceanu A, Mundis G, Hostin R, Protopsaltis T, Hamilton DK, Kelly M, Gupta M, Schwab FJ, Shaffrey CI, Ames CP, Burton DC; International Spine Study Group. Machine learning generates phenotypes of ASD patients: classification with 2-year prognostic value." *Spine J* 23(9):S78-S79, 2023.

Mullin J, Gum J, Soliman M, Line B, Bess S, Lenke L, Lafage R, Smith J, Kelly M, Diebo B, Buell TJ, Scheer J, Lafage, Klineberg E, Kim HJ, Kebaish K, Eastlack R, Daniels A, Lewis S, Okonkwo DO, Soroceanu A, Mundis G, Hostin R, Protopsaltis TS, Hamilton DK, Schwab FJ, Shaffrey CI, Ames CP, Passias PG, Burton, DC; International Spine Study Group. Utilization of TXA in ASD patients with potential contraindications for TXA does not lead to increased thromboembolic complications: critical information for surgical and anesthesia teams. *Spine J*, 23(9): S163, 2023.

Agarwal N, Roy S, Lavadi RS, Alan N, Ozpinar A, Buell TJ, Hamilton DK, Kanter AS, Okonkwo DO. Durability of stand-alone antºerolateral interbody fusion in staged minimally invasive circumferential scoliosis surgery with delayed posterior instrumentation due to medical necessity. *Spine Deform* 11(6):1495-1501, 2023.

Turner JD, Schupper A.J, Mummaneni PV, Uribe JS, Eastlack RK, Mundis Jr, GM, Buell TJ, Mullin, JP. Evolving concepts in pelvic fixation in adult spinal deformity surgery. *Seminars in Spine Surgery* 35(4):101060 2023.

Buell TJ, Sardi JP, Yen CP, Okonkwo DO, Hamilton DK, Gum JL, International Spine Study Group. Use of supplemental rod constructs in adult spinal deformity surgery. *Seminars in Spine Surgery* 35(4):101062, 2023.

Thomas J. Buell, MD

Smith JS, Kelly MP, Buell TJ, Ben-Israel D, Diebo B, Scheer JK, Line B, Lafage V, Lafage R, Klineberg E, Kim HJ, Passias P, Gum JL, Kebaish K, Mullin JP, Eastlack R, Daniels A, Soroceanu A, Mundis G, Hostin R, Protopsaltis TS, Hamilton DK, Gupta M, Lewis SJ, Schwab FJ, Lenke LG, Shaffrey CI, Burton D, Ames CP, Bess S; International Spine Study Group. Adult Cervical Deformity Patients Have Higher Baseline Frailty, Disability, and Comorbidities Compared With Complex Adult Thoracolumbar Deformity Patients: A Comparative Cohort Study of 616 Patients. *Global Spine J* [Online ahead of print], 2023.

Marco Capogrosso, PhD

Assistant Professor
Director, Spinal Cord Stimulation Laboratory

Marco Capogrosso, PhD, joined the University of Pittsburgh Department of Neurological Surgery as an assistant professor in January of 2020. He completed his doctoral studies in biomedical engineering and robotics at the Scuola Superiore Sant'Anna in Pisa, Italy. His doctorate work focused on the implementation of a computational framework to support the design of peripheral and central neural interfaces for sensory and motor applications.

After the receiving his PhD, Dr. Capogrosso completed his post-doctoral training at the Ecole Polytechnique Fédérale de Lausanne, Switzerland where he worked on the development of brain spinal interfaces for the restoration of voluntary motor control in animals and humans with spinal cord injury. Before joining the University of Pittsburgh, he directed his own research group as a research faculty at the primate center of the University of Fribourg, Switzerland and was a manager of the primate platform. Dr. Capogrosso received the Young Investigator Award of the Society for Neuroscience in November 2023. He is now director of the Spinal Cord Stimulation Laboratory and part of the Rehab and Neural Engineering Labs of the University of Pittsburgh.

Specialized Areas of Interest
Neural control of movement; neural engineering; biophysics of electrical stimulation; arm paralysis; stroke, neurodegeneration, spinal cord injury; brain computer interfaces.

Professional Organization Membership
Society for Neuroscience

Education & Training
BA, Physics (cum laude) Università di Pisa, Italy, 2007
MS, Applied Physics (cum laude) Università di Pisa, Italy, 2009
PhD, Engineering, Institute of Biorobotics, Scuola Superiore Sant'Anna, 2013
Post-Doc, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, 2016

Honors & Awards
Young Investigator Award, Society for Neuroscience, 2023
Senior Vice Chancellor's Research Seminar Award, University of Pittsburgh 2023
Outstanding Reviewer Award, The Journal of Neural Engineering 2020
European Research Council Starting Grant Award, 2019
Career Award, Technological Advances in Spinal Cord Injury, Lupicaia Foundation 2018
MIT 10 Best Breakthrough Technologies, Wireless Brain-Spine Interface, 2017
Swiss National Science Foundation Ambizione Fellowship, 2016
Best Post-Doc Paper, NCCR Robotics, 2014, 2016
Finalist, Tomorrow's PI Prize, Swiss Life Science Annual Meeting, 2015

Marco Capogrosso, PhD

News Media Appearances

"Collaborative Research Shapes the Future of Assistive Tech," *U.S. News & World Repor*t, April 2, 2024.

"Spinal Cord Stimulation for Stroke Victims," *American Medicine Today*, March 2, 2024.

"Pittsburgh-based stroke study brings improvements for Hempfield man and hope for a better future," *TribLive*, November 20, 2023.

"A moving story: Spinal cord stimulators restore hand and arm function after paralysis," *PittMed Magazine*, August 2, 2023.

Publications: 2023-24

• Refereed Articles:

Katic Secerovic N, Balaguer JM, Gorskii O, Pavlova N, Liang L, Ho J, Grigsby E, Gerszten PC, Karal-Ogly D, Bulgin D, Orlov S, Pirondini E, Musienko P, Raspopovic S, Capogrosso M. Neural population dynamics reveals disruption of spinal circuits' responses to proprioceptive input during electrical stimulation of sensory afferents. *Cell Rep* 43(2):113695, 2024.

Nanivadekar AC, Bose R, Petersen BA, Okorokova EV, Sarma D, Madonna TJ, Barra B, Farooqui J, Dalrymple AN, Levy I, Helm ER, Miele VJ, Boninger ML, Capogrosso M, Bensmaia SJ, Weber DJ, Fisher LE. Restoration of sensory feedback from the foot and reduction of phantom limb pain via closed-loop spinal cord stimulation. *Nat Biomed Eng* [Online ahead of print], 2023.

Rogers ER, Capogrosso M, Lempka SF. Biophysics of frequency-dependent variation in paresthesia and pain relief during spinal cord stimulation. *J Neurosci* 44(26):e2199232024, 2024.

Rogers ER, Lempka SF, Capogrosso M. Does high-frequency stimulation of sensory axons break the causal link between pain relief and paresthesia? *Neuron* 112(3):331-333, 2024.

Capogrosso M, Balaguer JM, Prat-Ortega G, Verma N, Yadav P, Sorensen E, de Freitas R, Ensel S, Borda L, Donadio S, Liang L, Ho J, Damiani A, Grigsby E, Fields D, Gonzalez-Martinez J, Gerszten P, Weber D, Pirondini E. Supraspinal control of motoneurons after paralysis enabled by spinal cord stimulation. *Res Sq* [Preprint], 2024.

Mahrous AA, Liang L, Balaguer JM, Ho JC, Hari K, Grigsby EM, Karapetyan V, Damiani A, Fields DP, Gonzalez-Martinez JA, Gerszten PC, Bennett DJ, Heckman CJ, Pirondini E, Capogrosso M. GABA Increases Sensory Transmission In Monkeys. *bioRxiv* [Preprint], 2023.

Balaguer JM, Prat-Ortega G, Verma N, Yadav P, Sorensen E, de Freitas R, Ensel S, Borda L, Donadio S, Liang L, Ho J, Damiani A, Grigsby E, Fields DP, Gonzalez-Martinez JA, Gerszten PC, Fisher LE, Weber DJ, Pirondini E, Capogrosso M. Supraspinal control of motoneurons after paralysis enabled by spinal cord stimulation. *medRxiv* [Preprint], 2023.

Milekovic T, Moraud EM, Macellari N, Moerman C, Raschellà F, Sun S, Perich MG, Varescon C, Demesmaeker R, Bruel A, Bole-Feysot LN, Schiavone G, Pirondini E, YunLong C, Hao L, Galvez A, Hernandez-Charpak SD, Dumont G, Ravier J, Le Goff-Mignardot CG, Mignardot JB, Carparelli G, Harte C, Hankov N, Aureli V, Watrin A, Lambert H, Borton D, Laurens J, Vollenweider I, Borgognon S, Bourre F, Goillandeau M, Ko WKD, Petit L, Li Q, Buschman R, Buse N, Yaroshinsky M, Ledoux JB, Becce F, Jimenez MC, Bally JF, Denison T, Guehl D, Ijspeert A, Capogrosso M, Squair JW, Asboth L, Starr PA, Wang DD, Lacour SP, Micera S, Qin C, Bloch J, Bezard E, Courtine G. A spinal cord neuroprosthesis for locomotor deficits due to Parkinson's disease. *Nat Med* 29(11):2854-2865, 2023.

Marco Capogrosso, PhD

Liang L, Damiani A, Del Brocco M, Rogers ER, Jantz MK, Fisher LE, Gaunt RA, Capogrosso M, Lempka SF, Pirondini E. A systematic review of computational models for the design of spinal cord stimulation therapies: from neural circuits to patient-specific simulations. *J Physiol* 601(15):3103-3121, 2023.

Research Activities

In 2024, Dr. Capogrosso reported the initial results of the first-in-human clinical trial testing the efficacy of spinal cord stimulation (SCS) to restore arm and hand function in people with chronic stroke that was approved by the University of Pittsburgh IRB (NCT04512690). This trial is performed in collaboration with Peter Gerzten, MD, and Robert Friedlander, MD, from the University of Pittsburgh Department of Neurological Surgery; Elvira Pirondini, PhD, and Lee Fisher, PhD, from the University of Pittsburgh Department of Physical Medicine and Rehabilitation; George F. Wittenberg, MD, PhD, from the University of Pittsburgh Department of Neurology; Douglas J. Weber, PhD, from Carnegie Mellon University; and John W. Krakauer, MD, from Johns Hopkins University.

The study's hypothesis is that SCS can support residual motor function in people with upper limb paralysis in consequence of stroke and significantly improve motor control. Dr. Capogrosso and his fellow researchers are now close to completing the first part of the study in seven subjects and preparing to transition to the new phase of the study. They have observed unexpectedly large effect sizes that substantially improved strength, motor control and daily-life abilities of people with stroke. The results of this work were published in the important journal *Nature Medicine*. Dr. Capogrosso believes that data shows that their technology has the potential of becoming the first effective therapy for permanent post-stroke upper limb hemiparesis. This work has received worldwide media coverage including the BBC and the *New York Times.*

Finally, Dr. Capogrosso is continuing a clinical trial to explore the feasibility of using SCS to treat motor deficits and slow disease progress in people with spinal muscular atrophy (NCT05430113), a genetic disease that progressively destroys spinal motoneurons leading to paralysis. This study is supported by the venture branch of Roche: Genentech.

Diane L. Carlisle, PhD

Associate Professor

Diane Carlisle, PhD, joined the Department of Neurological Surgery in October 2010. She received her undergraduate degree in molecular biology from Washington and Jefferson College and her graduate degree in molecular and cellular oncology from George Washington University where she identified new signaling pathways involved in occupational causes of lung cancer.

Dr. Carlisle came to the University of Pittsburgh after a postdoctoral fellowship at Johns Hopkins University under the mentorship of Robert Casero Jr., PhD, in drug development for lung cancer. She then developed an independent research program using stem cells to investigate adult disease.

The mission of her laboratory is to use human pluripotent stem cells to model disease. She has an active program using stem cells generated from tissue samples donated by sporadic ALS patients and by Huntington's Disease patients. By differentiating these cells into mature neurons, she is able to identify neurologic disease specific changes in mitochondrial function. In addition, she uses her expertise in pluripotent stem cell methods and directed differentiation to collaborate in her department, and across the university, in cross disciplinary projects that use pluripotent stem cell technologies.

Diane L. Carlisle, PhD

Dr. Carlisle serves as faculty for the NIH-funded stem cell course, Frontiers in Stem Cells and Regeneration, which is held annually at the Marine Biological Laboratories in Woods Hole, Massachusetts.

Specialized Areas of Interest
Fetal basis for adult disease; use of stem cells for developmental modeling and drug discovery; amyotrophic lateral sclerosis (ALS); Huntington's Disease.

Professional Activities
Faculty, Frontiers in Stem Cells and Regeneration Course, University of Chicago Marine Biological Laboratory
Study Section, 2023 NIH Neural Oxidative Metabolism, Mitochondria and Cell Death
Mentor, 2023-24 Health Sciences Research Training Program, University of Pittsburgh School of Medicine

Education & Training
BA, Biology, Washington & Jefferson College, 1994
PhD, Molecular and Cellular Oncology, George Washington University, 1999
Fellowship, Johns Hopkins University, 2001

Publications: 2023-24
• Refereed Articles:
Kim J, Li W, Wang J, Baranov SV, Heath BE, Jia J, Suofu Y, Baranova OV, Wang X, Larkin TM, Lariviere WR, Carlisle DL, Friedlander RM. Biosynthesis of neuroprotective melatonin is dysregulated in Huntington's disease. *J Pineal Res* 75(4):e12909, 2023.

Research Activities
In the past year, Dr. Carlisle used patient-specific induced pluripotent stem cells (iPSCs) to investigate mitochondrial function of neural progenitors and neurons from Huntington's Disease patients. She differentiated iPSCs into neural progenitors and mature neurons and isolated mitochondria for analysis. She found proteomic and functional differences between neurons and controls from neurodegenerative disease patients. Dr. Carlisle also initiated a new study in coordination with the Huntington's Disease Society of America (HDSA) Center of Excellence at the University of Pittsburgh to use HD patient blood samples for analysis.

Shaun W. Carlson, PhD

Assistant Professor

Shaun Carlson, PhD, joined the faculty of the Department of Neurological Surgery at UPMC Children's Hospital of Pittsburgh in October of 2017.

Dr. Carlson graduated from the University of Kansas in 2007 with a Bachelor of Science degree in cell biology. He earned his PhD in physiology in 2013 from the University of Kentucky, studying the effects of traumatic brain injury on hippocampal neurogenesis and the efficacy of a growth factor based therapeutic approach to promote neurogenic plasticity and functional recovery after brain injury. He continued his training in 2013 as a postdoctoral fellow at the University of Pittsburgh Department of Neurological Surgery.

Specialized Areas of Interest
Mechanisms of synaptic dysfunction and plasticity and the identification of therapeutic approaches to promote recovery following brain injury.

Shaun W. Carlson, PhD

Professional Organization Membership
National Neurotrauma Society
Society for Neuroscience

Professional Activities
Membership Committee, National Neurotrauma Society
Training, Education and Mentoring (TEAM), National Neurotrauma Society

Education & Training
BSc, Cell Biology, University of Kansas, 2007
PhD, Physiology, University of Kentucky, 2013
Postdoctoral Fellowship, Neurological Surgery, University of Pittsburgh, 2017

Honors & Awards
Mellon Scholar, Richard King Mellon Foundation Institute for Pediatric Research, 2023-present
Ruth L. Kirschstein National Research Service Award (NIH), 2015-17
Nancy Caroline Fellow Award, Safar Center for Resuscitation Research, 2016
Murray Goldstein Award of Excellence, National Neurotrauma Symposium, 2013
Anthony Marmarou Award of Excellence, National Neurotrauma Symposium, 2012
Brian J. Hardin Award for Research, Department of Physiology, University of Kentucky, 2008

Publications: 2023-24
• Refereed Articles:
Svirsky SE, Li Y, Henchir J, Rodina A, Carlson SW, Chiosis G, Dixon CE, "Experimental traumatic brain injury increases epichaperome formation." *Neurobiol Dis* 188:106331 2023.

Svirsky SE, Henchir J, Li Y, Carlson SW, Dixon CE. Temporal-specific sex and injury-dependent changes on neurogranin-associated synaptic signaling after controlled cortical in rats. *Mol Neurobiol* [Online ahead of print], 2024.

Research Activities
Dr. Carlson continues his research efforts to investigate the mechanisms underlying synaptic and neurobehavioral dysfunction following traumatic brain injury, utilizing a number of experimental injury models, in support of NIH, Department of Defense and foundation grants. His research efforts have expanded the implementation of multiple non-invasive imaging, fluid and genetic biomarkers to examine outcomes after traumatic brain injury.

Yue-Fang Chang, PhD

Research Associate Professor

Yue-Fang Chang, PhD has worked in a variety of areas, such as brain tumor, traumatic brain injury, health outcome, neuroimaging study, women's health, and diabetes epidemiology. She serves as the statistician in several epidemiological studies including Cardiovascular Health Study, Women's Health Initiative and Study of Women's Health Across the Nation. Over the years she has been involved in numerous grant preparations, providing statistical expertise in design, analysis and power/sample size calculations.

Specialized Areas of Interest
Longitudinal data analysis; survival analysis; statistical computing; research methodology; injury epidemiology.

Yue-Fang Chang, PhD

Education & Training

BS, Statistics, National Chung-Hsing University, Taiwan, 1984
MS, Statistics, University of Illinois at Urbana-Champaign, 1987
PhD, Statistics, University of Illinois at Urbana-Champaign, 1991
MPH, Epidemiology, University of Pittsburgh, 1994

Publications: 2023-24

• Refereed Articles:

Thurston RC, Chang Y, Kline CE, Swanson LM, El Khoudary SR, Jackson EA, Derby CA. Trajectories of Sleep Over Midlife and Incident Cardiovascular Disease Events in the Study of Women's Health Across the Nation. *Circulation* 149(7):545-555, 2024.

Lopez OL, Villemagne VL, Chang YF, Cohen AD, Klunk WE, Mathis CA, Pascoal T, Ikonomovic MD, Rowe C, Dore V, Snitz BE, Lopresti BJ, Kamboh MI, Aizenstein HJ, Kuller LH. Association Between β-Amyloid Accumulation and Incident Dementia in Individuals 80 Years or Older Without Dementia. *Neurology* 102(2):e207920, 2024.

Casillo SM, Gatesman TA, Chilukuri A, Varadharajan S, Johnson BJ, David Premkumar DR, Jane EP, Plute TJ, Koncar RF, Stanton AJ, Biagi-Junior CAO, Barber CS, Halbert ME, Golbourn BJ, Halligan K, Cruz AF, Mansi NM, Cheney A, Mullett SJ, Land CV, Perez JL, Myers MI, Agrawal N, Michel JJ, Chang YF, Vaske OM, MichaelRaj A, Lieberman FS, Felker J, Shiva S, Bertrand KC, Amankulor N, Hadjipanayis CG, Abdullah KG, Zinn PO, Friedlander RM, Abel TJ, Nazarian J, Venneti S, Filbin MG, Gelhaus SL, Mack SC, Pollack IF, Agnihotri S. An ERK5-PFKFB3 axis regulates glycolysis and represents a therapeutic vulnerability in pediatric diffuse midline glioma. *Cell Rep* 43(1):113557, 2024.

Thurston RC, Maki P, Chang Y, Wu M, Aizenstein HJ, Derby CA, Karikari TK. Menopausal vasomotor symptoms and plasma Alzheimer disease biomarkers. *Am J Obstet Gynecol* 230(3):342.e1-342.e8, 2024.

Thurston RC, Jakubowski K, Chang Y, Wu M, Barinas Mitchell E, Aizenstein H, Koenen KC, Maki PM. Posttraumatic Stress Disorder Symptoms and Cardiovascular and Brain Health in Women. *JAMA Netw Open* 6(11):e2341388, 2023.

Bethamcharla R, Abou-Al-Shaar H, Maarbjerg S, Chang YF, Gacka CN, Sekula RF Jr. Percutaneous glycerol rhizolysis of the trigeminal ganglion for the treatment of idiopathic and classic trigeminal neuralgia: Outcomes and complications. *Eur J Neurol* 30(10):3307-3313, 2023.

Thurston RC, Wu M, Barinas-Mitchell E, Chang Y, Aizenstein H, Derby CA, Maki P. Carotid intima media thickness and white matter hyperintensity volume among midlife women. *Alzheimers Dement* 19(7):3129-3137, 2023.

Gillman GS, Bakeman AE, Soose RJ, Wang EW, Schaitkin BM, Lee SE, Chang YF, Mims MM. Will nasal airway surgery improve my sense of smell? A prospective observational study. *Int Forum Allergy Rhinol* 13(8):1511-1517, 2023.

Or Cohen-Inbar, MD, PhD

Clinical Associate Professor

Or Cohen-Inbar, MD, PhD, joined the faculty at the University of Pittsburgh Department of Neurological Surgery in 2019. He completed his medical degree at the Technion Israel Institute of Technology in Haifa, Israel in 2008 and completed his residency in neurological surgery at Rambam Health Care in Haifa in 2014. He obtained his doctorate in immunology and tumor immunotherapy focusing on developing immunotherapeutical approaches to battles Glioblastoma Multiforme and other malignant brain tumors from the Technion Israel Institute of Technology in 2014.

Dr. Cohen-Inbar completed a two-year clinical fellowship in surgical oncology and stereotactic radiosurgery at the University of Virginia Department of Neurological Surgery in 2016. His research has focused on developing new multi-modality approaches to battle benign and malignant brain tumors, with his basic research focusing on new immuno-therapeutical approaches to help battle malignant brain tumors.

Dr. Cohen-Inbar completed several mini-fellowships encompassing a wide range of neurosurgical techniques, including those related to the different techniques in managing degenerative spine surgery and neuro-endoscopy.

Dr. Cohen-Inbar has authored several books such as *Focused Neurosurgery* published by Jaypee Brothers Publishing House in 2016, and *Focused Neuro-Anatomy for Medical Students* published by Nova Science Publishers in 2015. He also has contributed chapters to many other books and publications, including the recently published edition of the well renowned and famous *Youmans and Winn Neurological Surgery, 8th Edition*.

Dr. Cohen-Inbar currently serves on the editorial boards of several leading neurosurgical and neuro-oncological journals.

Specialized Areas of Interest
Neuro-oncology; stereotactic radiosurgery; pituitary lesions, pain syndromes, psychiatric illnesses; neurotrauma; degenerative spine diseases.

Board Certifications
Israeli Board Certified in Neurosurgery

Hospital Privileges
UPMC Western Maryland

Professional Organization Membership
American Association of Neurological Surgeons
Congress of Neurological Surgeons
European Association of Neurosurgical Societies
Foundation for International Education in Neurological Surgery
Israeli Neurosurgical Association

Professional Activities
Section Editor, *Youmans & Winn Neurological Surgery, 8th Edition*, Elsevier

Or Cohen-Inbar, MD, PhD

Education & Training
MD, Technion Israel Institute of Technology, Haifa, Israel, 2008
PhD, Technion Israel Institute of Technology, Haifa, Israel, Molecular Immunology, 2014
Residency, Rambam Health Care, Haifa, Israel, 2014
Fellowship, University of Virginia, Surgical Neuro-Oncology and Radiosurgery, 2016

Honors & Awards
America's Best Spine Surgeons Nominee, *Becker's Spine Review*, 2022-24
Young Investigator Award, Clinical/Translational Research, Biennial Canadian Neuro-Oncology Meeting, 2016
Israeli-Cancer-Association Award, Cancer Research and Treatment, 2014
Rambam Knowledge Center Fellowship Grant, 2014
Best Poster Award, Third German-Israeli Cancer Research School, DKFZ-MOST, 2010
MD Thesis Cum Laude, Technion Institute of Technology, 2007
Magna Cum Laude Rector's Honor, University of Debrecen, Hungary, 2003

News Media Appearances: 2023-24
"Our view | A better view," *Cumberland Times-News* (Md.), April 29, 2024.
"Healthbeat: Local neurosurgeon helps develop 'all-in-one' instrument set", *Cumberland Times-News* (Md.), April 28, 2024.
"UPMC Western Maryland launches monthly conference," *The Garrett County Republican*, April 25, 2024.

Donald J. Crammond, PhD

Associate Professor
Associate Director, Movement Disorder Surgery

Donald Crammond, PhD, joined the Center for Clinical Neurophysiology as a staff neurophysiologist in November 1997. Dr. Crammond received his undergraduate education in physiology at the University of Glasgow in Scotland and his graduate education in neurophysiology at the University of Toronto. After postdoctoral studies at the University of Wisconsin and later at the Université de Montréal, he was appointed visiting associate scientist at the National Institute of Mental Health in Bethesda, Md.

Dr. Crammond specializes in intra-operative neurophysiological monitoring (IONM) and in systems-level, behavioral neurophysiology, examining the neuronal substrates of higher cognitive processes such as movement planning and speech and the functional interactions between, the cerebral cortex, thalamus and basal ganglia, and the mechanisms underlying motor control and movement disorders.

Dr. Crammond is the associate director for microelectrode recording and subcortical mapping for the movement disorder and epilepsy surgery programs at UPMC. Dr. Crammond is vice-chair of the American Board of Neurophysiologic Monitoring (ABNM).

Specialized Areas of Interest
Intraoperative neurophysiological monitoring (IONM) and the application of neurophysiological mapping in the surgical treatment of movement disorders and epilepsy for optimal DBS or RNS electrode placement, functional localization in cerebral cortex; motor system physiology and research to investigate and study novel indications for DBS therapy such as in addiction and post-stroke motor rehabilitation.

Donald J. Crammond, PhD

Board Certifications
American Board of Neurophysiological Monitoring

Hospital Privileges
Indiana Regional Medical Center
UPMC Altoona
UPMC Bedford
UPMC Children's Hospital of Pittsburgh
UPMC East
UPMC Horizon
UPMC Magee-Womens Hospital
UPMC McKeesport
UPMC Mercy
UPMC Muncy
UPMC Northwest
UPMC Passavant
UPMC Passavant, Cranberry
UPMC Pinnacle
UPMC Presbyterian
UPMC St. Margaret
UPMC Shadyside
UPMC Somerset
UPMC Susquehanna
UPMC Western Maryland

Professional Organization Membership
American Society for Neurophysiological Monitoring
Movement Disorder Society
Society for Neuroscience

Professional Activities
Vice-Chair, American Board of Neurophysiologic Monitoring
Chair, Ethics Committee, American Society of Neurophysiologic Monitoring
Education Committee, American Society of Neurophysiologic Monitoring
University of Pittsburgh IRB, DSMB
Carnegie Mellon University IRB, DSMB

Education & Training
BSc (Hons), Physiology, University of Glasgow, 1980
PhD, Neurophysiology, University of Toronto, 1988
Fellowship, Neurophysiology, University of Wisconsin, 1987
Fellowship, Neurophysiology, Université de Montreal, 1992
Fellowship, Clinical Neurophysiology, University of Pittsburgh, 1999

Publications: 2023-24
• Refereed Articles:
Al-Qudah AM, Thirumala PD, Anetakis KM, Crammond DJ, Algarni SA, Al Majali M, Shandal V, Gross B, Lang M, Bhatt NR, Alhamza R, Al-Bayati AR, Nogueira RG and Balzer JR. Intraoperative neuromonitoring as real-time diagnostic for cerebral ischemia in endovascular treatment of ruptured brain aneurysms. *Clin Neurophysiol* 161:69-79, 2024.

Donald J. Crammond, PhD

Al-Qudah AM, Sreeja S, Anetakis KM, Crammond DJ, Balzer J, Thirumala PD, Subramaniam K, Sentil S, Shandal V. Role of intraoperative electroencephalography in predicting postoperative delirium in patients undergoing cardiovascular surgeries. *Clin Neurophysiol* 164:40-46, 2024.

Gorijala VK, Reddy RP, Anetakis KM, Balzer JR, Crammond DJ, Shandal V, Shaw JD, Christie MR and Thirumala PD. Diagnostic utility of different types of somatosensory evoked potential changes in pediatric idiopathic scoliosis correction surgery. *Eur Spine J* 33(4):1644-1656, 2024.

Al-Qudah AM, Ta'ani OA, Thirumala PD, Sultan I, Visweswaran S, Nadkarni N, Kiselevskaya V, Crammond DJ, Balzer J, Anetakis KM, Shandal V, Subramaniam K, Subramanium B, Sadhasivam S. Role of intraoperative neuromonitoring to predict postoperative delirium in cardiovascular surgery. *J Cardiothorac Vasc Anesth* 38(2):526-533, 2024.

Reddy RP, Gorijala VK, Kaithi VR, Shandal V, Anetakis KM, Balzer JR, Crammond DJ, Shaw JD, Lee JY, Thirumala PD. Utility of transcranial motor-evoked potential changes in predicting postoperative deficit in lumbar decompression and fusion surgery: a systematic review and meta-analysis. *Eur Spine J* 32(10):3321-3332, 2023.

Jimenez, JE, Omar M, Adams G, Costacou T, Thirumala PD, Crammond DJ, Anetakis KM, Balzer JR, Shandal V, Snyderman C, Gardner P, Zenonos G and Wang E,. Electromyographic predictors of abducens nerve palsy after endoscopic skull base surgery. *J Neurosurg* 140(6):1584-1590, 2023.

Reddy RP, Singh-Varma A, Chang R, Vedire A, Anetakis KM, Balzer JR, Crammond DJ, Shandal V, Lee JY, Shaw JD, Thirumala PD. Transcranial Motor Evoked Potentials as a Predictive Modality for Postoperative Deficit in Cervical Spine Decompression Surgery – A Systematic Review and Meta-analysis. *Global Spine J* 14(5):1609-1628, 2023.

Ho JC, Grigsby EM, Damiani, A, Liang L, Balaguer J-M, Kallakuri S, Barrios-Martinez J, Karapetyan V, Fields D, Gerszten PC, Hitchens KT, Constantine T, Adams G, Crammond DJ, Capogrossi M, Gonzalez-Martinez J and Pirondini E. Potentiation of cortico-spinal output via targeted electrical stimulation of the motor thalamus. *medRxiv* [Preprint], 2023.

Bata A, Al Qudah A, Algarni SA, Al Ta'ani O, Balzer JR, Crammond DJ, Shandal V, Gross BA, Lang MJ, Anetakis KM, Narayanan S, Mina A, Thirumala PD. Diagnostic accuracy of somatosensory evoked potentials and electroencephalography during endovascular treatment of unruptured cerebral aneurysms. *World Neurosurg* [Online ahead of print], 2023.

Research Activities

Dr. Crammond's major clinical research interest is 1) the study of basal ganglia, thalamus and cerebral cortical physiology and their functional interactions related to the control of movement in movement disorders including Parkinson's disease, Dystonia and Essential Tremor, 2) the use of subcortical mapping using micro-electrode recording (MER) to optimize placement of implanted DBS electrodes for DBS therapy of movement disorders, and 3) studying thalamic physiology using MER mapping for the optimal placement of RNS electrodes in the treatment of generalized epilepsy. This is accomplished by recording neurophysiological data using MER to record from single neurons and local field potential (LFP) recordings in the basal ganglia or thalamus simultaneously with electrocorticography (ECoG) and LFP from sensorimotor cortex and by stimulating various structures to examine the physiological relationship between basal ganglia and thalamus and functional areas of cerebral cortex that are known circuits involved in these respective conditions.

Donald J. Crammond, PhD

His research examines how these cortical areas and subcortical nuclei are involved in different aspects of movement planning and movement execution during the performance of controlled behavioral tasks. Currently, two research studies are ongoing. The first is examining the role of the motor thalamus in the facilitation of primary motor cortex to test if motor thalamus stimulation can facilitate corticospinal activation of arm and face muscles in patients with a loss of motor function after suffering a subcortical stroke. Dr. Crammond hopes to use DBS therapy to treat patients with spinal lesions or subcortical strokes and this is being actively tested in patients undergoing DBS implantation into motor thalamus to treat essential tremor. The plan is to soon study the use of motor thalamus DBS in stroke patients as a potential new therapy to enhance movement in these stroke patients who have impaired arm/hand and speech function and to facilitate their recovery after stroke with rehabilitation therapies. The second study is examining the potential use of DBS to treat addiction, specifically studying two patients who have had DBS implanted into the limbic area of the globus pallidum. They will be followed for over a year to examine if limbic pallidal DBS can treat their alcohol addiction.

As we understand more about basal ganglia and thalamic physiology and cortical-basal ganglia interactions, the hope is improve the targeting for optimal DBS placement within the basal ganglia and motor thalamus to be more specific to movement disorder patients' symptoms, to decrease the incidence of post-operative DBS side effects and to continue to explore new indications for DBS therapy. Related studies are examining how to better use brain imaging and potential electrophysiological biomarkers of PD, ET and Epilepsy, to improve DBS targeting.

Dr. Crammond's ongoing clinical research interests utilize the review of clinical outcome data to determine the impact of various modalities of Intra-Operative Neurophysiological Monitoring (IONM) and cortical and subcortical mapping, to prevent and/or reduce iatrogenic injury, improve clinical outcomes and to use neurophysiological mapping of the basal ganglia, thalamus and cerebral cortex to study the application of neuromodulation therapies, such as DBS and RNS, to treat currently indicated conditions and to investigate their application to treat novel medical indications.

C. Edward Dixon, PhD

Neurotrauma Chair Professor
Vice Chair, Research
Director, Brain Trauma Research Center

C. Edward Dixon, PhD, received his PhD degree in physiological psychology from the Virginia Commonwealth University in 1985.That year, he was awarded a National Research Service Award for Postdoctoral Fellows by the National Institutes of Health and joined the Division of Neurological Surgery at the Medical College of Virginia.

In 1986, he became a postdoctoral fellow in the Biomedical Science Department of the General Motors Technical Center in Warren, Mich. Dr. Dixon was named assistant professor in the Division of Neurosurgery at the Medical College of Virginia in 1987 and became an assistant professor in the Department of Neurological Surgery at the University of Texas Health Science Center in Houston in 1991.

In 1995, he joined the Brain Trauma Research Center in the Department of Neurological Surgery at the University of Pittsburgh as associate professor. He became the director of the center in October 2002.

C. Edward Dixon, PhD

Dr. Dixon received his adjunct faculty positions with the Department of Anesthesiology in 1995; the Department of Neurobiology in 2000 and the Department of Physical Medicine/Rehabilitation in 2003.

In 2001, he became a co-director of the Safar Center for Resuscitative Research. In May of 2004, Dr. Dixon was named full professor of neurological surgery at the University of Pittsburgh and was later appointed vice chairman of research in the Department of Neurological Surgery in 2008.

In 2011, Dr. Dixon was honored with one of the highest honors the university can present a faculty member when he was awarded The Neurotrauma Chair in Neurosurgery at the University of Pittsburgh.

Dr. Dixon is a member of the advisory committee for PRE Clinical Interagency reSearch resourcE-TBI (PRECISE-TBI). As part of the PRECISE-TBI, he directs the Preclinical Model Catalogue Core and is a member of the working group for preclinical common data elements

Dr. Dixon served as president of the National Neurotrauma Society for the 2002-03 term and continued as councilor of the society for terms 2004-07 and 2009-12. He also has continued as a study section participant of several public and private grant review panels. His research has dealt primarily with mechanisms of post-traumatic memory deficits, rodent models of traumatic brain injury, and functional outcomes.

Dr. Dixon has published 257 papers in refereed journals, two books (coeditor), 29 book chapters, and two editorials.

Specialized Areas of Interest
Mechanisms of induction and recovery of functional deficits following traumatic brain injury; neurotransmitter agonist therapies for recovery of post traumatic functional deficits; models of traumatic brain injury; clinical studies of pharmacotherapy.

Professional Organization Membership
American Association for the Advancement of Science
International Behavioral Neuroscience Society
National Neurotrauma Society (Charter Member)
Pittsburgh Chapter of Society for Neuroscience
Society for Neuroscience

Professional Activities
TBI Model Core Director, PRE Clinical Interagency reSearch resourcE-TBI
Scientific Board Member, Texas Institute for Rehabilitation Research
Grant Reviewer, Congressionally Directed Medical Research Programs (CDMRP)
Grant Reviewer, NIH Special Emphasis Panel/Scientific Review Group
Grant Reviewer, Department of Defense, CDMRP TBI Panel
Grant Reviewer and Chair, NIH, Special Emphasis Panel
Co-Chair, Kentucky Spinal Cord & Head Injury Study Section
Grant Reviewer, NJCBIR (New Jersey Commission on Brain Injury Research)
Grant Reviewer, Mission Connect-TIRR Foundation
Grant Reviewer, US Army Medical Research and Development Command (MRDC) Military Operational Medicine (MOM)

C. Edward Dixon, PhD

Education & Training
BA, Psychology, Virginia Commonwealth University, 1981
MS, Physiology/Psychology, Virginia Commonwealth University, 1984
PhD, Physiology/Psychology, Virginia Commonwealth University, 1985
NIH-NHRSA Fellow, Medical College of Virginia, 1986
Fellowship, General Motor Research Laboratories, 1987

Publications: 2023-24
• Refereed Articles:
Mi Z, Ma J, Zeh DJ, Rose ME, Henchir JJ, Liu H, Ma X, Cao G, Dixon CE, Graham SH. Systemic treatment with ubiquitin carboxy terminal hydrolase L1 TAT protein ameliorates axonal injury and reduces functional deficits after traumatic brain injury in mice. *Exp Neurol* 373:114650, 2024.

Snyder K, Dixon CE, Henchir J, Gorse K, Vagni VA, Janesko-Feldman K, Kochanek PM, Jackson TC. Gene knockout of RNA binding motif 5 in the brain alters RIMS2 protein homeostasis in the cerebellum and Hippocampus and exacerbates behavioral deficits after a TBI in mice. *Exp Neurol* 374:114690 2024.

Zhou C, Li S, Qiu N, Sun P, Hamblin MH, Dixon CE, Chen J, Yin KJ. Loss of microRNA-15a/16-1 function promotes neuropathological and functional recovery in experimental traumatic brain injury. *JCI Insight* 9(12):e178650, 2024.

Svirsky SE, Henchir J, Li Y, Carlson SW, Dixon CE. Temporal-Specific Sex and Injury-Dependent Changes on Neurogranin-Associated Synaptic Signaling After Controlled Cortical Impact in Rats. *Mol Neurobiol* [Online ahead of print], 2024.

Svirsky SE, Li Y, Henchir J, Rodina A, Carlson SW, Chiosis G, Dixon CE. Experimental traumatic brain injury increases epichaperome formation. *Neurobiol Dis* 188:106331 2023.

Research Activities
Dr. Dixon's funded research activities include performing studies to test the hypothesis that decreased neurogranin expression contributes to dysfunctional synaptic plasticity and cognition after TBI. He has examined the effects of TBI on neurogranin signaling and on therapies that modulate neurogranin expression.

Another research area is the role of epichaperomes on TBI pathology. Under conditions of cellular stress, the chaperomes become biochemically 'rewired' to form a network of stable, high-molecularweight complexes, recently called epichaperomes. Epichaperomes protect aberrant proteins from degradation, aid in their aggregation and ultimately alter complex protein networks associated with neuronal degeneration. Dr. Dixon has recently published the first demonstration of TBI produces an epichaperome response.

He is also a co-principal investigator of the Veterans Administration-funded PRE Clinical Interagency research resourcE-TBI grant with the overarching mission is to develop a center entitled PRE-Clinical Interagency reSearch resourcE-Traumatic Brain Injury (PRECISE-TBI) with the mission of accelerating the development of therapies for TBI. Within this center, Dr. Dixon directs the TBI model catalog that has the goal to enhance reproducibility of preclinical TBI research by increasing the ability for researchers to find and access preclincial TBI model papers.

Shawn R. Eagle, PhD

Research Assistant Professor

Shawn R. Eagle, PhD, has collaborated on Department of Defense (DoD) funded research through the University of Pittsburgh since 2013. Dr. Eagle extended his doctoral studies as a postdoctoral fellow in the UPMC Sports Medicine Concussion Clinic from 2019 to 2021. His research interests are currently focused on mitigating risk for long-term sequelae following traumatic brain injury, with a specific focus on mental health issues.

Dr. Eagle has published 130 papers in refereed journals and presented his research at local, national and international scientific conferences. He is a member of the Editorial Board for the Journal of Athletic Training and Neurosurgery.

Specialized Areas of Interest

Optimizing identification, assessment and management of traumatic brain injury using objective assessments and biological markers to improve long-term patient outcomes.

Board Certifications

Certified Athletic Trainer

Professional Organization Membership

Concussion in Sport Group
International Initiative for Traumatic Brain Injury Research (InTBIR)
National Athletic Trainers' Association
National Neurotrauma Society
Sports Neuropsychology Society

Education & Training

BA, Athletic Training, Denison University, 2011
MAT, Athletic Training, Texas Tech University, 2013
PhD, Rehabilitation Science, University of Pittsburgh, 2019
Postdoctoral Fellowship, Department of Orthopaedic Surgery, University of Pittsburgh, 2021

Honors & Awards

Young Investigator Award Finalist, Military Health Sciences Research Symposium, 2020
Neuromuscular Plasticity Scholar Award, University of Florida, 2018
Doctoral Student Award, International Congress on Soldiers' Physical Performance, 2017
Mid-Atlantic Regional Doctoral Student Investigator Award, American College of Sports Medicine, 2016

News Media Appearances: 2023-24

"Could Living Football Players Be Overdiagnosed for CTE?" *U.S. News & World Report*, October 6, 2023.
"Multidomain Assessment Outcomes with Referral for Vestibular Therapy after Concussion." Journal of Athletic Training Chat, August 2023.

Publications: 2023-24

• Refereed Articles:

Eagle SR, Nwachuku E, Deng H, Okonkwo D, Elmer J, Pease M. Applying the sliding scale approach to quantifying functional outcomes up to two years after severe traumatic brain injury. *J Neurotrauma* 41(11-12):1417-1424 2024.

Shawn R. Eagle, PhD

Albrecht TJ, Mehmel BM, Rossi EA, Trbovich AM, Eagle SR, Kontos AP. Temporal changes in fixational eye movements (FEMs) following concussion in adolescents and adults: preliminary findings. *J Neurotrauma* 41(1-2):199-208 2024.

Eagle SR, Grashow R, DiGregorio H, Terry D, Baggish A, Weisskopf MG, Okonkwo DO, Zafonte R. Interaction of medical conditions and football exposures associated with premortem chronic traumatic encephalopathy diagnosis in former professional American football players. *Sports Med* 54(3):743-752 2024.

Preszler J, Manderino L, Eagle SR, Trbovich A, Kissinger-Knox A, Feder A, Mehmel B, Collins MW, Kontos AP. Evaluating recovery after two and three repeated concussions using growth curves. *J Neurotrauma* 41(11-12):1409-1416, 2024.

Eagle SR, Grashow R, Terry DP, DiGregorio H, Baggish A, Weisskopf MG, Kontos A, Okonkwo DO, Zafonte R. Medical conditions in former professional American-style football players are associated with endorsing symptoms of traumatic encephalopathy syndrome. *Neurotrauma Rep* 5(1):376-386 2024.

Eagle SR, Basantani MK, Preszler J, Sherry N, McIntyre P, Kershaw EE, Puccio AM, Okonkwo DO. Interaction of obesity and NLRP3 inflammasome activation following mild traumatic brain injury. *Sci Rep* 14(1):10178, 2024.

Gomes D, Eagle S, Mehmel B, Albrecht T, Versace A, Lima Santos JP, Trbovich A, Stiffler R, Martinez L, Holland CL, Zynda AJ, Collins MW, Kontos AP. Impact of sex and pubertal development on anxiety in adolescents following concussion. *J Neurotrauma* [Online ahead of print], 2024.

Yue JK, Lee YM, Sun X, van Essen TA, Elguindy MM, Belton PJ, Pisica D, Mikolic A, Deng H, Kanter JH, McCrea MA, Bodien YG, Satris GG, Wong JC, Vardhaan SA, Grandhi R, Puccio AM, Mukherjee P, Valadka AB, Tarapore PE, Huang MC, DiGiorgio AM, Markowitz AJ, Yuh EL, Okonkwo DO, Steyerberg EW, Lingsma HF, Menon DK, Maas AIR, Jain S, Manley GT, the TRACK-TBI Investigators. Performance of the IMPACT and CRASH prognostic models for traumatic brain injury in a contemporary multicenter cohort: a TRACK-TBI study. *J Neurosurg* [Online ahead of print], 2024.

Shumski EJ, Eagle SR, Kontos AP, Bazarian JJ, Caccese JB, Chrisman SPD, Clugston JR, McAllister TW, McCrea M, Broglio SP, Lynall RC, Schmidt JD, the CARE Consortium Investigators. The interval between concussions does not influence time to asymptomatic or return to play: a CARE Consortium study. *Sports Med* [Online ahead of print], 2024.

Terry DP, Grashow R, Iverson GL, Atkeson P, Rotem R, Eagle SR, Daneshvar D, Zuckerman SL, Zafonte RD, Weisskopf MG, Baggish A. Age of first exposure does not relate to post-career health in former professional American-style football players. *Sports Med* [Online ahead of print], 2024.

Eagle SR, Mital AM, Kellogg R, Vargas J, Nwachuku E, Deng H, Buell TJ, Okonkwo DO, Pease M. Interaction of platelet count at admission and current medication increases risk for chronic subdural recurrence. *Neurosurg Focus* 55(4):E4, 2023.

Sinnott A, Eagle SR, Kochick V, Trbovich A, Collins M, Sparto P, Flanagan S, Elbin RJ, Connaboy C, Kontos A. Comparison of physiological outcomes after dynamic exertion between athletes at return to sport from concussion and controls. *J Sci Med Sport* 26(12):682-687 2023.

Eagle SR, Jain S, Sun X, Preszler J, McCrea M, Giacino J, Manley G, Okonkwo D, Nelson L. Network analysis and relationship of symptom factors to functional outcomes and quality of life following mild traumatic brain injury: A TRACK-TBI study. *Front Neurol* 14:1308540, 2023.

Matt El-Kadi, MD, PhD

Clinical Professor
Vice Chair
Chief, Neurosurgery, UPMC Passavant
Director, UPMC Passavant Spine Center

Matt El-Kadi, MD, PhD, FACS, joined the Department of Neurological Surgery as a clinical assistant professor in September of 1999. He became clinical associate professor in January 2003 and clinical professor in June 2006. He became vice chairman of the Department of Neurological Surgery in 2010 and has been chief of neurosurgery at UPMC Passavant since 2005. Dr. El-Kadi is also director of the UPMC Passavant Spine Center and is a member of the Tri-State Neurosurgical Associates.

Dr. El-Kadi is board-certified in neurological surgery and has been nominated as one of Pittsburgh's best doctors in the region since 2012 and as one of the best doctors in America by Castle Connelly since 2009. He has also been honored since 2019 as one of Marquis Who's Who in America. He specializes in the treatment of complex spine disorders, including spinal fusion and instrumentation, and minimally invasive spinal surgery for both the cervical and lumbar spine, with a special interest in the removal of primary and secondary spinal tumors. He has authored seven books and book chapters and has over 100 publications in circulation. He is an active participant in professional societies.

Before joining UPMC, Dr. El-Kadi received training in complex spinal surgery at Allegheny General Hospital in Pittsburgh. He completed his neurosurgery residency training at West Virginia University and a one-year clinical fellowship in neurosurgery at Hartford Hospital, University of Connecticut. Dr. El-Kadi began his surgical career doing brain surgery. The minimally invasive and microscopic techniques used then on the brain have served him well as a spine surgeon for minimally invasive approaches and has been reflected in his patients' shorter hospital stays and good outcomes.

Specialized Areas of Interest
Minimally invasive spine surgery; complex spine disorders; spinal stabilization; spinal tumors.

Board Certifications
American Board of Neurological Surgeons

Hospital Privileges
Grove City Medical Center
Heritage Valley Hospital, Sewickley
UPMC Mercy
UPMC Passavant
UPMC Presbyterian
The Washington Hospital

Professional Organization Membership
Allegheny County Medical Society
American Academy of Anti-Aging Medicine
American Association of Neurological Surgeons
American Medical Association
Congress of Neurological Surgeons
International Spinal Injections Society
North American Spine Society

Matt El-Kadi, MD, PhD

Ohio County Medical Society
Pennsylvania Medical Society
Pennsylvania Neurosurgical Society

Professional Activities
Board of Directors, UPMC Passavant and St. Margaret
Board of Directors, Passavant Foundation

Education & Training
MD, Second Moscow State Pirogov Medical Institute, 1983
Residency, Neurosurgery, Burdenko Neurosurgical Institute, 1989
Fellowship, Brain Tumor Research, LAC + USC Medical Center, 1992
Fellowship, Neurosurgery, University of Connecticut, 1994
Fellowship, Neurosurgery, Allegheny General Hospital, 1998
Residency, Neurosurgery, West Virginia University, 1999

Honors & Awards
UPMC Passavant dedicates family lounge as the "Matt El-Kadi MD, PhD, Surgical Family Lounge at UPMC Passavant" reflecting his contribution to the hospital, 2024
Castle Connolly Top Doctors in America, 2012-24
Marquis *Who's Who in America*, 2019-20
UPMC Passavant Legacy of Caring Award, 2014
UPMC Champion of Nursing Award, 2011

David T. Fernandes Cabral, MD

Assistant Professor of Neurological Surgery
Director, Resident Education

David T. Fernandes Cabral, MD, joined the University of Pittsburgh Department of Neurological Surgery at UPMC Mercy in July of 2024 after completing a seven-year residency at the University of Pittsburgh as well as a enfolded skull base fellowship. He received his medical degree from the José María Vargas School of Medicine at the Universidad Central de Venezuela in Caracas, Venezuela where he graduated at the top of his class. While in medical school, Dr. Fernandes was a teacher assistant in the Department of Anatomy and Neuroanatomy, as well as a research assistant at the Department of Pharmacology.

After graduating from medical school, David completed two years of mandatory service in a rural community in Venezuela where he served in a leadership role at the health center and was actively involved in teaching medical students during their rural rotations.

Dr. Fernandes has been invited to lecture in white matter connectivity of the human brain at the University of Pittsburgh Department of Psychology, and is currently in charge of teaching the practical sessions in the surgical neuroanatomy course for fourth year medical students at the university.

During his free time, David enjoys cooking, travelling, biking, watching movies and spending time with his family and friends.

Specialized Areas of Interest
Skull base surgery, cerebrovascular surgery, surgical neuro-oncology, diffusion-MRI fiber tractography, microsurgical anatomy, traumatic brain injury, spine trauma, and teaching.

David T. Fernandes Cabral, MD

Hospital Privileges
UPMC Mercy
UPMC Presbyterian
UPMC Shadyside

Professional Organization Membership
American Association of Neurological Surgeons
American Medical Association
Congress of Neurological Surgeons
North America Skull Base Society

Education & Training
MD, Universidad Central de Venezuela, 2017
Post-Doctoral Fellowship, High-Definition Fiber Tractography, University of Pittsburgh, 2017
Enfolded Skull Base Fellowship, University of Pittsburgh, 2023-24
Residency, Neurological Surgery, University of Pittsburgh, 2024
Skull Base Fellowship, University of Pittsburgh, 2024

Honors & Awards
Joseph Maroon Aequanimitas Award, University of Pittsburgh, 2024
Best Resident Teacher, Department of Neurological Surgery, 2024
Best Clinical Research Poster, Disorders of the Spine and Peripheral Nerves Session, Congress of Neurological Surgeons Annual Meeting, 2023
Cover Call Competition Winner, *Nature Reviews Neurology*, 2017
Best Poster Presentation, Venezuelan Neurosurgery Society, 2012
Research Assistant of the Year, Universidad Central de Venezuela, 2011
Teacher Assistant of the Year, Department of Anatomy and Neuroanatomy, Universidad Central de Venezuela, 2010

Publications: 2023-24
• Refereed Articles
Abalkhi I, Shafqat A, Bin-Alamer O, Mallela AN, Gersey ZC, Fernandes Cabral DT, Sabbagh A, Hadjipanayis CG, Gonzalez-Martinez J, Friedlander RM, Abou-Al-Shaar H. Complications and visual outcomes following surgical resection of pediatric optic pathway/hypothalamic gliomas: a systematic review and meta-analysis. *Childs Nerv Syst* 40(7):2033-2042, 2024.

Fernandes Cabral D, Fernandez-deThomas R, Alattar Al, Paul D, Wang E, Gardner P. Endoscopic endonasal approach for resection of Odontoid process, decompression of the cervicomedullary junction spinal cord and resection of pannus. *Neurosurg Focus Video* 10(2):V2 2024.

Linn WJ, Barrios-Martinez J, Fernandes-Cabral D, Jacquesson T, Nuñez M, Gomez R, Anania Y, Fernandez-Miranda J, Yeh FC. Probabilistic coverage of the frontal aslant tract in young adults: Insights into individual variability, lateralization, and language functions. *Hum Brain Mapp* 45(3):e26630, 2024.

Mallela A, Plute T, Abou-Al-Shaar H, Fernandes Cabral D, Hadjipanayis C. Exoscope-based supra-secerebellar infratentorial approach for a pineal meningioma in prone position. *Neurosurg Focus Video* 10(1):V15, 2024.

Algattas H, Gersey Z, Fernandes Cabral D, Alattar A, Abdallah H, Muthiah N, Khiyami A, Mehrota N, Abdulwahid T, Wang E, Snyderman C, Zenonos G, Fazeli P, Gardner P. Endoscopic Endonasal Resection of Rathke's Cleft Cysts: A Single Institution Analysis of 148 Consecutive Patients. *J Neurosurg* [Online ahead of print], 2024.

David T. Fernandes Cabral, MD

Samanci Y, Askeroglu MO, Nabeel AM, Reda WA, Tawadros SR, Abdelkarim K, El-Shehaby AMN, Emad RM, Legarreta A, Fernandes Cabral D, Anand S, Niranjan A, Lunsford LD, Tripathi M, Kumar N, Liscak R, May J, Lee CC, Yang HC, Martinez Moreno N, Martinez Alvarez R, Douri K, Mathieu D, Pikis S, Mantziaris G, Sheehan JP, Bernstein K, Kondkiolka D, Peker S. Stereotactic Radiosurgery for Meningiomas in Children and Adolescents: An International Multi-Institutional Study. *Neurosurgery* 93(5):p 1066-1074, 2023.

Deng H, Habib A, Fernandes Cabral DT, Wei Z, Kulich S, Zinn PO. Microsurgical Drilling of Intradural Spinal Collision Tumor with Meningioma and Carcinomatous Features: 2-dimensional Operative Video. *Oper Neurosurg* (Hagerstown) 25(6):e368 2023.

Robert M. Friedlander, MD

Chair, Walter E. Dandy Distinguished Professor
Director, Complex Brain Surgery Program
Co-Director, UPMC Neurological Institute

Robert Friedlander, MD, MA, is the Walter E. Dandy Distinguished Professor, chair of the University of Pittsburgh Department of Neurological Surgery and co-director of the UPMC Neurological Institute, positions he has held since 2010. Before coming to the University of Pittsburgh, Dr. Friedlander was a professor at Harvard Medical School. He was also vice-chair of neurosurgery, associate director of cerebrovascular surgery and co-director of the Neuroscience Research Center at the Brigham and Women's Hospital in Boston.

Dr. Friedlander has received a number of significant academic awards, most significantly an induction into the prestigious National Academy of Medicine in 2019. Election to the academy is considered one of the highest honors in the fields of health and medicine and recognizes individuals who have demonstrated outstanding professional achievement and commitment to service. He has also received the Bayer Cerebrovascular Award from the Joint Section of Cerebrovascular Surgery, the International Charcot Prize for Motor Neuron Diseases, the Award from the Academy of Neurological Surgeons, the H. Richard Winn Prize from the Society of Neurological Surgeons, and the Distinguished Chancellor University of Pittsburgh Research Award.

Dr. Friedlander is an elected member of the prestigious American Society for Clinical Investigation, and the Association of American Physicians. As a sign of his prominence as a clinician and scientist, Dr. Friedlander is one of a very select group of authors to have been invited by the *New England Journal of Medicine* to write both a basic science review (mechanisms of neuronal cell death), as well as a clinical review (management of AVMs). Clinically, Dr. Friedlander focuses on the operative management of complex cerebrovascular disorders, brain tumors and Chiari malformations.

Dr. Friedlander's major research interests lie in the study of the mechanistic pathways of the caspase apoptosis gene family. His work includes the evaluation of treatment strategies for neurodegenerative diseases (Huntington's and ALS), stroke, brain trauma, and spinal cord injury through the modulation of the caspase-family apoptotic pathways. He was first to demonstrate activation and a functional role of caspase cell death pathways in neurological diseases. His research has received significant media attention. His major work has been published in the highest impact journals, most notably four publications in *Nature,* two in *Science,* one in *Nature Medicine,* one in *Nature Neuroscience* and eight in *PNAS*. For over two decades, he has had continuous NIH support as a principal investigator, as well numerous foundation awards. He directs a busy and prolific laboratory.

Robert M. Friedlander, MD

Dr. Friedlander served on the National Advisory Council of the National Institutes of Neurological Disorders and Stroke (NINDS). Additionally, a rewarding aspect of Dr. Friedlander's activities is his involvement in organized neurosurgery. He was a member of the executive committee of the Congress of Neurological Surgeons, as well as chair of the CNS Research Committee, the CNS Membership Committee, and the CNS Publications Committee. He directed the Society of Neurological Surgeons RUNN (Research Update in Neuroscience for Neurosurgeons) Course from 2004 to 2018 and served as chair of the Society of Neurological Surgeons research committee. He is a past chair of the AANS/CNS Joint Section of Cerebrovascular Surgery.

A native of Caracas, Venezuela, Dr. Friedlander came to the United States in 1983 and earned a joint BA and MA in biochemistry from Brandeis University in 1987. In 1991, he graduated from Harvard Medical School and went on to fulfill his internship in general surgery and residency in neurosurgery at Massachusetts General Hospital.

Specialized Areas of Interest
Aneurysms, vascular malformations, brain tumors, carotid disease, cerebrovascular disease, Chiari malformation, spinal cord tumors. Research focuses on mechanisms of apoptosis, Huntington's disease, ALS, and stroke.

Board Certifications
American Board of Neurological Surgeons

Hospital Privileges
UPMC Altoona
UPMC Children's Hospital of Pittsburgh
UPMC Hamot
UPMC Magee-Womens Hospital
UPMC Mercy
UPMC Passavant
UPMC Presbyterian
UPMC Shadyside

Professional Organization Membership
American Academy of Neurological Surgeons
American Association for the Advancement of Science
American Association of Neurological Surgeons
American Association of Physicians
American Society for Clinical Investigation
Brain Aneurysm Foundation, Medical Advisory Board
Congress of Neurological Surgeons
Joint Section of Cerebrovascular Surgery
National Academy of Medicine
Pennsylvania Neurosurgical Society
Sociedad Venezolana de Neurocirugia
Society for Neurological Surgeons
Society for Neuroscience

Professional Activities
Annual Meeting Committee, American Association of Neurological Surgeons
Research Committee, American Association of Neurological Surgeons
Publications Committee, Congress of Neurological Surgeons
Executive Committee, Congress of Neurological Surgeons

Robert M. Friedlander, MD

Chair, Scientific Advisory Board, NeuBase Therapeutics
Chief Scientific Officer, NeuBase Therapeutics
Clinical Trials Subcommittee, NINDS National Advisory Council
Fellowships and Training Subcommittee, NINDS National Advisory Council
Basic Science Subcommittee, NINDS National Advisory Council
Chair, AANS/CNS Joint Cerebrovascular Section, American Academy of Neurological Surgery
NAM Nominating Committee, National Academy of Medicine
Research Committee, Society of Neurological Surgeons
Scientific Advisory Board, Brain Aneurysm Foundation
Scientific Advisory Board, Worldwide Syringomyelia and Chiari Taskforce
Scientific Advisory Board, DiFusion Technologies

Education & Training
BA, Brandeis University, 1987
MA, Biochemistry, Brandeis University, 1987
MD, Harvard Medical School, 1991

Honors & Awards
Distinguished Chancellor University of Pittsburgh Research Award, 2021
Castle Connolly Top Doctors in America, 2012-24
National Academy of Medicine induction, 2019
Honored Guest, HRH Crown Prince Alexander and HRH Crown Princess Katherine, Belgrade, Serbia, 2014
Honored Guest, US Ambassador, Belgrade, Serbia, 2013
America's Top Surgeons, 2013
H. Richard Winn Prize for Neurosurgical Research, 2012

Publications: 2023-24
• Refereed Articles
Albalkhi I, Shafqat A, Bin-Alamer O, Mallela AN, Gersey ZC, Fernandes Cabral D, Sabbagh AJ, Hadjipanayis CG, González-Martínez JA, Friedlander RM, Abou-Al-Shaar H. Complications and visual outcomes following surgical resection of pediatric optic pathway/hypothalamic gliomas: a systematic review and meta-analysis. *Childs Nerv Syst* 40(7):2033-2042, 2024.

Plute T, Bin-Alamer O, Mallela AN, Kallos JA, Hamilton DK, Pollack IF, Lunsford LD, Friedlander RM, Abou-Al-Shaar H. A comprehensive evaluation of career trajectories of the American Association of Neurological Surgeons William P. Van Wagenen fellows. *World Neurosurg X* 23:100365, 2024.

Bin-Alamer O, Plute T, Mallela AN, Jacobs R, Hadjipanayis CG, Hamilton DK, Maroon JC, Lunsford LD, Friedlander RM, Abou-Al-Shaar H. Cross-sectional examination of current and future trends and attributes of the presidents of the American Association of Neurological Surgeons and the Congress of Neurological Surgeons societies. *World Neurosurg X* 23:100285, 2024.

Mittal AM, Nowicki KW, Mantena R, Cao C, Rochlin EK, Dembinski R, Lang MJ, Gross BA, Friedlander RM. Advances in biomarkers for vasospasm - Towards a future blood-based diagnostic test. *World Neurosurg: X* 22:100343, 2024.

Kim S, Nowicki KW, Kohyama K, Mittal A, Ye S, Wang K, Fujii T, Rajesh S, Cao C, Mantena R, Barbuto M, Jung Y, Gross BA, Friedlander RM, Wagner WR. Development of an Injectable, ECM-Derivative Embolic for the Treatment of Cerebral Saccular Aneurysms. *Biomacromolecules* [Online ahead of print], 2024.

Robert M. Friedlander, MD

Casillo SM, Gatesman TA, Chilukuri A, Varadharajan S, Johnson BJ, David Premkumar DR, Jane EP, Plute TJ, Koncar RF, Stanton AJ, Biagi-Junior CAO, Barber CS, Halbert ME, Golbourn BJ, Halligan K, Cruz AF, Mansi NM, Cheney A, Mullett SJ, Land CV, Perez JL, Myers MI, Agrawal N, Michel JJ, Chang YF, Vaske OM, MichaelRaj A, Lieberman FS, Felker J, Shiva S, Bertrand KC, Amankulor N, Hadjipanayis CG, Abdullah KG, Zinn PO, Friedlander RM, Abel TJ, Nazarian J, Venneti S, Filbin MG, Gelhaus SL, Mack SC, Pollack IF, Agnihotri S. An ERK5-PFKFB3 axis regulates glycolysis and represents a therapeutic vulnerability in pediatric diffuse midline glioma. *Cell Rep* 43(1):113557, 2024.

Kedia N, McDowell MM, Yang J, Wu J, Friedlander RM, Kainerstorfer JM. Pulsatile microvascular cerebral blood flow waveforms change with intracranial compliance and age. *Neurophotonics* 11(1):015003, 2024.

Luy DD, Agarwal N, McDowell MM, Tonetti DA, Goldschmidt E, Friedlander RM. Acquired Chiari Type I Malformation Associated with Type IV Dural Arteriovenous Fistula: Case Report. *J Neurol Surg A Cent Eur Neurosurg* 85(1):94-99, 2024.

Kim J, Li W, Wang J, Baranov SV, Heath BE, Jia J, Suofu Y, Baranova OV, Wang X, Larkin TM, Lariviere WR, Carlisle DL, Friedlander RM. Biosynthesis of neuroprotective melatonin is dysregulated in Huntington's disease. *J Pineal Res* 75(4):e12909, 2023.

Tasiou A, Brotis AG, Kalogeras A, Tzerefos C, Alleyne CH Jr, Andreou A, Demetriades AK, Foroglou N, Friedlander RM, Karlsson B, Kitchen N, Meling TR, Mitsos A, Panagiotopoulos V, Papasilekas T, Pavesi G, Rasulic L, Santos AN, Spetzler RF, Sure U, Tjoumakaris S, Tolias CM, Vajkoczy P, Fountas KN. Cavernous malformations of the central nervous system: An international consensus statement. *Brain Spine* 3:102707, 2023.

Algattas HN, Alattar AA, Okonkwo DO, Wang EW, Snyderman CH, Hamilton DK, Friedlander RM, Zenonos GA, Gardner PA. A novel classification and management scheme for craniocervical junction disorders with ventral neural element compression. *J Neurosurg* 140(2):585-594, 2023.

Paul A. Gardner, MD

Professor, Peter J. Jannetta Endowed Chair
Neurosurgical Co-Director, Center for Cranial Base Surgery
Neurosurgical Co-Director, Pituitary Center of Excellence
Director, Surgical Neuroanatomy Lab
Co-Director, Endoscopic and Open Skull Base Fellowship

Paul A. Gardner, MD, joined the faculty at the University of Pittsburgh Department of Neurological Surgery in 2008 after completing his residency and fellowship training at the University of Pittsburgh. He completed his undergraduate studies at Florida State University, majoring in biochemistry, and received his medical degree from the University of Pittsburgh School of Medicine.

Dr. Gardner completed a two-year fellowship in endoscopic endonasal pituitary and endoscopic and open skull base surgery. His research has focused on evaluating patient outcomes following these surgeries and more recently on genomic and molecular analysis of skull base tumors. Dr. Gardner has been the neurosurgical director of the Center for Cranial Base Surgery at the University of Pittsburgh Medical Center since April of 2008 and, along with Carl Snyderman, MD, of the University of Pittsburgh Department of Ophthalmology, leads a renowned course on endoscopic endonasal surgery three times a year.

Dr. Gardner is co-author of the book *Skull Base Surgery*, part of the *Master Techniques in Otolaryngology: Head and Neck Surgery* series published by Wolters Kluwer. The book offers step-by-step

Paul A. Gardner, MD

expert instruction on more than 45 procedures, covering both open and minimally invasive approaches to the skull base. He is also the primary editor of the recently released book *Vascular Challenges in Skull Base Surgery*, described as an "essential multidisciplinary guide for the prevention and management of vascular injury from master skull base surgeons," published by Thieme. Dr. Gardner is an author on over 400 peer-reviewed articles.

Specialized Areas of Interest
Endoscopic endonasal and open skull base surgery; pituitary tumors; vascular surgery; cranial nerve disorders; minimally invasive surgery; peripheral nerve surgery.

Board Certifications
American Board of Neurological Surgeons

Hospital Privileges
UPMC Children's Hospital of Pittsburgh
UPMC Mercy
UPMC Presbyterian
UPMC Select Specialty

Professional Organization Membership
Acoustic Neuroma Association
American Academy of Neurological Surgeons
American Association of Neurological Surgeons
Congress of Neurological Surgeons
International Federation of Neuroendoscopy
North American Skull Base Society
Pituitary Network Society

Professional Activities
Skull Base Committee, AANS/CNS Tumor Section
Course Co-Director, Comprehensive Endoscopic Endonasal Course, UPMC
Course Co-Director, Complex Endoscopic Endonasal Course, UPMC
CNS Foundation Liaison, AANS/CNS Tumor Section
Member, Medical Advisory Board, Chordoma Foundation
Section Editor, *Journal of Neurological Surgery Part B: Skull Base*
Editorial Board, Member, *Journal of Neurological Surgery Part B: Skull Base: Operative Videos*
Associate/Assistant Editor, Skull Base Section, *Operative Neurosurgery*
Editorial Review Board, Member, *Operative Neurosurgery: The Surgeon's Armamentarium*
Skull Base Liaison, Tumor Section, Congress of Neurological Surgeons
Fellowship Match Committee, Member, North American Skull Base Society
2024 Annual Meeting Scientific Program Committee, Member, North American Skull Base Society
Co-Chair, Anterior Skull Base Track: Intradura/Intraaxia Tumor, North American Skull Base Society
Advisory Board, Member, Collaborative Research Education and Technology Enhancement in Surgery (CREATES), University of Pittsburgh
International Telemedicine Services Workgroup Committee, UPMC
Surgical Services Oversight Committee, UPMC

Education & Training
AA, Okaloosa-Walton College, 1993
BS, Biochemistry, Florida State University, 1997 (Magna cum laude)
MD, University of Pittsburgh, 2001
Fellowship, Endoscopic and Open Skull Base Surgery, 2007
Residency, Neurosurgery, University of Pittsburgh, 2008

Paul A. Gardner, MD

Honors & Awards
Castle Connolly Top Doctors in America, 2012-24
Pituitary Center of Excellence, Designated Physician, UPMC

News Media Appearances: 2023-24
"Lower Cranial Nerve Schwannomas: Cohort Study and Systemic Review." *CNS Journal Podcast*, April 17, 2024.

Publications: 2023-24
• Refereed Articles:
Mamelak AN, Little AS, Gardner PA, Almeida JP, Recinos P, Soni P, Kshettry VR, Barkhoudarian G, Barkhoudarian G, Kelly DF, Dodd R, Mukherjee D, Gersey ZC, Fukuhara N, Nishioka H, Kim EH, Litre CF, Sina E, Mazer MW, Cui Y, Bonert V. A prospective multi-center observational study of surgical versus non-surgical management for pituitary apoplexy. *J Clin Endocrinol Metab* 109(2):e711-725, 2024.

Findlay MC, Sabahi M, Azab M, Drexler R, Rotermund R, Ricklefs FL, Flitsch J, Smith TR, Kilgallon JL, Honegger J, Nasi-Kordhishti I, Gardner PA, Gersey ZC, Abdallah HM, Jane JA, Knappe UJ, Uksul N, Schroder HWS, Eordogh M, Losa M, Mortini P, Gerlach R, Antunes ACM, Couldwell WT, Budohoski KP, Rennert RC, Karsy M. The role of surgical management for prolactin-secreting tumors in the era of dopaminergic agonists: an international multicenter report. *Clin Neurol Neurosurg* 236:108079, 2024.

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Hallak H, Rindler R, Dang D, Abou-Al-Shaar H, Carlstrom LP, Singh R, Kanaan I, Link MJ, Gardner PA, Peris-Celda M. Trigeminal neuralgia pain outcomes following microsurgical resection versus stereotactic radiosurgery for petroclival meningiomas: a systematic review and meta-analysis. *J Neurosurg* 140(2):420-429, 2024.

Algattas HN, Nayar GM, Snyderman CH, Stefko ST, Al-Bayati AR, Gardner PA. Endoscopic endonasal approach for salvage embolization of indirect carotid-cavernous fistula: 2-dimensional operative video. *Oper Neurosurg* (Hagerstown) 26(2):240, 2024.

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Ali MS, Algattas H, Zenonos GA, Wang EW, Snyderman CH, Gardner PA. Endoscopic endonasal far-medial approach: 2-dimensional operative video. *Oper Neurosurg* (Hagerstown) 26(3):346, 2024.

Paul A. Gardner, MD

Karsy M Kshettry V, Gardner P, Chicoine M, Fernandez-Miranda JC, Evans JJ, Barkhoudarian G, Hardesty D, Kim W, Zada G, Crocker T, Torok I, Little A. The RAPID Consortium: a platform for clinical and translational pituitary tumor research. *J Neurol Surg B Skull Base* 85(01):1-8, 2024.

Abdallah HM, Gersey ZC, Plute T, Remick M, Abou-Al-Shaar H, Fazeli PK, Mahumd H, Lang MJ, Gardner PA, Zenonos GA, Gross BA. Toward optimized and cost-efficient protocols for inferior petrosal sinus sampling in the diagnosis of Cushing disease. *Neurosurgery* 94(3):508-514, 2024.

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Paul A. Gardner, MD

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Hoppe M, Gersey ZC, Muthiah N, Abdallah H, Plute T, Abou-Al-Shaar H, Wang EW, Snyderman CH, Zenonos GA, Gardner PA. The utility of inflammatory biomarkers in predicting overall survival and recurrence in skull base chordoma. *Neurosurg Focus* 56(5):E16, 2024.

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Tang A, Calcaterra M, Harris M, Gardner PA, Zenonos GA, Stefko ST, Geltzeiler M, Zandberg DP, Snyderman CH, Wang EW, Choby G. The role of induction chemotherapy for orbital invasion in sinonasal malignancies: a systematic review. *Int Forum Allergy Rhinol* [Online ahead of print] 2024.

Stevens AR, Branstetter BF, Gardner PA, Pearce TM, Zenonos GA, Arani K. Ecchordosis physaliphora: does it even exist? *AJNR Am J Neuroradiol* 44(8):889-893, 2023.

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Fong KY, Lim MJR, Fu S, Low CE, Chan YH, Deepak DS, Xu X, Thong M, Jain S, Teo K, Gardner PA, Snyderman CH, Nga VDW, Yeo TT. Postsurgical outcomes of nonfunctioning pituitary adenomas: a patient-level meta-analysis. *Pituitary* 26(4):461-473, 2023.

Magill ST, Schwartz TH, Couldwell WT, Gardner PA, Heilman CB, Sen C, Akagami R, Cappabianca P, Prevedello DM, McDermott MW; International Tuberculum Sellae Meningioma Study. International Tuberculum Sellae Meningioma Study: Surgical outcomes and management trends. *Neurosurgery* 93(6):1259-1270, 2023.

Paul A. Gardner, MD

Choby G, Geltzeiler M, Almeida JP, Champagne P-O, Cetas J, Chan E, Ciporen J, Chaskes MB, Fernandez-Miranda J, Gardner P, Hwang P, Ji KSY, Kalyvas A, Kong KA, McMillan R, Nayak J, O'Byrne J, Patel C, Patel Z, Peris Celda M, Pinheiro-Neto C, Sanusi O, Snyderman C, Thorp BD, Van Gompel JJ, Young SC, Zenonos G, Zwagerman NT, Wang EW. Multicenter survival analysis and application of an olfactory neuroblastoma staging modification incorporating Hyams grade. *JAMA Otolaryngol Head Neck Surg* 149(9):837-844, 2023.

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Chen S, Ulloa R, Soffer J, Alcazar-Felix RJ, Snyderman CH, Gardner PA, Patel VA, Polster SP. Chordoma: a comprehensive systematic review of ongoing clinical trials. *Cancers* 15(24):5800, 2023.

Findlay MC, Drexler R, Azab M, Karbe A, Rotermund R, Ricklefs FL, Flitsch J, Smith TR, Kilgallon JL, Honegger J, Nasi-Kordhishti I, Gardner PA, Gersey ZC, Abdallah HM, Jane JA Jr, Marino AC, Knappe UJ, Uksul N, Rzaev JA, Bervitskiy AV, Schroeder HWS, Eordogh M, Losa M, Mortini P. Gerlach R, Antunes ACM, Couldwell WT, Budohoski KP, Rennert RC, Karsy M. Crooke cell adenoma confers poorer endocrinological outcomes compared with corticotroph adenoma: results of a multicenter, international analysis. *World Neurosurg* 180:e376-e391, 2023.

Jimenez JE, Omar M, Adams GM, Costacou T, Thirumala PD, Crammond DJ, Anetakis KM, Balzer JR, Shandal V, Snyderman CH, Gardner PA, Zenonos GA, Wang EW. Electromyographic predictors of abducens nerve palsy after endoscopic skull base surgery. *J Neurosurg* 140(6):1584-1590 2023.

Plute T, Bin-Alamer O, Mallela AN, Zenonos GA, Wang EW, Gardner PA, Couldwell WT, Snyderman CH, Abou-Al-Shaar H. A comprehensive analysis of academic attributes of the Presidents of the North American Skull Base Society. *J Neurol Surg B Skull Base* [Online ahead of print], 2023.

Balogun Z, Dharmarajan H, Kanwar A, Gardner PA, Zenonos GA, Snyderman CH, Traylor K, Wang EW. Self-reported olfactory outcomes in transplanum and transtuberculum approaches. *J Neurol Surg B Skull Base* [Online ahead of print], 2023.

Wingrove PM, Arani KN, Snyderman CH, Gardner PA, Fernandes Cabral DT, Zenonos GA, Wang EW, Chabot J, Fernandez-Miranda JC, Chang YF, Hughes MA. Association of decreased enhancement of nasoseptal flap on postoperative MRI with risk of complication. *J Neurol Surg B Skull Base* [Online ahead of print], 2023.

• Letters to the Editor:
Algattas HN, Alattar AA, Gardner PA. Craniocervical junction disease management. *J Neurosurg* 140(4):1205-1206, 2023.

Peter C. Gerszten, MD

Peter E. Sheptak Professor
Vice Chair, Quality Improvement
Director, Percutaneous Spine Service

Peter C. Gerszten, MD, MPH, is the Peter E. Sheptak Professor of Neurosurgery at the University of Pittsburgh. Dr. Gerszten joined the Department of Neurological Surgery and the UPMC Spine Services Division in 1999. He received his undergraduate degree from the University of Virginia and completed his medical degree at the Johns Hopkins School of Medicine. He completed his residency in neurological surgery at the University of Pittsburgh Medical Center. Dr. Gerszten obtained a master of public health degree from the University of Pittsburgh Graduate School of Public Health. He completed a fellowship in spinal surgery at the University of Pittsburgh Medical Center.

Dr. Gerszten specializes in disorders of the spine. His areas of clinical interest within the field of neurosurgery include spinal tumors, failed back syndrome, stereotactic radiosurgery of spinal lesions, minimally invasive spine surgical techniques, sacroiliac dysfunction, compression fractures, and percutaneous techniques including neuromodulation. Dr. Gerszten's area of research is the application of outcomes research to spinal surgical interventions. He is a pioneer in the field of spine radiosurgery. His current clinical research involves the use of electrical spinal cord stimulation for a variety of neurological disorders including stroke, spinal cord injury, and spinal muscular atrophy.

Dr. Gerszten currently serves on the editorial boards of *The Spine Journal,* the *Journal of the North American Spine Society, Neurosurgery,* the *Journal of the Congress of Neurological Surgery,* and *The International Journal of Spine Surgery*.

Specialized Areas of Interest
Neuromodulation; spinal cord stimulation for post-stroke paralysis; outcomes research applied to neurosurgical interventions; failed back syndrome; stereotactic radiosurgery of spinal lesions; minimally invasive spine surgical techniques.

Board Certifications
American Board of Neurological Surgery

Hospital Privileges
Excela Health
UPMC Magee-Womens Hospital
UPMC Presbyterian
UPMC Shadyside
Veterans Affairs Pittsburgh Healthcare System

Professional Organization Membership
American Academy of Neurological Surgery
American Association of Neurological Surgeons
American Board of Neurological Surgery
American College of Surgeons
American Medical Association
Congress of Neurological Surgeons
Delta Omega Public Health National Honor Society
International Stereotactic Radiosurgery Society
Joint Section on Disorders of the Spine and Peripheral Nerves

Peter C. Gerszten, MD

North American Spine Society
Paleopathology Society

Professional Activities
Assistant Editor, *Neurosurgery*
Editorial Board, *The Spine Journal*
Senior Review Editor, *International Journal of Spine Surgery*
Associate Appointment, Carnegie Mellon University, The Neuroscience Institute Course
Course Lecturer, Principles and Practice of Gamma Knife Radiosurgery, UPMC
Course Lecturer, Spine Surgery Anatomy Course, University of Pittsburgh School of Medicine
Site Reviewer, Radiosurgery Accreditation Program, American College of Radiation Oncology and the Radiosurgery Society
UPMC Presbyterian Physician Unit Partner Program Leader, Unit 6D
Quality and Safety Leadership Committee, UPMC Presbyterian/Shadyside
Quality and Safety Committee Clinical Leader, UPMC Presbyterian/Shadyside
Scientific Program Committee, 16th Annual Meeting of the International Stereotactic Radiosurgery Society, New York, N.Y., May 12-15, 2024

Education & Training
BA, University of Virginia, 1988
MD, Johns Hopkins School of Medicine, 1992
MPH, University of Pittsburgh Graduate School of Public Health, 1998
Residency, Neurological Surgery, University of Pittsburgh, 1999
Fellowship, Spine Surgery, University of Pittsburgh, 2000

Honors & Awards
Castle Connolly Top Doctors in America, 2018-24

News Media Appearances: 2023-24
"Pittsburgh-based stroke study brings improvements for Hempfield man and hope for a better future," *TribLive*, November 20, 2023.
"A moving story: Spinal cord stimulators restore hand and arm function after paralysis," *PittMed Magazine*, August 2, 2023.

Publications: 2023-24
• Refereed Articles:
Bin-Alamer O, Qedair J, Abou-Al-Shaar H, Mallela AN, Balasubramanian K, Alnefaie N, Abou Al-Shaar AR, Plute T, Lu VM, McCarthy DJ, Fields DP, Agarwal N, Gerszten PC, Hamilton DK. Surgical intervention ≤ 24 hours versus > 24 hours after injury for the management of acute traumatic central cord syndrome: a systematic review and meta-analysis. *J Neurosurg Spine* 40(5):653-661, 2024.

Adida MS, Legarreta AD, Hudson JS, McCarthy D, Andrews E, Shanahan R, Taori S, Lavadi R, Buell TJ, Hamilton DK, Agarwal N, Gerszten PC. Machine learning in spine surgery: A narrative review. *Neurosurgery* 94(1):53-64, 2024.

Gajjar AA, Kumar RP, Paliwoda ED, Kuo CC, Adida S, Legaretta AD, Deng H, Anand SK, Hamilton DK, Buell TJ, Agarwal N, Gerszten PC, Hudson JS. Usefulness and accuracy of artificial intelligence chatbot responses to patient questions for neurosurgical procedures. *Neurosurgery* [Online ahead of print], 2024

Peter C. Gerszten, MD

Marvaso G, Jereczek-Fossa BA, Zaffaroni M, Vincini MG, Corrao G, Andratschke N, Balagamwala EH, Bedke J, Blanck O, Capitanio U, Correa RJM, De Meerleer G, Franzese C, Gaeta A, Gandini S, Garibaldi C, Gerszten PC, Gillessen S, Grubb WR, Guckenberger M, Hannan R, Jhaveri PM, Josipovic M, Kerkmeijer LGW, Lehrer EJ, Lindskog M, Louie AV, Nguyen QN, Ost P, Palma DA, Procopio G, Rossi M, Staehler M, Tree AC, Tsang YM, Van As N, Zaorsky NG, Zilli T, Pasquier D, Siva S. A Delphi consensus study on stereotactic body radiotherapy (SBRT) for oligometastatic renal cell carcinoma (RCC), an ESTRO ACROP study. European Society for Therapeutic Radiation and Oncology. *Lancet Oncol* 25(5):e193-e204, 2024.

Katic Secerovic N, Balaguer J-M, Gorskii O, Pavlova N, Liang L, Ho J, Grigsby E, Gerszten PC, Karalogly D, Bulgin D, Orlov S, Pirondini E, Musienko P, Raspopovic S, Capogross M. Neural population dynamis reveals disruption of spinal sensorimotor computations during electrical stimulation of sensory afferents. *Cell Rep* 43(2):113695, 2024.

Taori S, Adida S, Tang A, Rajan A, Sefcik RK, Burton SA, Flickinger JC, Zinn PO, Gerszten PC. The role of spine stereotactic radiosurgery for patients with breast cancer metastases. Journal of Neuro-oncology. *J Neurooncol* 167(2):257-266, 2024.

Taori S, Adida S, Tang A, Rajan A, Sefcik RK, Burton SA, Flickinger JC, Gerszten PC. Stereotactic radiosurgery for patients with spinal metastases from thyroid cancer: A 20-year experience. *World Neurosurg* 25:S1878-8750(24)00315-2, 2024.

Adida S, Tang A, Taori S, Wong V, Sefcik RK, Zhang X, Gerszten PC. Prediction of 30-day and 1-year postoperative complications after balloon-assisted kyphoplasty in the elderly using the Risk Analysis Index. *J Neurosurg Spine* 40(4):498-504, 2024.

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Albalki I, Shafqat A, Bin-Alamer O, Abou Al-Shaar AR, Mallela AN, Fernandes-de Thomas RJ, Zinn PO, Gerszten PC, Hadjipanayis C, About-Al-Shaar H. Fluorescene-guided resection of intradural spinal tumors: A systematic review and meta-analysis. *Neurosurg Rev* 47(1):10, 2023

Research Activities

Dr. Gerszten has a research interest in spinal neuromodulation. His work explores the role of spinal cord electrical stimulation for a variety of clinical indications. Dr. Gerszten collaborates with members of the University of Pittsburgh Rehabilitation Neural Engineering Laboratory (RNEL) and the Neurosciences Institute of Carnegie Mellon University to conduct the first ever clinical trial to implant cervical spinal cord stimulators in patients with post-stroke upper limb paralysis in order to regain arm function. Epidural electrical stimulation is currently used to treat pain caused by damage or injury to the cervical spinal nerves. The implantation of electrodes over the cervical dorsal root ganglia allows for the selective engagement of hand and arm muscles by providing the surviving neural circuits with appropriate electrical signals. By adjusting the location of the cervical leads as well as modifying the electrical stimulation of the spinal cord stimulator, patients have regained the ability to use paralyzed limbs. The team has also begun clinical trials to evaluate the effect of spinal cord stimulation in patients with spinal cord injury and spinal muscular atrophy (SMA).

Dr. Gerszten also collaborates with members of RNEL on a variety of non-human primate investigations. The team has developed a technique for robot assisted neurosurgery for high-accuracy minimally-invasive deep brain electrophysiology in monkeys. This research focuses on better

Peter C. Gerszten, MD

defining the neuronal pathways of motor and sensory transmission within the spinal cord. The work has led to a novel deep brain neuromodulation modality for post-stroke patients. These experiments also determined that proprioceptive pulses consistently produced neural trajectories in the network that were disrupted by concurrent cutaneous branch stimulation. This disruption propagated to the somatosensory cortex, suggesting that peripheral electrical stimulation can disrupt natural information processing across the neural axis.

Dr. Gerszten's clinical research focuses on the adoption of minimally invasive surgical treatments for disorders of the spine. Such minimally invasive techniques allow for decreased morbidity while improving outcomes in neurosurgical patients. Such techniques include the use radiosurgery and expanded radio frequency ablative techniques for patients with spinal tumors. Dr. Gerszten was a co-principal investigator of the NRG Oncology/RTOG 0631 Clinical Trial comparing stereotactic radiosurgery versus conventional radiotherapy for localized vertebral metastases of the spine which was published this year in *JAMA Oncology*. Dr. Gerszten continues to expand and systematically analyze the clinical outcomes and safety profiles associated with the use of new spinal implant devices. Dr. Gerszten has a particular interest in documenting the safety and efficacy of minimally invasive sacroiliac joint fusions using titanium screw implants for sacroiliac joint dysfunction.

Avniel Singh Ghuman, PhD

Associate Professor
Director, Cognitive Neurodynamics Lab

Avniel Singh Ghuman, PhD, joined the Department of Neurological Surgery in September of 2011. He received his undergraduate education in math and physics at The Johns Hopkins University and completed his doctoral education in biophysics at Harvard University. He completed his postdoctoral training at the National Institute of Mental Health prior to joining the faculty at the University of Pittsburgh.

As co-director of MEG (Magnetoencephalography) research, one of Dr. Ghuman's primary roles is to facilitate, develop, and advance clinical and basic neuroscience research using MEG. To this end, he is helping to develop new research applications for MEG in collaboration with researchers throughout the community. MEG is the most powerful functional neuroimaging technique for noninvasively recording magnetic fields generated by electrophysiological brain activity, providing millisecond temporal resolution and adequate spatial resolution of neural events.

Dr. Ghuman's research focuses on how our brain turns what falls upon our eyes into the rich meaningful experience that we perceive in the world around us. Specifically, his lab studies the neural basis of the visual perception of objects, faces, words, and social and affective visual images in the real-world. His lab examines the spatiotemporal dynamics of how neural activity reflects the stages of information processing and how information flow through brain networks responsible for visual perception.

To accomplish these research goals, Dr. Ghuman's lab records electrophysiological brain activity from humans using both invasive (intracranial EEG; iEEG — in collaboration with Taylor Abel, MD, and Jorge González-Martínez, MD, PhD) and non-invasive (magnetoencephalography; MEG) measures. In conjunction with these millisecond scale recordings they use multivariate machine learning methods, network analysis, and advanced signal processing techniques to assess the information processing dynamics reflected in brain activity. Additionally, his lab uses direct neural stimulation to examine how disrupting and modulating brain activity alters visual perception. This combination of modalities and analysis techniques allow Dr. Ghuman to ask fine-grained questions about neural information processing and information flow at both the scale of local brain regions and broadly distributed networks.

Avniel Singh Ghuman, PhD

Specialized Areas of Interest
The dynamics of brain interactions; visual cognition; magnetoencephalography (MEG), intracranial EEG (iEEG); face recognition; reading; social and affective perception.

Professional Organization Membership
American Epilepsy Society
Cognitive Neuroscience Society
Society for Neuroscience
Vision Sciences Society

Education & Training
BA, Math and Physics, The John Hopkins University, 1998
PhD, Biophysics, Harvard University, 2007

Honors & Awards
Young Investigator Award, NARSAD, 2012
Award for Innovative New Scientists, National Institute of Mental Health, 2015

Publications: 2023-24
• ***Refereed Articles:***
Boring MJ, Richardson RM, Ghuman AS. Interacting ventral temporal gradients of timescales and functional connectivity and their relationships to visual behavior. *iScience* 15;27(6):110003, 2024.

Research Activities
Social perception unfolds in the real world, as we actively interact with people around us. Dr. Ghuman investigated the neural basis of real-world face perception using multi-electrode intracranial recordings during unscripted natural interactions with friends, family, and others. Computational models reconstructed videos of faces participants viewed from brain activity alone and highlighted a critical role for the social-vision pathway in natural face perception. The brain was more sharply tuned to subtle expressions over strong one—a "Weber's law" for facial expressions—which was confirmed in controlled psychophysical experiments. This study leveraged neural recordings during natural social interactions to model neuro-perceptual relationships in an uncontrolled real-world environment, revealed neural coding rules for facial expressions, and demonstrated the perceptual implications of those rules using controlled experimentation.

Critical neurocognitive processes, such as performing natural activities and fluctuations of arousal, take place over minutes-to-days in real-world environments. Dr. Ghuman harnessed 3-12 days of continuous multi-electrode intracranial recordings in twenty humans that engaged in natural activities, including interacting with friends and family, watching TV, sleeping, etc., while under simultaneous neural and video recordings. Applying deep learning and dynamical systems analysis to the data revealed that brain network dynamics predicted neurocognitive phenomena such as circadian rhythm, heart rate, and multiple aspects of behavior (socializing, watching a screen, etc.). Network activity formed a "punctuated equilibrium" of stable states and transitory bursts between them. These transitory bursts coincided with shifts in behavior, such as switching from using a phone to talking to a friend. During these transitions, the brain would rapidly explore several interim states in a highly chaotic and disorganized fashion. Despite this chaos, large-scale dynamics were guided by a consistent set of anatomical networks that slowly modulated their activity in accordance with broad neurophysiological and conscious states. These large-scale dynamics were anchored by a homeostatic-like central attractor involving activation of the default mode network. Together, these findings suggest ways our brains use rapid, chaotic transitions that coalesce into neurocognitive states slowly fluctuating around a stabilizing central equilibrium to balance flexibility and stability during real-world behavior.

Jorge A. González-Martínez, MD, PhD

Stuart Niles Rowe Professor
Vice-Chair, Department of Neurological Surgery
Director, Epilepsy & Movement Disorders Program
Co-Director, University of Pittsburgh Epilepsy Center
Director, Cortical Systems Laboratory

Jorge González-Martínez, MD, PhD, FAANS—the Stuart Niles Rowe Endowed Chair in Neurosurgery at the University of Pittsburgh—is a board-certified neurosurgeon subspecialized in epilepsy and functional neurosurgery and is the director of the Epilepsy, Movement Disorders and Psychiatry Surgical Program at the University of Pittsburgh.

The Epilepsy, Movement Disorders and Psychiatry Surgical Program, encompasses the treatment of medically intractable epilepsy, movement disorders and psychiatry disorders. These pathological neurological conditions are similar in that successful neurosurgical treatment requires an expert understanding of the involved brain networks and their potential for modulation by functional neurosurgical procedures, as well as multidisciplinary teams that deliver surgical care to these special groups of patients. Dr. González-Martínez has expertise in both adult and pediatric patients. Pediatric patients are treated at the UPMC Children's Hospital of Pittsburgh, one of the best pediatric hospitals in the country, as noted in *U.S. News and World Report*.

Dr. González-Martínez, co-director of the epilepsy center, has the country's largest experience in SEEG procedures, SEEG guided resections and neuromodulation surgeries, with more than 3,000 successful surgical procedures performed. To promote an optimal safety profile and seizure outcome, many procedures are performed under robotic guidance. In addition of developing and implementing the SEEG method in North America, Dr. González-Martínez is also a pioneer in robotic surgery, having performed more than 1,000 procedures using this technique. The University of Pittsburgh has the largest experience in robotic neurosurgery in the country and was one of the first institutions in adopting the novel technology.

In addition to clinical activities, The Epilepsy, Movement Disorders and Psychiatry Surgical Program is considered one the premier programs in the country regarding translational and basic science research, working in collaboration with the University of Pittsburgh Department of Neuroscience, the Carnegie Mellon University Department of Biomedical Engineering, John Hopkins University and Aix Marseille University in France. The program's research activities are led by Dr. González-Martínez and his research team and conducted through the University of Pittsburgh Cortical Systems Laboratory located in the medical school facility. Combined, the clinical and basic science efforts have been guiding his academic and clinical pathway for safer and more efficient methods for treating patients with severe seizures and abnormal movement disorders, promoting the improvement of symptoms, in combination with better functional and quality of life outcomes.

Dr. González has published more than 300 peer-reviewed articles and book chapters related to epilepsy surgery and methods of brain mapping for patients with medically intractable epilepsy and movement disorders. He has been serving the American Society of Stereotactic and Functional Neurosurgery and the American Epilepsy Society in the capacity of member of the executive committee for the last six years, developing high relevant projects and topics related to the field of functional neurosurgery and epilepsy.

Specialized Areas of Interest
Adult and pediatric epilepsy surgery; movement disorder surgery; neuro-oncology; general neurosurgery.

Jorge A. González-Martínez, MD, PhD

Board Certifications
American Board of Neurological Surgeons

Hospital Privileges
UPMC Children's Hospital of Pittsburgh
UPMC Hamot
UPMC Presbyterian
UPMC Shadyside

Professional Organization Membership
American Association of Neurological Surgeons
American Epilepsy Society
American Society of Stereotactic and Functional Neurosurgery
Congress of Neurological Surgeons

Education & Training
MD, University of Sao Paulo Medical School, 1994
PhD, University of Sao Paulo Medical School, 2002
Neuro-oncology Fellowship, Wayne State University, 2001
Functional Neurosurgery Fellowship, Cleveland Clinic, 2002
Epilepsy Surgery Fellowship, Cleveland Clinic, 2003
Neurosurgery Residency, Cleveland Clinic, 2008
Epilepsy & Stereotactic Fellowship, University of Grenoble, France, 2009

Honors & Awards
Castle Connolly Top Doctors in America, 2020-24
Legacy Award, Cleveland Epilepsy Association, 2017
Harvey Cushing Award, Congress of Neurological Surgeons, 2005
Preuss Award, National Brain Tumor Foundation, 2002

Publications: 2023-24
• Refereed Articles:
Albalkhi I, Shafqat A, Bin-Alamer O, Mallela AN, Gersey ZC, Fernandes Cabral D, Sabbagh AJ, Hadjipanayis CG, González-Martínez JA, Friedlander RM, Abou-Al-Shaar H. Complications and visual outcomes following surgical resection of pediatric optic pathway/hypothalamic gliomas: a systematic review and meta-analysis. *Childs Nerv Syst* 40(7):2033-2042, 2024.

Ikegaya N, Aung T, Mallela A, Hect JL, Damiani A, González-Martínez JA. Thalamic stereoelectroencephalography for neuromodulation target selection: Proof of concept and review of literature of pulvinar direct electrical stimulation. *Epilepsia* 65(6):e79-e86, 2024.

Pease M, Mittal A, Merkaj S, Okonkwo DO, González-Martínez JA, Elmer J, Liou WS, Pingue V, Hammond FM, Abramovici S, Castellano J, Barot N. Early Seizure Prophylaxis in Mild and Moderate Traumatic Brain Injury: A Systematic Review and Meta-Analysis. *JAMA Neurol* 81(5):507-514, 2024.

Capogrosso M, Balaguer JM, Prat-Ortega G, Verma N, Yadav P, Sorensen E, de Freitas R, Ensel S, Borda L, Donadio S, Liang L, Ho J, Damiani A, Grigsby E, Fields D, González-Martínez J, Gerszten P, Weber D, Pirondini E. Supraspinal control of motoneurons after paralysis enabled by spinal cord stimulation. *Res Sq* [Preprint], 2024.

Jorge A. González-Martínez, MD, PhD

Pease M, Gupta K, Moshé SL, Correa DJ, Galanopoulou AS, Okonkwo DO, González-Martínez J, Shutter L, Diaz-Arrastia R, Castellano JF. Insights into epileptogenesis from post-traumatic epilepsy. *Nat Rev Neurol* 20(5):298-312, 2024.

Hect JL, Mallela AN, Pupi M, Anthony A, Fogg D, Ho J, Slingerland AL, Ikegaya N, Abou-Al-Shaar H, Aung T, González-Martínez J. Safety of Concomitant Cortical and Thalamic Stereoencephalography Explorations in Patients With Drug-Resistant Epilepsies. *Neurosurgery* [Online ahead of print], 2024.

Shelchkova ND, Downey JE, Greenspon CM, Okorokova EV, Sobinov AR, Verbaarschot C, He Q, Sponheim C, Tortolani AF, Moore DD, Kaufman MT, Lee RC, Satzer D, González-Martínez J, Warnke PC, Miller LE, Boninger ML, Gaunt RA, Collinger JL, Hatsopoulos NG, Bensmaia SJ. Microstimulation of human somatosensory cortex evokes task-dependent, spatially patterned responses in motor cortex. *Nat Commun* 14(1):7270, 2023.

Roth J, Bergman L, Weil AG, Brunette-Clement T, Weiner HL, Treiber JM, Shofty B, Cukiert A, Cukiert CM, Tripathi M, Chandra PS, Bollo RJ, Machado HR, Santos MV, Gaillard WD, Oluigbo CO, Ibrahim GM, Jallo GI, Shimony N, O'Neill BR, Budke M, Pérez-Jiménez MÁ, Mangano FT, Iwasaki M, Iijima K, González-Martínez J, Kawai K, Ishishita Y, Elbabaa SK, Bello-Espinosa L, Fallah A, Maniquis CAB, Ben-Zvi I, Tisdall M, Panigrahi M, Jayalakshmi S, Blount JP, Dorfmüller G, Bulteau C, Stone SS, Bolton J, Uliel-Sibony S. The added value of Corpus Callosotomy following Vagus Nerve Stimulation in children with Lennox-Gastaut Syndrome: A multicenter, multinational study. *Epilepsia* 64(12):3205-3212, 2023.

Mahrous AA, Liang L, Balaguer JM, Ho JC, Hari K, Grigsby EM, Karapetyan V, Damiani A, Fields DP, González-Martínez JA, Gerszten PC, Bennett DJ, Heckman CJ, Pirondini E, Capogrosso M. GABA Increases Sensory Transmission In Monkeys. *bioRxiv* [Preprint], 2023.

Balaguer JM, Prat-Ortega G, Verma N, Yadav P, Sorensen E, de Freitas R, Ensel S, Borda L, Donadio S, Liang L, Ho J, Damiani A, Grigsby E, Fields DP, González-Martínez JA, Gerszten PC, Fisher LE, Weber DJ, Pirondini E, Capogrosso M. Supraspinal control of motoneurons after paralysis enabled by spinal cord stimulation. *medRxiv* [Preprint], 2023.

Aung T, Mallela A, Ho J, Tang LW, Abou-Al-Shaar H, González-Martínez J. Challenging Cortical Explorations in Difficult-to-Localize Seizures: The Rationale and Usefulness of Perisylvian Paralimbic Explorations With Orthogonal Stereoelectroencephalography Depth Electrodes. *Neurosurgery* [Online ahead of print], 2023.

Breault MS, Sacré P, Fitzgerald ZB, Gale JT, Cullen KE, González-Martínez JA, Sarma SV. Internal states as a source of subject-dependent movement variability are represented by large-scale brain networks. *Nat Commun* 14(1):7837, 2023.

Bradley Gross, MD

Associate Professor
Director, Endovascular Neurosurgery
Program Director, Endovascular Neurosurgery/Interventional Neurology Fellowship

Bradley Gross, MD, joined the Department of Neurological Surgery in July of 2016, specializing in cerebrovascular disease. His particular clinical and research interests include the comprehensive management of aneurysms, arteriovenous malformations, and arteriovenous fistulas of the brain and spinal cord. He also performs embolization of brain and spinal cord tumors, revascularization for acute ischemic stroke as well as cervical, intracranial and venous stenting.

Bradley Gross, MD

Dr. Gross graduated summa cum laude from Northwestern University and then earned his medical degree from Northwestern University Medical School. He completed his internship and neurosurgical residency at Brigham and Women's Hospital/Boston Children's Hospital/Harvard Medical School. He then had the privilege to serve as an endovascular fellow at the Barrow Neurological Institute.

Specialized Areas of Interest
Intracranial aneurysms; arteriovenous malformations; arteriovenous fistulas; intracranial stenosis; venous sinus stenosis; ischemic stroke.

Board Certifications
American Board of Neurological Surgery

Hospital Privileges
UPMC Children's Hospital of Pittsburgh
UPMC Mercy
UPMC Presbyterian
UPMC Shadyside

Professional Organization Membership
Alpha Omega Alpha
American Association of Neurological Surgeons
AANS/CNS Joint Section of Cerebrovascular Neurosurgery
Congress of Neurological Surgeons
Phi Beta Kappa

Professional Activities
Editorial Board, Associate Editor, *Stroke: Vascular and Interventional Neurology*
Editorial Board, Assistant Editor, *Neurosurgery*

Education & Training
BA with Honors, Chemistry, Northwestern University, 2004
MD, Feinberg School of Medicine, Northwestern University, 2008
Internship, Harvard Medical School, 2009
Residency, Harvard Medical School, 2015
Fellowship, Endovascular Neurosurgery, Barrow Neurological Institute, 2016

Publications: 2023-24
• Refereed Articles:
Belkhir JR, Pease M, McCarthy DJ, Legarretta A, Mittal AM, Crago EA, Gross BA, Lang MJ. Subarachnoid hemorrhage outcomes in an endovascular right of first refusal neurosurgical environment. *World Neurosurg* 181:e524-e532, 2024.

Al-Qudah AM, Thirumala PD, Anetakis KM, Crammond DJ, Algarni SA, AlMajali M, Shandal V, Gross BA, Lang M, Bhatt NR, Al-Bayati AR, Nogueira RG, Balzer JR. Intraoperative neuromonitoring as real-time diagnostic for cerebral ischemia in endovascular treatment of ruptured brain aneurysms. *Clin Neurophysiol* 161:69-79, 2024.

Abdallah HM, Gersey ZC, Plute T, Remick M, Abou-Al-Shaar H, Fazeli PK, Mahmud H, Lang MJ, Gardner PA, Zenonos GA, Gross BA. Toward optimized and cost-efficient protocols for inferior petrosal sinus sampling in the diagnosis of cushing disease. *Neurosurgery* 94(3):508-514, 2024.

Bradley Gross, MD

Walker E, Srienc A, Lew D, Guniganti R, Lanzino G, Brinjikji W, Hayakawa M, Samaniego EA, Derdeyn CP, Du R, Lai R, Sheehan JP, Starke RM, Abla A, Abdelsalam A, Gross B, Albuquerque F, Lawton MT, Kim LJ, Levitt M, Amin-Hanjani S, Alaraj A, Winkler E, Fox WC, Polifka A, Hall S, Bulters D, Durnford A, Satomi J, Tada Y, van Dijk JMC, Potgieser ARE, Chen CJ, Becerril-Gaitan A, Osbun JW, Zipfel GJ. Dural arteriovenous fistulas are not observed to convert to a higher grade after partial embolization. *Neurosurg Focus* 56(3):E8, 2024.

Becerril-Gaitan A, Ding D, Ironside N, Buell TJ, Kansagra AP, Lanzino G, Brinjikji W, Kim L, Levitt MR, Abecassis IJ, Bulters D, Durnford A, Fox WC, Blackburn S, Chen PR, Polifka AJ, Laurent D, Gross B, Hayakawa M, Derdeyn C, Amin-Hanjani S, Alaraj A, van Dijk JMC, Potgieser ARE, Starke RM, Peterson EC, Satomi J, Tada Y, Abla AA, Winkler EA, Du R, Lai PMR, Zipfel GJ, Chen CJ, Sheehan JP. The VEBAS score: a practical scoring system for intracranial dural arteriovenous fistulas. *J Neurointerv Surg* 16(3):272-279, 2024.

Nogueira RG, Lobsien D, Klisch J, Pielenz D, Lobsien E, Sauvageau E, Aghaebrahim N, Mohlenbruch M, Vollherbst D, Ulfert C, Bozorgchami H, Clark W, Priest R, Samaniego EA, Ortega-Gutierrez S, Ghannam M, Lopes D, Billingsley J, Keigher K, Haussen DC, Al-Bayati AR, Siddiqui A, Levy E, Chen M, Munich S, Schramm P, Boppel T, Narayanan S, Gross BA, Roth C, Boeckh-Behrens T, Hassan A, Fifi J, Budzik RF, Tarpley J, Starke RM, Raz E, Brogan G, Liebeskind DS, Hanel RA. Thrombectomy with the pRESET vs Solitaire stent retrievers as first-line large vessel occlusion stroke treatment: A randomized clinical trial. *JAMA Neurol* 81(2):170-178, 2024.

Scoville JP, Joyce E, Tonetti D, Bounajem MT, Thomas A, Ogilvy CS, Moore JM, Riina HA, Tanweer O, Levy EI, Spiotta AM, Gross BA, Jankowitz BT, Cawley CM, Khalessi AA, Pandey AS, Ringer AJ, Hanel R, Ortiz RA, Langer D, Levitt MR, Binning M, Taussky P, Kan P, Grandhi R. Radiographic and clinical outcomes with particle or liquid embolic agents for middle meningeal artery embolization of nonacute subdural hematomas. *Interv Neuroradiol* 29(6):683-690.

Luther E, McCarthy DJ, Burks J, Govindarajan V, Lu VM, Silva M, Lang M, Gross BA, Starke RM. National reduction in cerebral arteriovenous malformation treatment correlated with increased rupture incidence. *J Neurointerv Surg* 15(8):735-740.

Suarez JV, Mendez-Ruiz A, Farooqui M, Bekelis K, Singer JA, Javed K, Altschul DJ, Fifi JT, Matsoukas S, Cooper J, Al-Mufti F, Gross B, Jankowitz B, Kan PT, Hafeez M, Orru E, Dajles A, Galecio-Castillo M, Zevallos CB, Wakhloo AK, Ortega-Gutierrez S. Safety and efficacy of the surpass streamline for intracranial aneurysms (SESSIA): A multi-center US experience pooled analysis. *Interv Neuroradiol* 29(5):589-598, 2023.

Salem MM, Kuybu O, Nguyen Hoang A, Baig AA, Khorasanizadeh M, Baker C, Hunsaker JC, Mendez AA, Cortez G, Davies JM, Narayanan S, Cawley CM, Riina HA, Moore JM, Spiotta AM, Khalessi AA, Howard BM, Hanel R, Tanweer O, Levy EI, Grandhi R, Lang MJ, Siddiqui AH, Kan P, Ogilvy CS, Gross BA, Thomas AJ, Jankowitz BT, Burkhardt JK. Middle meningeal artery embolization for chronic subdural hematoma: Predictors of clinical and radiographic failure from 636 embolizations. *Radiology* 307(4):e222045, 2023.

Salem MM, Khalife J, Desai S, Sharashidze V, Badger C, Kuhn AL, Monteiro A, Salahuddin H, Siddiqui AH, Singh J, Levy EI, Lang M, Grandhi R, Thomas AJ, Lin L, Tanweer O, Burkhardt JK, Puri AS, Gross BA, Nossek E, Hassan AE, Shaikh HA, Jankowitz BT. Comaneci mechanical dilatation for vasospasm (COMMAND): multicenter experience. *J Neurointerv Surg* 15(9):864-870, 2023.

Bradley Gross, MD

Srinivasan VM, Karahalios K, Colasurdo M, Rhodenheiser E, Scherschinski L, Lazaro TT, Cortez G, Gross BA, Kühn AL, Puri A, Winkler EA, Catapano JS, Akamatsu Y, Thomas A, Hanel RA, Wakhloo A, Jadhav AP, Ducruet AF, Albuquerque FC, Kan P. Transvenous embolization of dural arteriovenous fistulas through the galenic (deep venous) system: multicenter case series and meta-analysis. *Oper Neurosurg* 25(6):489-498, 2023.

Sanchez S, Raghuram A, Wendt L, Hayakawa M, Chen CJ, Sheehan JP, Kim LJ, Abecassis KJ, Levitt MR, Meyer RM, Guniganti R, Kansagra A, Lanzino G, Giordan E, Brinjikji W, Bulters DO, Durnford A, Fox WC, Smith J, Polifka AJ, Gross B, Amin-Hanjani S, Alaraj A, Kwasnicki A, Starke RM, Chen SH, van Dijk JMC, Potgieser ARE, Satomi J, Tada Y, Phelps R, Abla A, Winkler E, Du R, Lai PMR, Zipfel GJ, Derdeyn C, Samaniego EA. Natural history, angiographic presentation and outcomes of anterior cranial fossa dural arteriovenous fistulas. *J Neurointerv Surg* 15(9):903-908, 2023.

Mohammaden MH, Haussen DC, Al-Bayati AR, Hassan AE, Tekle W, Fifi JT, Matsoukas S, Kuybu O, Gross BA, Lang M, Narayanan S, Cortez GM, Hanel RA, Aghaebrahim A, Sauvageau E, Farooqui M, Ortega-Gutierrez S, Zevallos CB, Galecio-Castillo M, Sheth SA, Nahhas M, Salazar-Marioni S, Ngyuen TN, Abdalkader M, Klein P, Hafeez M, Kan P, Tanweer O, Khaldi A, Li H, Jumaa M, Zaidi SF, Oliver M, Salem M, Burkhardt JK, Pukenas B, Kumar R, Lai M, Siegler JE, Peng S, Alaraj A, Nogueira RG. General anesthesia vs procedural sedation for failed neurothrombectomy undergoing rescue stenting: intention to treat analysis. *J Neurointerv Surg* 15(e2):e240-247, 2023.

Research Activities

• Embolization of the Middle Meningeal Artery With Onyx Liquid Embolic System for Subacute and Chronic Subdural Hematoma (EMBOLISE):
Embolise is a multicenter randomized control trial evaluating the safety and efficacy of embolization of the middle meningeal artery with Onyx liquid embolisate in the management of chronic subdural hematoma. Dr. Gross is the UPMC principal investigator on this multicenter study.

• US IDE Study of the Contour Neurovascular System for Intracranial Aneurysm Repair (NECC Trial):
The Contour Neurovascular System is a novel agent used in the intrasaccular treatment of intracranial aneurysms. UPMC is part of an initial multicenter effort employing this system. Dr. Gross is the UPMC principal investigator on this multicenter study.

• A Randomized, Controlled Trial to Evaluate the Safety and Efficacy of the Route 92 Medical Reperfusion System (SUMMIT MAX):
The Route 92 system is a novel acute stroke embolectomy system that utilizes an ultra-large bore catheter to remove clot. This randomized controlled trial will compare this system to standard systems currently employed for stroke embolectomy. Dr. Gross is the UPMC principal investigator on this multicenter study.

Costas G. Hadjipanayis, MD, PhD

L. Dade Lunsford Professor
Executive Vice Chair
Director, Center for Image-Guided Neurosurgery
Co-Director, UPMC Brain Tumor Program
Director, Brain Tumor Nanotechnology Laboratory

Constantinos (Costas) G. Hadjipanayis, MD, PhD, is a board-certified neurosurgeon-scientist who has devoted his entire career to the treatment of brain tumor patients. He completed his neurosurgical residency and graduate PhD training at the University of Pittsburgh School of Medicine with additional neurosurgical oncology training at the University of California San Francisco.

Costas G. Hadjipanayis, MD, PhD

Dr. Hadjipanayis is the executive vice-chair for the University of Pittsburgh Neurological Surgery, director of the UPMC Center for Image-Guided Neurosurgery (CIGNS) and serves as co-director of the UPMC Brain Tumor Program. Dr. Hadjipanayis directs the CAST-approved neurosurgical oncology fellowship at UPMC. He also directs the Brain Tumor Nanotechnology Laboratory in the Hillman Cancer Center and has been the principal investigator of multiple clinical trials and university, private foundation, and NIH-funded grants focused on brain tumors.

He was recruited back to UPMC in October of 2022 from the Icahn School of Medicine at Mount Sinai in New York City where he served as the chair of neurosurgery at Mount Sinai Union Square/Beth Israel and the director of neurosurgical oncology for the Mount Sinai Health System.

Dr. Hadjipanayis has focused much of his career on innovation, translational research, and intraoperative technology development. In 2011, Dr. Hadjipanayis was the first to use 5-ALA (Gleolan) and perform fluorescence-guided surgery (FGS) in the United States. He helped lead the FDA approval of Gleolan for glioma surgery in June 2017. In 2024, Dr. Hadjipanayis and Jan Drappatz, MD, chief of the UPMC Division of Neuro-Oncology, launched the first 5-ALA intraoperative photodynamic therapy (PDT) clinical trial in North America at UPMC for glioblastoma patients utilizing the new drug Pentalafen. Dr. Hadjipanayis and his lab are actively studying the development and use of magnetic hyperthermia therapy (MHT) for treatment of glioblastoma in combination with adjuvant therapies. This collaborative research involves Johns Hopkins University and Penn State University. Other areas of focus in the laboratory include photodynamic therapy (PDT) and focused ultrasound (FUS) therapy of malignant brain tumors.

Dr. Hadjipanayis is the elected chair of the American Association of Neurological Surgeons (AANS)/Congress of Neurological Surgeons (CNS) Section on Tumors. During his term, he will lead over 25 subcommittees focused on patient care, educational, and research initiatives with neurosurgical oncology leaders from the U.S. and around the world. He is also an elected member of the American Academy of Neurological Surgeons, Neurosurgical Society of America (NSA), and the Society of Neurological Surgeons (SNS). He currently serves as the chair of the research subcommittee for the SNS and oversees the Neurosurgeon-Scientist Training Program (NSTP) with Linda Liau, MD, from UCLA. This new program provides select research funding to neurosurgery residents from across the country who have demonstrated productive research in a mentored setting.

Dr. Hadjipanayis is actively involved with the training of residents, fellows, and students. He is the co-principal investigator—along with Page Pennell, MD, chair of the University of Pittsburgh Department of Neurology, and Julia Kofler, MD, director of the University of Pittsburgh Division of Neuropathology—of the newly established NIH R25 Neurology, Neurosurgery, Neuropathology Pittsburgh Research Education Program (N3 PREP) for residents and fellow trainees. The goal of N3 PREP is to train the next generation of physician-neuroscientists at the University of Pittsburgh. Dr. Hadjipanayis is also the director of the CAST-approved neurosurgical oncology fellowship at UPMC. This unique fellowship combines the expertise and mentorship of multiple faculty at UPMC Presbyterian Shadyside for the training of residents on surgery and stereotactic radiosurgery for primary brain, skull-based, and spinal tumors after their chief year. In addition, Dr. Hadjipanayis's laboratory is actively involved with training students on basic research involving malignant brain tumors. His students have been granted awards and fellowships that include the Certificate of Merit Award by the University of Pittsburgh School of Medicine and the ABTA Medical Student Summer Fellowship.

Dr. Hadjipanayis has been a tireless brain tumor advocate serving on the nonprofit boards of the Southeastern Brain Tumor Foundation (SBTF) and StacheStrong.

Costas G. Hadjipanayis, MD, PhD

Specialized Areas of Interest
Surgical management of brain and spinal cord tumors; stereotactic radiosurgery (Gamma Knife and LINAC-based); fluorescence-guided neurosurgery; laser-interstitial thermal therapy (LITT); intraoperative awake/cortical mapping; use of a robotic-assisted exoscope; neuroendoscopy for colloid cysts and hydrocephalus.

Board Certifications
American Board of Neurological Surgery

Hospital Privileges
UPMC Children's Hospital of Pittsburgh
UPMC Magee-Womens Hospital
UPMC Passavant
UPMC Presbyterian
UPMC Shadyside

Professional Organization Membership
American Academy of Neurological Surgeons
American Board of Neurological Surgery
American Association of Neurological Surgeons
Congress of Neurological Surgeons
Neurosurgery Research Education Fund
Neurosurgical Society of America
Society of Neuro-Oncology
Society of Neurological Surgeons

Professional Activities
Chair, AANS/CNS Section on Tumors
Chair, Research Subcommittee, Society of Neurological Surgeons
Co-Principal Investigator, NIH R25 Neurology, Neurosurgery, and Neuropathology Pittsburgh Research Education Program (N3 PREP)
Director, CAST-approved neurosurgical oncology fellowship at UPMC

Education & Training
BA, Medical Scholar's Program, University of Delaware, 1994
MD, Sydney Kimmel Jefferson Medical College, 1998
General Surgery, University of Pittsburgh, 1999
Gamma Knife radiosurgery fellowship, University of Pittsburgh 2004
PhD, Biochemistry/Molecular Genetics, University of Pittsburgh, 2005
Neurological Surgery Residency, University of Pittsburgh, 2006
Surgical Neuro-oncology fellowship, University of California, San Francisco, 2006

Honors & Awards
Top Doctor for Neurosurgery, Castle Connolly, 2018-24
Super Doctor, superdoctor.com, 2021-24
Leica Award, AANS Annual Meeting, Philadelphia, 2022
Cullman Family Award For Excellence in Physician Communication, Mount Sinai Health System, 2019
Distinguished Physician of the Year, Hellenic Medical Society, 2019
Inaugural Brain Tumor Biotech Young Innovator Award, Weill Cornell Medicine, 2013
Health Care Hero Award Winner, Atlanta Business Chronicle, 2013
Young Investigator Award, American Brain Tumor Association, 2011
Translational Research Award, Winship Cancer Institute, Emory University, 2010

Costas G. Hadjipanayis, MD, PhD

Robbins Scholar Award, Winship Cancer Institute, Emory University, 2010
Robert Ginsberg Surgical Oncology Award, Radiation Therapy Oncology Group, 2009
Philip Jory Award, Southeastern Brain Tumor Foundation, 2009
Distinguished Cancer Clinician and Scientist, Georgia Cancer Coalition, 2007
Basic Research Fellowship Award, American Brain Tumor Association, 2006
Mentored Clinical Scientist Development Award (K08), National Institute of Health, 2005
Inaugural Stuart Rowe Society Presentation Award, University of Pittsburgh, 2005
Ruth L. Kirschstein National Research Service Award (T32), National Institutes of Health, 2003
Resident Teacher of the Year Award, Department of Neurological Surgery, University of Pittsburgh, 1999
Alpha Omega Alpha, Jefferson Medical College, 1997
Benjamin and Mary Siddons Measey Award, Jefferson Medical College, 1997
Hobart Amory Hare Medical Student Honor Society, Jefferson Medical College, 1996
Honor Society Award, Association of Pathology Chairs, 1996
Bernard B. Rotko Scholarship, Jefferson Medical College, 1996
Nicholas T. Padis Award, Hellenic University Club of Philadelphia, 1995
Golden Key National Honor Society, University of Delaware, 1994
Phi Beta Kappa, University of Delaware, 1994

Publications: 2023-24

• Refereed Articles:

Casillo SM, Gatesman TA, Chilukuri A, Varadharajan S, Johnson BJ, David Premkumar DR, Jane EP, Plute TJ, Koncar RF, Stanton AJ, Biagi-Junior CAO, Barber CS, Halbert ME, Golbourn BJ, Halligan K, Cruz AF, Mansi NM, Cheney A, Mullett SJ, Land CV, Perez JL, Myers MI, Agrawal N, Michel JJ, Chang YF, Vaske OM, MichaelRaj A, Lieberman FS, Felker J, Shiva S, Bertrand KC, Amankulor N, Hadjipanayis CG, Abdullah KG, Zinn PO, Friedlander RM, Abel TJ, Nazarian J, Venneti S, Filbin MG, Gelhaus SL, Mack SC, Pollack IF, Agnihotri S. An ERK5-PFKFB3 axis regulates glycolysis and represents a therapeutic vulnerability in pediatric diffuse midline glioma. *Cell Rep* 43(1):113557 2024.

Mallela AN, Plute TJ, Abou-Al-Shaar H, Fernandes Cabral DT, Hadjipanayis CG. Exoscope-based supracerebellar infratentorial approach for a pineal meningioma in the prone position. *Neurosurg Focus Video* 10(1):V15, 2024.

Filip P, Lerner DK, Kominsky E, Schupper A, Liu K, Khan NM, Roof S, Hadjipanayis C, Genden E, Iloreta AMC. 5-Aminolevulinic Acid Fluorescence-Guided Surgery in Head and Neck Squamous Cell Carcinoma. *Laryngoscope* 134(2):741-748, 2024.

Bin-Alamer O, Abou-Al-Shaar H, Mallela AN, Kallos JA, Deng H, Nabeel AM, Reda WA, Tawadros SR, Abdelkarim K, El-Shehaby AMN, Emad RM, Peker S, Samanci Y, Lee CC, Yang HC, Mathieu D, Tripathi M, Mantziaris G, Mullapudi A, Urgosik D, Liscak R, Bowden GN, Zaki P, Wegner RE, Shepard MJ, Sheehan JP, Niranjan A, Hadjipanayis CG, Lunsford LD. Intratumoral Hemorrhage in Vestibular Schwannomas After Stereotactic Radiosurgery: Multi-Institutional Study. *Neurosurgery* 94(2):289-296, 2024.

Wei Z, Jose SG, Agarwal P, Worrell S, Kulich S, Donohue JK, Deng H, Hadjipanayis CG, Niranjan A, Lunsford LD. Adjuvant Stereotactic Radiosurgery for Clear Cell Meningiomas. *World Neurosurg* 184:e784-e793 2024.

Vincze SR, Jaswal AP, Frederico SC, Nisnboym M, Li B, Xiong Z, Sever RE, Sneiderman CT, Rodgers M, Day KE, Latoche JD, Foley LM, Hitchens TK, Frederick R, Patel RB, Hadjipanayis CG, Raphael I, Nedrow JR, Edwards WB, Kohanbash G. ImmunoPET imaging of TIGIT in the glioma microenvironment. *Sci Rep* 14(1):5305, 2024.

Costas G. Hadjipanayis, MD, PhD

Bin-Alamer O, Abou-Al-Shaar H, Niranjan A, Hadjipanayis CG, Lunsford LD. Straining the Limits of the Brain: Arteriovenous Malformation Rupture Case Report in the Context of Chronic Constipation. *Stroke* 55(4):e124-e126, 2024.

Bin-Alamer O, Plute T, Mallela AN, Jacobs R, Hadjipanayis CG, Hamilton DK, Maroon JC, Lunsford LD, Friedlander RM, Abou-Al-Shaar H. Cross-sectional examination of current and future trends and attributes of the presidents of the American Association of Neurological Surgeons and the Congress of Neurological Surgeons societies. *World Neurosurg X* 23:100285, 2024.

Bin-Alamer O, Abou-Al-Shaar H, Niranjan A, Hadjipanayis CG, Lunsford LD. Straining the Limits of the Brain: Arteriovenous Malformation Rupture Case Report in the Context of Chronic Constipation. *Stroke* 55(4):e124-e126, 2024.

Wei Z, Jose SG, Agarwal P, Worrell S, Kulich S, Donohue JK, Deng H, Hadjipanayis CG, Niranjan A, Lunsford LD. Adjuvant Stereotactic Radiosurgery for Clear Cell Meningiomas. *World Neurosurg* 184:e784-e793, 2024.

Albalkhi I, Shafqat A, Bin-Alamer O, Mallela AN, Gersey ZC, Fernandes Cabral D, Sabbagh AJ, Hadjipanayis CG, González-Martínez JA, Friedlander RM, Abou-Al-Shaar H. Complications and visual outcomes following surgical resection of pediatric optic pathway/hypothalamic gliomas: a systematic review and meta-analysis. *Childs Nerv Syst* 40(7):2033-2042, 2024.

Rentzeperis F, Rivera D, Zhang JY, Brown C, Young T, Rodriguez B, Schupper A, Price G, Gomberg J, Williams T, Bouras A, Hadjipanayis C. Recent Developments in Magnetic Hyperthermia Therapy (MHT) and Magnetic Particle Imaging (MPI) in the Brain Tumor Field: A Scoping Review and Meta-Analysis. *Micromachines* (Basel) 24;15(5):559, 2024.

Wei Z, Srinivasan P, Patel R, Bednarz G, Flickinger JC, Hadjipanayis CG, Niranjan A, Lunsford LD. Stereotactic Radiosurgery for Patients with Brain Metastases from Hepatopancreaticobiliary Cancers. *Cancers* (Basel) 16(9):1665, 2024.

Zhu P, Pichardo-Rojas PS, Dono A, Tandon N, Hadjipanayis CG, Berger MS, Esquenazi Y. The detrimental effect of biopsy preceding resection in surgically accessible glioblastoma: results from the national cancer database. *J Neurooncol* 168(1):77-89, 2024.

Huq S, Shanahan RM, Adida S, Bin-Alamer O, Abou-Al-Shaar H, Niranjan A, Hadjipanayis CG, Lunsford LD. Gamma knife radiosurgery for clival metastasis: case series and systematic review. *J Neurooncol* 168(1):171-183, 2024.

Ember K, Dallaire F, Plante A, Sheehy G, Guiot MC, Agarwal R, Yadav R, Douet A, Selb J, Tremblay JP, Dupuis A, Marple E, Urmey K, Rizea C, Harb A, McCarthy L, Schupper A, Umphlett M, Tsankova N, Leblond F, Hadjipanayis C, Petrecca K. In situ brain tumor detection using a Raman spectroscopy system-results of a multicenter study. *Sci Rep* 14(1):13309, 2024.

Skandalakis GP, Neudorfer C, Payne CA, Bond E, Tavakkoli AD, Barrios-Martinez J, Trutti AC, Koutsarnakis C, Coenen VA, Komaitis S, Hadjipanayis CG, Stranjalis G, Yeh FC, Banihashemi L, Hong J, Lozano AM, Kogan M, Horn A, Evans LT, Kalyvas A. Establishing connectivity through microdissections of midbrain stimulation-related neural circuits. *Brain* [Online ahead of print], 2024.

Schupper AJ, Hrabarchuk EI, McCarthy L, Hadjipanayis CG. Improving Surgeon Well-Being: Ergonomics in Neurosurgery. *World Neurosurg* 175:e1220-e1225, 2023.

Costas G. Hadjipanayis, MD, PhD

Taori S, Wei Z, Deng H, Hadjipanayis CG, Lunsford LD, Niranjan A. Stereotactic radiosurgery for patients with brain metastases from gastroesophageal cancers. *J Neurooncol* 164(1):147-155, 2023.

Price G, Schupper A, Kalagara R, Chennareddy S, He C, Zhang JY, Sudhir S, Rentzeperis F, Wanna G, Hadjipanayis C. Application of the Robotic-Assisted Digital Exoscope for Resection of Posterior Fossa Tumors in Adults: A Series of 45 Cases. *Oper Neurosurg* (Hagerstown) 25(5):397-407, 2023.

Mantica M, Drappatz J, Lieberman F, Hadjipanayis CG, Lunsford LD, Niranjan A. Phase II study of border zone stereotactic radiosurgery with bevacizumab in patients with recurrent or progressive glioblastoma multiforme. *J Neurooncol* 164(1):179-190, 2023.

Bin-Alamer O, Abou-Al-Shaar H, Mallela AN, Kallos JA, Deng H, Nabeel AM, Reda WA, Tawadros SR, Abdelkarim K, El-Shehaby AMN, Emad RM, Peker S, Samanci Y, Lee CC, Yang HC, Mathieu D, Tripathi M, Mantziaris G, Mullapudi A, Urgosik D, Liscak R, Bowden GN, Zaki P, Wegner RE, Shepard MJ, Sheehan JP, Niranjan A, Hadjipanayis CG, Lunsford LD. Intratumoral Hemorrhage in Vestibular Schwannomas After Stereotactic Radiosurgery: Multi-Institutional Study. *Neurosurgery* 94(2):289-296 2024.

Bin-Alamer O, Abou-Al-Shaar H, Gersey ZC, Huq S, Kallos JA, McCarthy DJ, Head JR, Andrews E, Zhang X, Hadjipanayis CG. Intraoperative Imaging and Optical Visualization Techniques for Brain Tumor Resection: A Narrative Review. *Cancers* (Basel) 15(19):4890, 2023.

Skandalakis GP, Barrios-Martinez J, Kazim SF, Rumalla K, Courville EN, Mahto N, Kalyvas A, Yeh FC, Hadjipanayis CG, Schmidt MH, Kogan M. The anatomy of the four streams of the prefrontal cortex. Preliminary evidence from a population based high definition tractography study. *Front Neuroanat* 17:1214629, 2023.

Bin-Alamer O, Abou-Al-Shaar H, Singh R, Mallela AN, Legarreta A, Bowden G, Mathieu D, Perlow HK, Palmer JD, Elhamdani S, Shepard M, Liang Y, Nabeel AM, Reda WA, Tawadros SR, Abdelkarim K, El-Shehaby AMN, Emad Eldin R, Elazzazi AH, Warnick RE, Gozal YM, Daly M, McShane B, Addis-Jackson M, Karthikeyan G, Smith S, Picozzi P, Franzini A, Kaisman-Elbaz T, Yang HC, Hess J, Templeton K, Zhang X, Wei Z, Pikis S, Mantziaris G, Simonova G, Liscak R, Peker S, Samanci Y, Chiang V, Kersh CR, Lee CC, Trifiletti DM, Niranjan A, Hadjipanayis CG, Lunsford LD, Sheehan JP. Local control and survival after stereotactic radiosurgery for colorectal cancer brain metastases: an international multicenter analysis. *J Neurosurg* 140(5):1233-1242 2023.

Albalkhi I, Shafqat A, Bin-Alamer O, Abou Al-Shaar AR, Mallela AN, Fernández-de Thomas RJ, Zinn PO, Gerszten PC, Hadjipanayis CG, Abou-Al-Shaar H. Fluorescence-guided resection of intradural spinal tumors: a systematic review and meta-analysis. *Neurosurg Rev* 12;47(1):10, 2023.

Research Activities

Dr. Hadjipanayis is involved with multiple NIH-funded grants focused on developing new therapies for malignant brain tumors, better surgical resection of better tumors, and understanding the cognitive impact of brain tumor surgery. One of the current NIH R01 grants he leads focuses on the development of magnetic hyperthermia therapy (MHT) for treatment of GBM in combination with adjuvant therapies (chemoradiation). This multidisciplinary and multi-institutional effort includes both the University of Pittsburgh Department of Neurological Surgery, Johns Hopkins University, and Penn State University. As part of this R01, a new collaboration has also been established at the Blue Pearl Pet Hospital in Pittsburgh. This large veterinary hospital will permit the study and MHT treatment of canines with spontaneous gliomas.

D. Kojo Hamilton, MD

Professor
Director, UPMC Neurosurgical Spine Services
Director, Residency Training Program
Co-Director, Spine Fellowship Program

D. Kojo Hamilton, MD, is a recognized leader in scoliosis, adult spinal deformity and trauma. He is also renowned for neurological surgery education and mentoring.

He received his medical degree and residency training from the University of Virginia in Charlottesville, Va. He underwent further subspecialty training in complex spine, spinal deformity, scoliosis and spine surgical oncology, with a combined neurosurgical and orthopedic (AOSpine) fellowship, at the University of Virginia. Dr. Hamilton further received subspecialty cranial training in Auckland City Hospital in Auckland, New Zealand.

He is board certified in neurological surgery, a member of the Society of Neurological Surgeons, a fellow of the American Association of Neurological Surgeons and a member of the Scoliosis Research Society. After training, Dr. Hamilton received appointments at the University of Maryland School of Medicine and Maryland Shock Trauma Hospital where he treated patients with complex spine deformity, severe spine and brain trauma.

Before joining UPMC, Dr. Hamilton was at the Oregon Health and Science University Spine Center where he treated patients with neurological trauma as well as spinal deformity conditions including adult idiopathic scoliosis, spondylolisthesis and general back and neck pain.

Dr. Hamilton is nationally involved in teaching advanced and current techniques in scoliosis and adult spine deformity. He has an extensive research background in spine surgery and has presented nationally and internationally on the subject.

Dr. Hamilton has received several awards and accolades from his patients, nurses and peers, including best doctor awards—locally and nationally, nine years in a row—since his first year at the University of Pittsburgh School of Medicine.

Specialized Areas of Interest
Scoliosis; adult and pediatric spinal deformity; cranial and spine trauma; degenerative conditions of the spine; revision and reconstructive spine surgery.

Board Certifications
American Board of Neurological Surgery
Fellow of the American Association of Neurological Surgeons

Hospital Privileges
UPMC Children's Hospital of Pittsburgh
UPMC Hamot Medical Center
UPMC Magee-Womens Hospital
UPMC Mercy
UPMC Presbyterian

Professional Organization Membership
American Association of Neurological Surgeons (AANS)
AANS/CNS Joint Section of Disorders of the Spine and Peripheral Nerves
AANS/CNS Joint Section of Neurotrauma and Critical Care

D. Kojo Hamilton, MD

AOSpine North America (AOSNA)
International Spine Study Group
Lumbar Spine Research Society
Scoliosis Research Society
Society of Neurological Surgeons

Professional Activities
IMAST Committee, Scoliosis Research Society
MOC/CME Committee, American Association of Neurological Surgeons
Executive Committee, AANS/CNS Joint Section Spine and Peripheral Nerves
Scientific Program Committee, AANS/CNS Joint Section Spine and Peripheral Nerves
DSPN Drugs & Devices Committee, AANS/CNS Joint Section Spine and Peripheral Nerves
ABNS Exam/Extra-Mural Writing Committee, American Board of Neurological Surgery

Education & Training
BS (High Honors), Biochemistry, University of Maryland, 1998
MD, University of Virginia, 2003
Fellowship, Brain and Spine, Auckland City Hospital, 2008
Residency, University of Virginia, 2009
Fellowship, Complex Spine, University of Virginia, 2010

Honors & Awards
Castle Connolly Top Doctors in America, 2016-24
UPMC Physician Excellence Award – UPMC Physician Excellence in Leadership 2023
Faculty Teaching Award, Department of Neurological Surgery, 2020
Distinguished Alumni, University of Virginia Summer Medical and Dental Education Program

Publications: 2023-24
• Refereed Articles:
Passias PG, Ahmad W, Tretiakov PS, Lafage R, Lafage V, Schoenfeld AJ, Line B, Daniels A, Mir JM, Gupta M, Mundis G, Eastlack R, Nunley P, Hamilton DK, Hostin R, Hart R, Burton DC, Shaffrey C, Schwab F, Ames C, Smith JS, Bess S, Klineberg EO, International Spine Study Group. Critical Analysis of Radiographic and Patient Reported Outcomes Following Anterior/Posterior Staged vs. Same Day Surgery in Patients Undergoing Identical Corrective Surgery for Adult Spinal Deformity. *Spine* (Phila Pa 1976) 49(13):893-901 2024.

Alan N, Zenkin S, Lavadi RS, Legarreta AD, Hudson JS, Fields DP, Agarwal N, Mamindla P, Ak M, Peddagangireddy V, Puccio L, Buell TJ, Hamilton DK, Kanter AS, Okonkwo DO, Zinn PO, Colen RR. Associating T1-weighted and T2-weighted Magnetic Resonance Imaging Radiomic Signatures with Preoperative Symptom Severity in Patients with Cervical Spondylotic Myelopathy. *World Neurosurg* 184:e137-e143, 2024.

Bin-Alamer O, Qedair J, Abou-Al-Shaar H, Mallela AN, Balasubramanian K, Alnefaie N, Abou-Al-Shaar AR, Plute T, Lu VM, McCarthy DJ, Fields DP, Agarwal N, Gerszten PC, Hamilton DK. Surgical Intervention < 24h versus >24h after Injury for the Management of Acute Traumatic Central Cord Syndrome: A Systematic Review and Meta-Analysis. *J Neurosurg Spine* 40(5):653-661, 2024.

Mullin JP, Soliman MAR, Smith JS, Kelly MP, Buell TJ, Diebo B, Scheer JK, Line B, Lafage V, Lafage R, Klineberg EO, Kim HJ, Passias PG, Gum JL, Kebaish KM, Eastlack R, Daniels AH, Soroceanu A, Mundis GM, Hostin RA, Protopsaltis TS, Hamilton DK, Gupta M, Lewis SJ, Schwab FJ, Lenke L, Shaffrey CI, Bess S, Ames CP, Burton D; International Spine Study Group. *J Neurosurg Spine* 40(6):684-691, 2024.

D. Kojo Hamilton, MD

Gajjar AA, Patel SV, Lavadi RS, Mitha R, Kumar RP, Taylor T, Elsayed GA, Hamilton DK, Agarwal N. Art and Neurosurgery: The Importance of Medical Illustration. *World Neurosurg* 181:82-89 2024.

Balmaceno-Criss M, Lafage R, Alsoof D, Daher M, Hamilton DK, Smith JS, Eastlack RK, Fessler, RG, Gum JL, Gupta M, Hostin R, Kebaish KM, Klineberg EO, Lewis SJ, Line BG, Nunley PD, Mundis GM, Passias PG, Protopsaltis TS, Buell T, Scheer JK, Mullin JP, Soroceanu A, Ames CP, Lenke LG, Bess S, Shaffrey CI, Schwab FJ, Lafage V, Burton DC, Diebo BG, Daniels AH; International Spine Study Group. Impact of Hip and Knee Osteoarthritis on Full Body Sagittal Alignment and Compensation for Sagittal Spinal Deformity. *Spine* (Phila Pa 1976) 49(11):743-751, 2024.

Lafage R, Bass DR, Klineberg E, Smith JS, Bess S, Shaffrey C, Burton DC, Kim HJ, Eastlack R, Mundis G, Ames, CP, Passias PG, Gupta M, Hostin R, Hamilton DK, Schwab F, Lafage V; International Spine Study Group. Complication Rates Following Adult Spinal Deformity Surgery: Evaluation of the Category of Complication and Chronology. *Spine* (Phila Pa 1976) 49(12):829-839, 2024.

Diebo B, Alsoof D, Balmaceno-Criss M, Daher M, Lafage R, Passias PG, Ames CP, Shaffrey CI, Burton DC, Deviren V, Line BG, Soroceanu A, Hamilton DK, Klineberg EO, Mundis GM, Kim HJ, Gum JL, Smith JS, Uribe JS, Kebaish KM, Gupta MC, Nunley PD, Eastlack RK, Hostin R, Protopsaltis TS, Lenke LG, Hart RA, Schwab FJ, Bess S, Lafage V, Daniels AH, International Spine Study Group. Hip Osteoarthritis in Patients Undergoing Surgery for Severe Adult Spinal Deformity: Prevalence and Impact on Spine Surgical Outcomes. *J Bone Joint Surg Am* 106(13):1171-1180 2024.

Bin-Alamer O, Plute T, Mallela AN, Jacobs R, Hadjipanayis CG, Hamilton DK, Maroon JC, Lunsford LD, Friedlander RM, Abou-Al-Shaar H. Cross-Sectional Examination of Current and Future Trends and Attributes of The Presidents of The American Association of Neurological Surgeons and The Congress of Neurological Surgeons Societies. *World Neurosurg X* 23:100285 2024.

Azad T, Schwab F, Lafage V, Soroceanu A, Eastlack R, Lafage R, Kebaish KM, Hart RA, Diebo BG, Kelly MP, Smith JS, Daniels AH, Hamilton DK, Gupta MC, Klineberg E, Protopsaltis T, Passias PG, Bess S, Gum JL, Hostin R, Lewis S, Shaffrey C, Burton D, Lenke L, Ames CP, Scheer JK. Stronger association of objective physical metrics with baseline patient-reported outcome measures than preoperative standing sagittal parameters for adult spinal deformity patients. *J Neurosurg Spine* 40(6):692-699, 2024.

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Anand KS, Lavadi RS, Johnston BR, Chalif JI, Scanlon JM, Wang W, Agarwal N, Hamilton DK, Fields DP, Van't Land CW. Time of Day Does Not Impact Spinal Serotonin Levels in Humans. *Synapse* 78(3):e22291 2024.

Hudson JS, Legarreta A, Fields DP, Deng H, McCarthy DJ, Sefcik R, Agarwal N, Hamilton DK. Intradiscal Osteotomy and Bilateral Expandable Transforaminal Interbody Fusion Cages for Iatrogenic Kyphotic Deformity: A Technical Report. *Asian J Neurosurg* 19(2):317-320, 2024.

Gajjar AA, PremKumar R, Hamilton DK, Buell TJ, Agarwal N, Gerszten PC, Hudson J. In Reply: Usefulness and Accuracy of Artificial Intelligence Chatbot Responses to Patient Questions for Neurosurgical Procedures. *Neurosurgery* [Online ahead of print], 2024.

D. Kojo Hamilton, MD

Kumar RP, Adida S, Lavadi RS, Mitha R, Legarreta AD, Hudson JS, Shah M, Diebo B, Fields DP, Buell TJ, Hamilton DK, Daniels AH, Agarwal N. A Guide to Selecting Upper-Thoracic versus Lower-Thoracic Uppermost-Instrumented Vertebra in Adult Spinal Deformity Correction. Eur Spine J [Online ahead of print], 2024.

Monek AC, Mitha R, Andrews E, Sarkaria IS, Agarwal N, Hamilton DK. Multidisciplinary Surgical Approach Utilizing Augmented Reality Pre-Planning for Resection of Giant Thoracic Schwannoma with Robotic Assisted Thoracoscopic Mobilization. *Oper Neurosurg* (Hagerstown) [Online ahead of print], 2024.

Gajjar AA, Kumar RP, Paliwoda ED, Kuo C, Adida S, Legarreta A, Deng H, Anand SK, Hamilton DK, Buell T, Agarwal N, Gerszten P, Hudson J. Usefulness and Accuracy of Artificial Intelligence Chatbot Responses to Patient Questions for Neurosurgical Procedures. *Neurosurgery* [Online ahead of print], 2024.

Diebo BG, Tataryn Z, Alsoof D, Lafage R, Hart RA, Passias PG, Ames CP, Scheer JK, Lewis SJ, Shaffrey CI, Burton DC, Deviren V, Line BG, Soroceanu A, Hamilton DK, Klineberg EO, Mundis GM, Kim HJ, Gum JL, Smith JS, Uribe JS, Kelly MP, Kebaish KM, Gupta MC, Nunley PD, Eastlack RK, Hostin R, Protopsaltis TS, Lenke LG, Schwab FJ, Bess S, Lafage V, Daniels AH, the International Spine Study Group. Height Gain Following Correction of Adult Spinal Deformity. *J Bone Joint Surg Am* 105(18):1410-1419, 2023.

Passias PG, Ahmad W, Dave P, Lafage R, Lafage V, Mir J, Klineberg EO, Kabeish KM, Gum JL, Line BG, Hart R, Burton D, Smith JS, Ames CP, Shaffrey CI, Schwab F, Hostin R, Buell T, Hamilton DK, Bess S. Economic burden of nonoperative treatment of adult spinal deformity. *J Neurosurg Spine* 39(6):751-756 2023.

Algattas HN, Alattar AA, Okonkwo DO, Wang EW, Snyderman CH, Hamilton DK, Friedlander RM, Zenonos GA, Gardner PA. A novel classification and management scheme for craniocervical junction disorders with ventral neural element compression. *J Neurosurg* 140(2):585-594 2023.

Passias PG, Pierce KE, Dave P, Lafage R, Lafage V, Schoenfeld AJ, Line B, Uribe J, Hostin R, Daniels A, Hart R, Burton D, Kim HJ, Mundis GM, Eastlack R, Diebo BG, Gum JL, Shaffrey C, Schwab F, Ames CP, Smith JS, Bess S, Klineberg E, Gupta MC, Hamilton DK, International Spine Study Group. When not to Operate in Spinal Deformity: Identifying Subsets of Patients With Simultaneous Clinical Deterioration, Major Complications, and Reoperation. *Spine* (Phila Pa 1976) 48(21):1481-1485, 2023.

Passias PG, Williamson TK, Mir JM, Smith JS, Lafage V, Lafage R, Line B, Daniels AH, Gum JL, Schoenfeld AJ, Hamilton DK, Soroceanu A, Scheer JK, Eastlack R, Mundis GM, Diebo B, Kebaish KM, Hostin RA Jr, Gupta MC, Kim HJ, Klineberg EO, Ames CP, Hart RA, Burton DC, Schwab FJ, Shaffrey CI, Bess S, On Behalf Of The International Spine Study Group. Are We Focused on the Wrong Early Postoperative Quality Metrics? Optimal Realignment Outweighs Perioperative Risk in Adult Spinal Deformity Surgery. *J Clin Med* 12(17):5565, 2023.

Passfall L, Imbo B, Lafage V, Lafage R, Smith JS, Line B, Schoenfeld AJ, Protopsaltis T, Daniels AH, Kebaish KM, Gum JL, Koller H, Hamilton DK, Hostin R, Gupta M, Anand N, Ames CP, Hart R, Burton D, Schwab FJ, Shaffrey CI, Klineberg EO, Kim HJ, Bess S, Passias PG. The impact of baseline cervical malalignment on the development of proximal junctional kyphosis following surgical correction of thoracolumbar adult spinal deformity. *J Neurosurg Spine* 39(6):742-750 2023.

D. Kojo Hamilton, MD

Ye J, Gupta S, Farooqi AS, Yin T, Soroceanu A, Schwab FJ, Lafage V, Kelly MP, Kebaish K, Hostin R, Agarwal N, Roy S, Lavadi RS, Alan N, Ozpinar A, Buell TJ, Hamilton DK, Kanter AS, Okonkwo DO. Durability of stand-alone anterolateral interbody fusion in staged minimally invasive circumferential scoliosis surgery with delayed posterior instrumentation due to medical necessity. *Spine Deform* 11(6):1495-1501 2023.

Gum JL, Smith JS, Shaffrey CI, Scheer JK, Protopsaltis TS, Passias PG, Klineberg EO, Kim HJ, Hart RA, Hamilton DK, Ames CP, Gupta MC. Predictive role of global spinopelvic alignment and upper instrumented vertebra level in symptomatic proximal junctional kyphosis in adult spinal deformity. *J Neurosurg Spine* 39(6):774-784 2023.

Wick JB, Blandino A, Smith JS, Line BG, Lafage V, Lafage R, Kim HJ, Passias PG, Gum JL, Kebaish KM, Eastlack RK, Daniels A, Mundis G, Hostin R, Protopsaltis T, Hamilton DK, Kelly MP, Gupta M, Hart RA, Schwab FJ, Burton DC, Ames CP, Lenke LG, Shaffrey CI, Bess S, Klineberg E, International Spine Study Group. The ISSG-AO Complication Intervention Score, but Not Major/Minor Designation, is Correlated With Length of Stay Following Adult Spinal Deformity Surgery. *Global Spine J* [Online ahead of print], 2023.

Luke C. Henry, PhD

Assistant Professor

Luke Henry, PhD, joined the Department of Neurological Surgery in November of 2015. Dr. Henry completed his doctorate in clinical neuropsychology, specializing in research and intervention, at the Université de Montréal in 2011. He then moved to Pittsburgh where he completed a post-doctoral fellowship at the UPMC Sports Concussion Program. Dr. Henry worked for two years as a clinical instructor within the concussion program before joining the Department of Neurological Surgery.

In his current role, Dr. Henry is responsible for pre- and post-operative neuropsychological testing for a variety of pathologies/conditions including movement disorders, epilepsy, Chiari malformations, brain tumors and post-TBI assessments. He is also actively involved with various research endeavors with other faculty members within the department. Dr. Henry is the lead neuropsychologist in the department, overseeing the growth of neuropsychological services within the department and in collaboration with other departments. He is also involved with doctoral-level training for clinical psychology students from the University of Pittsburgh and Chatham University. Additionally, he is the instructor for the graduate-level cognitive assessment class at the University of Pittsburgh where he is an adjunct professor.

Specialized Areas of Interest
Neuropsychological function; clinical outcomes.

Hospital Privileges
UPMC Mercy
UPMC Presbyterian
UPMC Shadyside

Professional Organization Membership
American Psychological Association
International Neuropsychological Society
National Academy of Neuropsychology

Luke C. Henry, PhD

Professional Activities
Adjunct Professor, Department of Psychology, University of Pittsburgh
Advisor, pre-doc psychology intern/grad students, University of Pittsburgh, Chatham University

Education & Training
BS, Psychology, University of Calgary, 2003
MS, Behavioral Neuroscience, University of Calgary, 2006
PhD, Clinical Neuropsychology, Université de Montréal, 2011
Fellowship, Clinical Neuropsychology, UPMC, 2013

Kathryn Hoes, MD

Clinical Assistant Professor

Kathryn Hoes, MD, MBS, received her bachelors of science degree from the University of Pittsburgh in 2006 with a full academic scholarship. In addition to her dedicated science studies and pre-medical preparatory courses, she obtained a certificate in Latin American Studies during her time as an undergraduate. Spanish language proficiency was a part of this certification. She completed an accelerated masters of biomedical science degree at Rutgers University prior to medical school in order to obtain a deeper foundation in biomedical research which would play a vital role in her planned academic medical practice.

Following her initial medical training at Rutgers University (formerly Robert Wood Johnson Medical School) Dr. Hoes went on to neurosurgery residency at University of Texas Southwestern Medical Center. She served as chief resident in her final year of training. For additional expertise. Dr. Hoes completed a CAST certified fellowship in complex spinal surgery at Indiana University School of Medicine as part of Goodman Campbell Brain and Spine. The training consisted of complex spinal and minimally invasive procedures, spinal oncology, peripheral nerve disorders, spinal deformity, degenerative spinal disease, pediatric spinal disorders, and disc arthroplasty.

The type of care that is patient-centered, humanistic, and collaborative is important to Dr. Hoes. She integrates the breadth of her multifaceted training in an approach to brain, spine and peripheral nerve disorders with the patient's health goals as her primary consideration. Dr. Hoes prefers conservative care and the least invasive strategies possible to return her patients back to the lifestyle they are seeking. Medical education remains her priority.

Specialized Areas of Interest
Spinal tumors; degenerative spinal disorders; complex spine surgery; spinal instrumentation; peripheral nerve surgery; brain and spine trauma.

Board Certifications
American Board of Neurological Surgery

Hospital Privileges
UPMC Mercy
UPMC Passavant
UPMC Presbyterian
UPMC Shadyside

Professional Organization Membership
American Association of Neurological Surgeons
American Medical Association
Congress of Neurological Surgeons
North American Spine Society

Kathryn Hoes, MD

Education & Training
BS, University of Pittsburgh, 2006
Masters, Biomedical Sciences, University of Medicine and Dentistry of New Jersey (Rutgers University), 2007
MD, University of Medicine and Dentistry of New Jersey (Rutgers University), 2011
Residency, University of Texas Southwestern Medical Center, 2018
Fellowship, Complex Spine Neurosurgery, Indiana University with Goodman Campbell Brain and Spine, 2019

Honors & Awards
Best Doctor, *Dallas 'D' Magazine*, 2022
Post Residency Clinical Fellowship Grant, Neurosurgery Research and Education Foundation, 2018-19
Alumni Award, Robert Wood Johnson Foundation, Rutgers University, 2011
Gold Humanism Honor Society, Arnold P. Gold Foundation, Rutgers University, 2010.
Graduation with Honors, Cum Laude, University of Pittsburgh, 2006
Helen Faison Scholarship, University of Pittsburgh, 2002-06.

Baoli Hu, PhD

Associate Professor
Director, Brain Tumor Evolution & Therapy Lab

Baoli Hu, PhD, joined the faculty of the University of Pittsburgh Department of Neurological Surgery at UPMC Children's Hospital of Pittsburgh in July of 2017 and was promoted to associate professor in February of 2024.

Dr. Hu received his bachelor's and master's degrees from the Northwest A&F University in Yangling, China in 2001. He earned his PhD degree in microbiology from Wuhan University in Wuhan, China in 2004 and completed his postdoctoral training in molecular oncology at H. Lee Moffitt Cancer Center and Research Institute in Tampa, Fla. in 2007.

Prior to joining the faculty at the University of Pittsburgh School of Medicine, Dr. Hu was a senior research scientist in the Department of Genomic Medicine and Cancer Biology at the University of Texas, MD Anderson Cancer Center from 2011-17, working in the lab of Ronald DePinho, MD. From 2007-11 he worked with Dr. DePinho as a research scientist in the Department of Medical Oncology and Belfer Institute for Applied Cancer Science at Dana-Farber Cancer Institute at the Harvard Medical School.

Dr. Hu's research is focused on understanding the molecular mechanisms of brain tumor evolution, including tumor development, progression, and recurrence after the treatment; and developing new strategies for the treatment of these devastating diseases.

Specialized Areas of Interest
Oncobiology of glioma and medulloblastoma; cancer stem cells; functional cancer genomics; mechanisms of tumor initiation, progression, treatment resistance, and recurrence; translational research in druggable targets and biomarkers discovery.

Hospital Privileges
UPMC Children's Hospital of Pittsburgh
UPMC Hillman Cancer Center

Baoli Hu, PhD

Professional Organization Membership
American Association for Cancer Research
Society for Neuro-Oncology
Children's Brain Tumor Tissue Consortium
Pediatric Brain Tumor Consortium

Professional Activities
Clinical Neuroimmunology and Brain Tumors Study Section, NIH
Grant Reviewer, Austrian Science Fund
Review Committee, Competitive Medical Research Fund, University of Pittsburgh
NCI Clinical and Translational R21 and Omnibus R03 Review Study Section, NIH/NCI
Ad Hoc Reviewer, The Children's Brain Tumor Network
Ad Hoc Reviewer, The Walter L. Copeland Fund, The Pittsburgh Foundation
Cell Image Core Advisory Committee, UPMC Children's Hospital of Pittsburgh

Education & Training
BS, Animal Science and Technology, Northwest A&F University, 1998
MS, Animal Breeding and Genetics, Northwest A&F University, 2001
PhD, Microbiology, Wuhan University, 2004
Fellow, Molecular Oncology, Moffitt Cancer Center & Research Institute, 2007

Honors & Awards
Pilot Award, RK Mellon Institute for Pediatric Research, 2024
Hillman Fellow for Innovative Developmental Cancer Research, 2023
Richard King Mellon Scholar, UPMC Children's Hospital of Pittsburgh, 2018
UPMC Competitive Medical Research Fund Award, 2018
B*CURED Brain Cancer Research Investigator Award, 2018
Caroline Ross Endowed Fellowship Award, MD Anderson Cancer Center, 2017

Publications: 2023-24
• Refereed Articles:
Srivastava R, Labani-Motlagh A, Chen A, Bohorquez JA, Qin B, Dodda M, Yang F, Ansari D, Patel S, Ji H, Trasti S, Chao Y, Patel Y, Zou H, Hu B, Yi G. Development of a human glioblastoma model using humanized DRAG mice for immunotherapy. *Antib Ther* 6(4):253-264 2023.

Singh SK, Wang Y, Habib A, Priyadarshini M, Kodavali CV, Chen A, Ma W, Wang J, Hameed NU, Hu B, Fuller GN, Kulich SM, Amankulor N, Colen RR, Edwards LA, Zinn PO. TP53-PTEN-NF1 depletion in human brain organoids produces a glioma phenotype in vitro. *Front Oncol* 10:13:1279806 2023.

Nisnboym M, Vincze SR, Xiong Z, Sneiderman CT, Raphael RA, Li B, Jaswal AP, Sever RE, Day KE, LaToche JD, Foley LM, Karimi H, Hitchens TK, Agnihotri S, Hu B, Rajasundaram D, Anderson CJ, Blumenthal DT, Pearce TM, Uttam S, Nedrow JR, Panigrahy A, Pollack IF, Lieberman FS, Drappatz J, Raphael I, Edwards WB, Kohanbash G. Immuno-PET Imaging of CD69 Visualizes T-Cell Activation and Predicts Survival Following Immunotherapy in Murine Glioblastoma. *Cancer Res Commun* 3(7):1173-1188, 2023.

Zheng C, Wei Y, Zhang Q, Sun M, Wang Y, Hou J, Zhang P, Lv X, Su D, Jiang Y, Gumin J, Sahni N, Hu B, Wang W, Chen X, McGrail DJ, Zhang C, Huang S, Xu H, Chen J, Lang FF, Hu J, Chen Y. Multiomics analyses reveal DARS1-AS1/YBX1-controlled posttranscriptional circuits promoting glioblastoma tumorigenesis/radioresistance. *Sci Adv* 9(31):eadf3984, 2023.

Baoli Hu, PhD

Research Activities
Over the past year, the research efforts in Dr. Hu's Brain Tumor Evolution Therapy Lab have mainly focused on the completion of two projects, which include 1) developing a new class of drugs for targeting the immune-suppressive microenvironment in glioblastoma and 2) understanding molecular mechanisms of medulloblastoma metastatic dissemination. The results of these projects have been generated for research grant applications and paper publications. The National Institute of Health (NIH)/National Cancer Institute (NCI) R01 and The National Institute of Neurological Disorders and Stroke (NINDS) R21 grants have been continuously supporting these projects. Additionally, the research projects have also been funded and supported by the Andrew McDonough B+ Foundation, the Walter L. Copeland Foundation, the UPMC Hillman Developmental Pilot Program, and the RK Mellon Institute for Pediatric Research. Four manuscripts were published over the past year. The lab has presented the results at local and international conferences, such as the UPMC Hillman Cancer Center Cancer Biology Program Retreat and the Society of Neuro-Oncology (SNO) 28th Annual Meeting.

There were nine undergraduate students, one medical student, one lab technician, one post-doctoral fellow, and one research scientist, who have been mentored and trained. Among them, two undergraduate students were enrolled in the CMP-SURP program and the UPMC Children's Hospital of Pittsburgh's Summer Research Internship Program (SRIP).

Furthermore, along with other faculty members in the Division of Pediatric Neurosurgery, the UPMC Children's Hospital of Pittsburgh brain tumor tissue bank continued to grow and expand.

Esther Jane, PhD

Research Assistant Professor

Esther Jane, PhD, graduated from Madurai Kamaraj University in India. She did her post doctoral training in Case Western Reserve University in Cleveland, Ohio, on the molecular mechanisms underlying regulation of homeotic gene expression during Drosophila development.

Before joining the University of Pittsburgh Department of Neurological Surgery, she worked in the Pittsburgh Development Center in studying the cell biology of human embryonic stem cells before and after differentiation towards neuronal lineage.

Specialized Areas of Interest
Mode of action of multi-target tyrosine kinase inhibitors in glioma cells.

Professional Organization Membership
American Association for Cancer Research

Education & Training
BSc, Zoology, Sarah Tucker College, 1983
MSc, Zoology, The American College, 1986
PhD, Biology, The Madurai Kamaraj University, 1992

David L. Kaufmann, MD

Clinical Assistant Professor

David L. Kaufmann, MD, is clinical assistant professor of neurological surgery at the University of Pittsburgh School of Medicine. He has an interest in both cranial and spinal neurosurgery and has practiced at UPMC Mercy since 2000 where he served as the chief of neurosurgery from 2014-23. His practice has an emphasis on the treatment of degenerative disorders of the spine and neurotrauma. He also has an interest in complex spinal reconstructive surgery for conditions involving spinal deformity and brain tumors.

Dr. Kaufmann received his medical degree from the Albert Einstein College of Medicine in New York and completed a general surgery internship at the Johns Hopkins Hospital in Baltimore. He performed his neurosurgical residency at the Albert Einstein College of Medicine at Montefiore Medical Center and the Hyman-Newman Institute for Neurology and Neurosurgery at Beth Israel Medical Center in New York. He is board certified in neurological surgery.

Dr. Kaufmann is a member of the American Association of Neurological Surgeons and the Congress of Neurological Surgeons.

Specialized Areas of Interest
Spinal decompression and fusion surgery; complex spine surgery; brain and spine trauma; brain tumors; neurosurgical treatment of pain.

Board Certifications
American Board of Neurological Surgeons

Hospital Privileges
UPMC Mercy

Professional Organization Membership
American Association of Neurological Surgeons
Congress of Neurological Surgeons

Education & Training
BA, Philosophy, Emory University, 1989
MA Candidate, Philosophy, Columbia University, 1990
MD, Albert Einstein College of Medicine, 1994
Internship, Johns Hopkins Hospital, 1995
Residency, Albert Einstein College of Medicine, Montefiore Medical Center and Beth Israel Medical Center, 2000

Robert Kellogg, MD

Assistant Professor
Director of Congenital and Fetal Neurosurgery
Neurosurgical Director of Craniofacial Surgery

Robert Kellogg, MD, joined the Department of Neurological Surgery, as an assistant professor in September of 2020 specializing in pediatric neurosurgery. His clinical and research interests include the comprehensive management of spasticity and movement disorders, craniofacial disorders, hydrocephalus, tethered spinal cord, pediatric brain tumors, Chiari malformations, congenital neurosurgical issues, and fetal neurosurgery.

Robert Kellogg, MD

Dr. Kellogg grew up in Connecticut but has deep ties to Pennsylvania. He is married and has two sons. Dr. Kellogg received his medical education from Indiana University School of Medicine and did his internship and residency training in neurological surgery at Rush University Medical Center in Chicago. Dr. Kellogg completed a pediatric neurosurgery fellowship at UPMC Children's Hospital of Pittsburgh.

Specialized Areas of Interest
Back/spine pain; craniofacial/craniosynostosis; plagiocephaly, congenital disorders of the brain and spine, fetal neurosurgery.

Board Certifications
American Board of Neurological Surgery
American Board of Pediatric Neurological Surgery

Hospital Privileges
UPMC Children's Hospital of Pittsburgh
UPMC Harrisburg
UPMC Magee-Womens Hospital

Professional Organization Membership
AANS/CNS Joint Section on Pediatric Neurosurgery
American Association of Neurological Surgeons

Education & Training
BA, Indiana University, 2005
MD, Indiana University School of Medicine, 2009
Residency, Rush University Medical Center, 2015
Fellowship, University of Pittsburgh, 2016

Publications: 2023-24
• Refereed Articles:
Shanahan RM, Hudson JS, Huq S, Legarreta A, Fields DP, Phillips HW, Kellogg RG. Infant Rudimentary Meningocele with Tethering of the Cervical Cord: A Case Report. *Asian J Neurosurg* 18(3):676-678, 2023.

Gary Kohanbash, PhD

Assistant Professor
Director, PNIO Laboratory

Gary Kohanbash, PhD, joined the faculty of the Department of Neurological Surgery at UPMC Children's Hospital of Pittsburgh in January of 2017.

Dr. Kohanbash graduated from the University of Pittsburgh in 2007 with a bachelor of science honors degree in neuroscience, specializing in neurodegenerative diseases. He then earned his masters of science degree in infectious diseases and microbiology in 2009, and a doctorate in philosophy in 2012, both from the University of Pittsburgh Graduate School of Public Health. While there, he identified novel pathways of immunosuppression in gliomas and participated in multiple phase I/II immunotherapy clinical trials.

Dr. Kohanbash subsequently completed a post-doctoral fellowship in the University of Pittsburgh Department of Neurological Surgery in 2014. He continued his training as a postdoctoral fellow at the University of California, San Francisco (UCSF) Department of Neurological Surgery.

Gary Kohanbash, PhD

While at UCSF, Dr. Kohanbash was privileged to complete a prestigious T32 training program in translational brain tumor research.

Specialized Areas of Interest
Immunotherapy for pediatric and adult central nervous system tumors.

Professional Organization Membership
Society for Immunotherapy of Cancer
Society for Neuro-Oncology
World Molecular Imaging Society

Professional Activities
Faculty Assembly Member, University of Pittsburgh
Senate Library Committee, University of Pittsburgh
Senate Member, University of Pittsburgh
Scientific Committee Member, Childhood Brain Tumor Tissue Consortium
Study Section, St. Baldrick's Foundation Fellowship
Study Section, American Brain Tumor Association
Study Section, NIH
Faculty, SITC Clinical Immuno-Oncology Network

Education & Training
BS, (hons), Neuroscience, University of Pittsburgh, 2007
MS, Infectious Diseases and Microbiology, University of Pittsburgh, 2009
PhD, Brain Tumor Immunology, University of Pittsburgh, 2012
Postdoctoral Fellow, Neurological Surgery, University of Pittsburgh, 2014
Postdoctoral Fellow, Neurological Surgery, University of California, San Francisco, 2016

Honors & Awards
Research Travel Award, Society for Immunotherapy of Cancer, 2014-15
Honoree, The Annual Convocation of the University of Pittsburgh, 2010, 2014
Best Dissertation Award, Department of Infectious Diseases and Microbiology, University of Pittsburgh, 2013
Top Oral Presentation, Translational Research Cancer Center Consortium (TRCCC), 2013
International Research Travel Award, Japanese Society for Brain Tumor Pathology, 2012
Best Graduate Thesis Award, Department of Infectious Diseases and Microbiology, University of Pittsburgh, 2010
Top Poster Award, Translational Research Cancer Center Consortium (TRCCC), 2009

Publications: 2023-24
• ***Refereed Articles:***
Pollack IF, Felker J, Frederico SC, Raphael I, Kohanbash G. Immunotherapy for pediatric low-grade gliomas. *Childs Nerv Syst* [Online ahead of print], 2024.

Frederico SC, Sharma N, Darling C, Taori S, Dubinsky AC, Zhang X, Raphael I, Kohanbash G. Myeloid cells as potential targets for immunotherapy in pediatric gliomas. *Front Pediatr* 12:1346493 2024.

Song S, Oft H, Metwally S, Paruchuri S, Bielanin J, Fiesler V, Sneiderman C, Kohanbash G, Sun D. Deletion of Slc9a1 in Cx3cr1+ cells stimulated microglial subcluster CREB1 signaling and microglia-oligodendrocyte crosstalk. *J Neuroinflammation* 21(1):69, 2024.

Gary Kohanbash, PhD

Vincze SR, Jaswal AP, Frederico SC, Nisnboym M, Li B, Xiong Z, Sever RE, Sneiderman CT, Rodgers M, Day KE, Latoche JD, Foley LM, Hitchens TK, Frederick R, Patel RB, Hadjipanayis CG, Raphael I, Nedrow JR, Edwards WB, Kohanbash G. ImmunoPET imaging of TIGIT in the glioma microenvironment. *Sci Rep* 14(1):5305, 2024.

Xiong Z, Raphael I, Olin M, Okada H, Li X, Kohanbash G. Glioblastoma vaccines: past, present, and opportunities. *EBioMedicine* 100:104963, 2024.

Sever RE, Rosenblum LT, Reyes-Múgica M, Edwards WB, Malek MM, Kohanbash G. Survival following complete resection of neuroblastoma in novel orthotopic rat xenograft model. *Sci Rep* 13(1):20214, 2023.

Nisnboym M, Vincze SR, Xiong Z, Sneiderman CT, Raphael RA, Li B, Jaswal AP, Sever RE, Day KE, LaToche JD, Foley LM, Karimi H, Hitchens TK, Agnihotri S, Hu B, Rajasundaram D, Anderson CJ, Blumenthal DT, Pearce TM, Uttam S, Nedrow JR, Panigrahy A, Pollack IF, Lieberman FS, Drappatz J, Raphael I, Edwards WB, Kohanbash G. Immuno-PET Imaging of CD69 Visualizes T-Cell Activation and Predicts Survival Following Immunotherapy in Murine Glioblastoma. *Cancer Res Commun* 3(7):1173-1188, 2023.

Research Activities

It was an outstanding year for Dr. Kohanbash's lab in evaluating and developing new PET tracers to monitor responses to immunotherapy for brain tumors and in developing a novel model to study devastating neuroblastoma tumors. Work from his lab has led to a new clinical trial which has been approved to open combining anti-TIGIT and anti-PDL1 therapy for patients with recurrent glioblastimas. He also continues to focus on translation of radiotherapies to the clinic.

Michael J. Lang, MD

Assistant Professor
Director of Cerebrovascular Neurosurgery

Michael J. Lang, MD, joined the University of Pittsburgh in 2019 as a vascular and endovascular neurosurgeon who specializes in treatment of vessel diseases of the brain, including aneurysms, stroke, carotid artery stenosis, arteriovenous malformations and fistulas, cavernomas, and intracerebral hemorrhage. Director of the department's cerebrovasular neurosurgery program, Dr. Lang performs both minimally invasive endovascular and traditional open & skull base surgery, allowing a comprehensive approach in the treatment of cerebrovascular disease. He also has subspecialty training in functional/epilepsy neurosurgery.

Dr. Lang completed his undergraduate work at the University of Wisconsin. He received his medical degree from Ohio State University, graduating with honors. Dr. Lang completed his neurosurgical residency and fellowships in both endovascular neurosurgery and functional & epilepsy surgery at Thomas Jefferson University. He then completed the prestigious fellowship in open cerebrovascular and skull base surgery at the Barrow Neurological Institute with extensive training in cerebral bypass surgery and removal of vascular lesions of the brainstem.

Dr. Lang has published numerous papers and book chapters, participated in clinical trials, and delivered lectures to audiences all over the world. His research interests include clinical outcomes in the treatment of cerebrovascular disease and epilepsy surgery, as well as MRI-compatible robotics.

Michael J. Lang, MD

Specialized Areas of Interest
Intracranial aneurysms, arteriovenous malformations, arteriovenous fistulas, cavernous malformations, brain tumors carotid stenosis, intracranial stenosis, venous sinus stenosis, ischemic stroke, trigeminal neuralgia, and epilepsy.

Board Certifications
American Board of Neurological Surgery

Hospital Privileges
UPMC Children's Hospital of Pittsburgh
UPMC Mercy
UPMC Presbyterian
UPMC Shadyside

Professional Organization Membership
Alpha Omega Alpha
American Association of Neurological Surgeons
AANS/CNS Joint Section of Cerebrovascular Neurosurgery
Congress of Neurological Surgeons
North American Neuromodulation Society

Education & Training
BS, Biology, University of Wisconsin-Madison, 2006
MD (Honors), The Ohio State University College of Medicine, 2011
Residency (Neurosurgery), Thomas Jefferson University, 2018
Fellowship (Functional/Epilepsy), Thomas Jefferson University, 2016
Fellowship (Endovascular), Thomas Jefferson University, 2018
Fellowship (Cerebrovascular/Skull Base), Barrow Neurological Institute, 2019

Benjamin B. Lee, MD, PhD

Clinical Assistant Professor

Benjamin Lee, MD, PhD, joined the University of Pittsburgh Center of Clinical Neurophysiology in August 2023. He specializes in intraoperative neurophysiological monitoring to adult and pediatric neurosurgical, orthopedic, ENT, vascular and interventional neuroradiology procedures, microelectrode recording and subcortical mapping for deep brain stimulation (DBS) electrode implantation, as well as motor and language mapping during awake craniotomy procedures.

Dr. Lee competed his adult neurology residency at SUNY Downstate Health Sciences University in Brooklyn, New York. Then completed a fellowship in clinical neurophysiology and epilepsy at the Massachusetts General Hospital in Boston.

Specialized Areas of Interest
Intraoperative neurophysiological monitoring; subcortical mapping with microelectrode recording.

Board Certifications
American Board of Psychiatry and Neurology

Hospital Privileges
JC Blair Memorial Hospital
Excela Health Hospital System

Benjamin B. Lee, MD, PhD

Indiana Regional Medical Center
Monongahela Valley Hospital
Trinity Health System
UPMC Altoona
UPMC Bedford
UPMC Children's Hospital of Pittsburgh
UPMC East
UPMC Greenville
UPMC Hamot
UPMC Harrisburg
UPMC Horizon
UPMC Jameson
UPMC Magee-Womens Hospital
UPMC McKeesport
UPMC Mercy
UPMC Northwest
UPMC Passavant
UPMC Presbyterian
UPMC St. Margaret
UPMC Shadyside
UPMC Shenango
UPMC Somerset
UPMC Susquehanna

Professional Organization Membership
American Academy of Neurology
American Clinical Neurophysiology Society
American Epilepsy Society

Education & Training
MD, PhD, SUNY Downstate Health Sciences University, 2017
Residency, Adult Neurology, SUNY Downstate Health Sciences University, 2021
Fellowship, Clinical Neurophysiology and Epilepsy, Massachusetts General Hospital, 2023

L. Dade Lunsford, MD

Lars Leksell & Distinguished Professor
Director Emeritus, Center for Image-Guided Neurosurgery
Associate Director, Neurological Surgery Residency

L. Dade Lunsford, MD, is the Lars Leksell Professor and Distinguished Professor at the Department of Neurological Surgery at the University of Pittsburgh. He is also director emeritus of the Center for Image-Guided Neurosurgery at the University of Pittsburgh Medical Center and an internationally recognized authority on stereotactic surgery, radiosurgery, and minimally invasive surgery.

In 1981 Dr. Lunsford arranged installation a dedicated CT scanner in a new state of the art stereotactic operating room, merging surgery with imaging for the first time. More than 10,000 patients have undergone various image-guided surgical procedures since that time.

In 1987, Dr. Lunsford was responsible for installing the Gamma Knife to the University of Pittsburgh Medical Center, the fifth unit ever built. This medical center was the first in the United States to offer this state-of-the-art, minimally invasive form of brain surgery. Since that time,

L. Dade Lunsford, MD

more than 18,800 patients have undergone brain stereotactic radiosurgery using one of the continuously updated versions of the Gamma Knife. He and his team have trained more than 2,800 surgeons, oncologists, and physicists in the field of radiosurgery via training courses conducted six times per year.

Dr. Lunsford graduated from the University of Virginia in 1970 and then received his medical degree in 1974 from the Columbia University College of Physicians and Surgeons. He completed his internship in surgery at the University of Virginia Hospital and his residency in neurological surgery at the University of Pittsburgh training under Peter Jannetta, MD. Following a one-year fellowship in stereotactic and functional neurosurgery at the Karolinska institute in Stockholm, Sweden—where he studied with Professors Lars Leksell and Erik-Olof Backlund—he joined the Department of Neurological Surgery faculty in 1981.

He is an active staff member of several UPMC hospitals and was president of the medical staff at UPMC Presbyterian from 1999-2001 and past president of the Council of Clinical Chairs for the University of Pittsburgh School of Medicine in 2001-2003. For 16 years Dr. Lunsford chaired the UPMC Health System Technology and Innovative Practice (TIPAC) committee. He arranged for installation of the UPMC Magnetoencephalography device and co-chairs the UPMC Brain Mapping (MEG) Center.

Dr. Lunsford has been board-certified by the American Board of Neurological Surgery since 1983. He is the author of more than 1,400 published articles, abstracts, and book chapters and has served as the editor or co-editor of 17 books.

Dr. Lunsford served as department chairman of the University of Pittsburgh Department of Neurological Surgery for ten years, before stepping down in July of 2006 to devote more time to his clinical work, clinical investigation, and resident and fellow training. He also served as the department residency program director from 1987 until 2020.

Since 2012, he has served as a team physician (neurosurgeon) for the National Hockey League's Pittsburgh Penguins. Prior to that he served as the neurosurgical team physician for Pitt football.

In 2016, Dr. Lunsford received the Cushing Award for Technical Excellence and Innovation in Neurosurgery from the American Association of Neurological Surgery. In December of 2017, he received the prestigious Herbert Olivecrona Award—considered by some as the "Nobel Prize of Neurosurgery"—from the Karolinska Institute & Karolinska University Hospital in Stockholm, Sweden. In April of 2018, he was honored to present the 2018 Van Wagenen Lecture during the American Association of Neurological Surgeons Annual Meeting in New Orleans. On June 19, 2020, he delivered the inaugural Dan Leksell Lecture at the fourth meeting of the International Radiosurgery Research Foundation. In 2021, Dr. Lunsford received the Andrew Parsa award for mentorship from the AANS-CNS Section on Tumors and delivered the annual Ronald Bittner Lecture. In May 2022 he delivered the inaugural Lunsford Radiosurgery Lecture at the Miami Baptist Cancer Institute. In 2024, Dr. Lunsford received the Congress of Neurological Surgery Founders Award.

Since 2002, Dr. Lunsford has been a Castle Connolly Top Doctor and currently serves on their Board of Medical Advisors.

Specialized Areas of Interest
Brain tumor management; Gamma Knife stereotactic radiosurgery; movement disorders and trigeminal neuralgia; vascular malformations; concussion and sports medicine.

L. Dade Lunsford, MD

Board Certifications
American Board of Neurological Surgery

Hospital Privileges
UPMC Children's Hospital of Pittsburgh
UPMC Presbyterian
UPMC Shadyside
UPMC St. Margaret (Consulting)

Professional Organization Membership
AANS/CNS Joint Section for Stereotactic and Functional Neurosurgery (chair, 1995-97)
Allegheny County Medical Society
American Academy of Neurological Surgery
American Association of Neurological Surgeons, Fellow
American College of Surgeons, Fellow
American Society for Stereotactic and Functional Neurosurgery (president, 1995-97)
Congress of Neurological Surgeons
Florida Medical Association
International Radiosurgery Research Foundation, (founding chair)
International Stereotactic Radiosurgery Society, (co-founder and president, 1991-1993)
North American Skull Base Society (prior Honored Guest)
Pennsylvania Medical Society
Pennsylvania Neurosurgical Society

Professional Activities
Course Co-Director, Principles and Practices of Gamma Knife Radiosurgery, UPMC
Past Chair and Founder, International Radiosurgery Research Foundation
Team Co-Neurosurgeon, Pittsburgh Penguins, National Hockey League
Chair Data Safety Monitoring Board, Insightec
Consultant, Teladoc, Inc.

Education & Training
BA, University of Virginia, 1970
MD, Columbia University, 1974
Internship, General Surgery, University of Virginia, 1975
Residency, University of Pittsburgh, 1980
Fellowship, Stereotactic and Functional Neurosurgery, Karolinska Sjukhuset, 1981

Honors & Awards
Castle Connolly Top Doctors in America, 2012-24
Inaugural Lunsford Radiosurgery Lecture, Miami Baptist Cancer Institute, 2022
Andy T. Parsa Mentorship Award, AANS/CNS Section on Tumors, 2021
Ronald L. Bittner Lecturer, AANS/CNS Section on Tumors, 2021
Excellence in Patient Experience Award, UPMC, 2018
Van Wagenen Lecturer, American Association of Neurological Surgeons Annual Meeting, 2018
Herbert Olivecrona Award, Karolinska Institute & Karolinska University Hospital, 2017
AANS Cushing Award for Technical Excellence and Innovation in Neurosurgery, 2016
Best Doctors in America, *Pittsburgh Business Times*, 2016
American Most Honored Professionals, Top 1%, 2016
America's Top Doctors for Cancer, Castle Connolly Medical, Ltd., 2005-16
Best Doctors in America, 2005-16
Top Doctor, *The Global Directory of Who's Who, Neurological Surgery*, 2013-16

L. Dade Lunsford, MD

Best Doctors in America database, 2010-16
Who's Who In America, Marquis, 2003, 2006-14
Pioneers in Radiosurgery Award, Leksell Gamma Knife Society, 2010
Leading Health Professionals of the World, 2010
Faculty Teaching Award, Department of Neurosurgery 1997, 1999, 2000, 2010
Guide to America's Top Surgeons, 2006-09
Allegheny County Medical Society Ralph C. Wilde Award, 2008
Castle Connolly Medical Ltd. National Physician of the Year Award, 2008
Who's Who in the World, 2008
Distinguished Professor, University of Pittsburgh, 2007
Who's Who in Science and Engineering, 2007
Congress of Neurological Surgeons Honored Guest, 2007
AANS Young Neurosurgeon Award, 2005
Academic Keys Who's Who in Medical Sciences Education, 2005
Lars Leksell Provost Lecture, 2000
International Stereotactic Radiosurgery Jacob Fabrikant Award, 1997
William S. McEllroy Award, University of Pittsburgh School of Medicine, 1997
Good Housekeeping Best Doctors, 1996
William P. Van Wagenen Fellowship, AANS, 1980
Phi Beta Kappa - University of Virginia, 1970
BA with High Honors - University of Virginia, 1970

News Media Appearances: 2023-24

"Radiosurgery Experts Meet in Miami to Discuss Important Treatment Developments," *South Florida Hospital News*, December 1, 2023.

Publications: 2023-24

• Refereed Articles:

Wei Z, Jose SG, Agarwal P, Worrell S, Kulich S, Donohue JK, Deng H, Hadjipanayis CG, Niranjan A, Lunsford LD. Adjuvant Stereotactic Radiosurgery for Clear Cell Meningiomas. *World Neurosurg* 184:e784-e793, 2024.

Niranjan A, Faramand A, Raju SS, Lee CC, Yang HC, Nabeel AM, Tawadros SR, El-Shehaby AMN, Abdelkarim K, Emad RM, Reda WA, Álvarez RM, Moreno NEM, Liscak R, May J, Mathieu D, Langlois AM, Snyder MH, Shepard MJ, Sheehan J, Muhsen BA, Borghei-Razavi H, Barnett G, Kondziolka D, Golfinos JG, Attuati L, Picozzi P, McInerney J, Daggubati LC, Warnick RE, Feliciano CE, Carro E, McCarthy D, Starke RM, Landy HJ, Cifarelli CP, Vargo JA, Flickinger J, Lunsford LD. Clinical and Imaging Outcomes After Trigeminal Schwannoma Radiosurgery: Results From a Multicenter, International Cohort Study. *Neurosurgery* 94(1):165-173, 2024.

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Plute T, Bin-Alamer O, Mallela AN, Kallos JA, Hamilton DK, Pollack IF, Lunsford LD, Friedlander RM, Abou-Al-Shaar H. A comprehensive evaluation of career trajectories of the American Association of Neurological Surgeons William P. Van Wagenen fellows. *World Neurosurg X* 23:100365, 2024.

L. Dade Lunsford, MD

Bin-Alamer O, Abou-Al-Shaar H, Niranjan A, Hadjipanayis CG, Lunsford LD. Straining the Limits of the Brain: Arteriovenous Malformation Rupture Case Report in the Context of Chronic Constipation. *Stroke* 55(4):e124-e126, 2024.

Taori S, Wei Z, Deng H, Lunsford LD, Niranjan A. The Role of Stereotactic Radiosurgery in Patients With Brain Metastases From Colorectal Cancers. *Neurosurgery* 94(4):828-837, 2024.

De Nigris Vasconcellos F, Mashiach E, Alzate JD, Bernstein K, Rotman L, Levy S, Qu T, Wegner RE, Shepard MJ, Patel S, Warnick RE, Moreno NM, Martínez Álvarez R, Picozzi P, Franzini A, Peker S, Samanci Y, Elguindy AN, Palmer JD, Lunsford LD, Jose SG, Wei Z, Niranjan A, Blagui S, Iorio-Morin C, Mathieu D, Briggs RG, Yu C, Zada G, Dayawansa S, Sheehan J, Schulder M, Goenka A, Begley S, Khilji H, Urgošík D, Liščák R, Kondziolka D. Impact of Multiple Sclerosis Subtypes on Pain Management in Patients With Trigeminal Neuralgia After Stereotactic Radiosurgery: An International Multicenter Analysis. *Neurosurgery* 94(4):838-846, 2024.

Plute T, Bin-Alamer O, Mallela AN, Kallos JA, Hamilton DK, Pollack IF, Lunsford LD, Friedlander RM, Abou-Al-Shaar H. A comprehensive evaluation of career trajectories of the American Association of Neurological Surgeons William P. Van Wagenen fellows. *World Neurosurg X* 23:100365, 2024.

Wei Z, Jose SG, Agarwal P, Worrell S, Kulich S, Donohue JK, Deng H, Hadjipanayis CG, Niranjan A, Lunsford LD. Adjuvant Stereotactic Radiosurgery for Clear Cell Meningiomas. *World Neurosurg* 184:e784-e793, 2024.

Bin-Alamer O, Abou-Al-Shaar H, Niranjan A, Hadjipanayis CG, Lunsford LD. Straining the Limits of the Brain: Arteriovenous Malformation Rupture Case Report in the Context of Chronic Constipation. *Stroke* 55(4):e124-e126, 2024.

Taori S, Wei Z, Deng H, Lunsford LD, Niranjan A. The Role of Stereotactic Radiosurgery in Patients With Brain Metastases From Colorectal Cancers. *Neurosurgery* 94(4):828-837, 2024.

De Nigris Vasconcellos F, Mashiach E, Alzate JD, Bernstein K, Rotman L, Levy S, Qu T, Wegner RE, Shepard MJ, Patel S, Warnick RE, Moreno NM, Martínez Álvarez R, Picozzi P, Franzini A, Peker S, Samanci Y, Elguindy AN, Palmer JD, Lunsford LD, Jose SG, Wei Z, Niranjan A, Blagui S, Iorio-Morin C, Mathieu D, Briggs RG, Yu C, Zada G, Dayawansa S, Sheehan J, Schulder M, Goenka A, Begley S, Khilji H, Urgošík D, Liščák R, Kondziolka D. Impact of Multiple Sclerosis Subtypes on Pain Management in Patients With Trigeminal Neuralgia After Stereotactic Radiosurgery: An International Multicenter Analysis. *Neurosurgery* 94(4):838-846, 2024.

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Huq S, Shanahan RM, Adida S, Bin-Alamer O, Abou-Al-Shaar H, Niranjan A, Hadjipanayis CG, Lunsford LD. Gamma knife radiosurgery for clival metastasis: case series and systematic review. *J Neurooncol* [Epub ahead of print], 2024.

L. Dade Lunsford, MD

Garcia G, Mantziaris G, Pikis S, Dumot C, Lunsford LD, Niranjan A, Wei Z, Srinivasan P, Tang LW, Liscak R, May J, Lee CC, Yang HC, Peker S, Samanci Y, Nabeel AM, Reda WA, Tawadros SR, Abdel Karim K, El-Shehaby AMN, Emad Eldin R, Elazzazi AH, Martínez Moreno N, Martínez Álvarez R, Padmanaban V, Jareczek FJ, McInerney J, Cockroft KM, Alzate JD, Kondziolka D, Tripathi M, Sheehan JP. Repeat stereotactic radiosurgery for persistent cerebral arteriovenous malformations in pediatric patients. *J Neurosurg Pediatr* [Epub ahead of print], 2024.

Huq S, Shanahan RM, Adida S, Bin-Alamer O, Abou-Al-Shaar H, Niranjan A, Hadjipanayis CG, Lunsford LD. Gamma knife radiosurgery for clival metastasis: case series and systematic review. *J Neurooncol* [Epub ahead of print], 2024.

Mantziaris G, Pikis S, Dumot C, Dayawansa S, Liščák R, May J, Lee CC, Yang HC, Martinez Moreno N, Martinez Álvarez R, Lunsford LD, Niranjan A, Wei Z, Srinivasan P, Tang LW, Nabeel AM, Reda WA, Tawadros SR, Abdelkarim K, El-Shehaby AMN, Emad RM, Hesham Elazzazi A, Peker S, Samanci Y, Padmanaban V, Jareczek FJ, McInerney J, Cockroft KM, Mathieu D, Aldakhil S, Alzate JD, Kondziolka D, Tripathi M, Palmer JD, Upadhyay R, Lin M, Zada G, Yu C, Cifarelli CP, Cifarelli DT, Xu Z, Sheehan JP. Outcome Evaluation of Repeat Stereotactic Radiosurgery for Cerebral Arteriovenous Malformations. *Stroke* 54(8):1974-1984, 2023.

Rusthoven CG, Staley AW, Gao D, Yomo S, Bernhardt D, Wandrey N, El Shafie R, Kraemer A, Padilla O, Chiang V, Faramand AM, Palmer JD, Zacharia BE, Wegner RE, Hattangadi-Gluth JA, Levy A, Bernstein K, Mathieu D, Cagney DN, Chan MD, Grills IS, Braunstein S, Lee CC, Sheehan JP, Kluwe C, Patel S, Halasz LM, Andratschke N, Deibert CP, Verma V, Trifiletti DM, Cifarelli CP, Debus J, Combs SE, Sato Y, Higuchi Y, Aoyagi K, Brown PD, Alami V, Niranjan A, Lunsford LD, Kondziolka D, Camidge DR, Kavanagh BD, Robin TP, Serizawa T, Yamamoto M. Comparison of first-line radiosurgery for small-cell and non-small cell lung cancer brain metastases (CROSS-FIRE). *J Natl Cancer Inst* 115(8):926-936, 2023.

Mantica M, Drappatz J, Lieberman F, Hadjipanayis CG, Lunsford LD, Niranjan A. Phase II study of border zone stereotactic radiosurgery with bevacizumab in patients with recurrent or progressive glioblastoma multiforme. *J Neurooncol* 164(1):179-190, 2023.

Taori S, Wei Z, Deng H, Hadjipanayis CG, Lunsford LD, Niranjan A. Stereotactic radiosurgery for patients with brain metastases from gastroesophageal cancers. *J Neurooncol* 164(1):147-155, 2023.

Maragkos GA, Mantziaris G, Pikis S, Chytka T, Liscak R, Peker S, Samanci Y, Bindal SK, Niranjan A, Lunsford LD, Kaur R, Madan R, Tripathi M, Pangal DJ, Strickland BA, Zada G, Langlois AM, Mathieu D, Warnick RE, Patel S, Minier Z, Speckter H, Kondziolka D, Lee CC, Vance ML, Sheehan JP. Silent Corticotroph Staining Pituitary Neuroendocrine Tumors: Prognostic Significance in Radiosurgery. *Neurosurgery* 93(6):1407-1414, 2023.

Wei Z, Taori S, Song S, Deng H, Niranjan A, Lunsford LD. Does Adjuvant Gamma Knife Stereotactic Radiosurgery Have a Role in Treating Optic Nerve Sheath Meningiomas? *J Neuroophthalmol* [Epub ahead of print], 2023.

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Agarwal P, Sharma N, Nayar G, Jacobs RC, Al-Bayati A, Lunsford LD, McDowell MM, Greene S. Long-term outcomes of deep pediatric arteriovenous malformations. *J Neurosurg Pediatr* [Epub ahead of print], 2023.

L. Dade Lunsford, MD

Lehrer EJ, Khosla AA, Ozair A, Gurewitz J, Bernstein K, Kondziolka D, Niranjan A, Wei Z, Lunsford LD, Mathieu D, Trudel C, Deibert CP, Malouff TD, Ruiz-Garcia H, Peterson JL, Patel S, Bonney P, Hwang L, Yu C, Zada G, Picozzi P, Franzini A, Attuati L, Prasad RN, Raval RR, Palmer JD, Lee CC, Yang HC, Fakhoury KR, Rusthoven CG, Dickstein DR, Sheehan JP, Trifiletti DM, Ahluwalia MS. Immune checkpoint inhibition and single fraction stereotactic radiosurgery in brain metastases from non-small cell lung cancer: an international multicenter study of 395 patients. *J Neurooncol* [Epub ahead of print], 2023.

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Nigris Vasconcellos F, Bernstein K, Kondziolka D, Speckter H, Mota R, Brito A, Bindal SK, Niranjan A, Lunsford LD, Benjamin CG, Abrantes de Lacerda Almeida T, Mao J, Mathieu D, Tourigny JN, Tripathi M, Palmer JD, Matsui J, Crooks J, Wegner RE, Shepard MJ, Vance ML, Sheehan JP. Stereotactic radiosurgery for non-functioning pituitary tumor: a multicenter study of new pituitary hormone deficiency. *Neuro Oncol* [Epub ahead of print], 2023.

Mantziaris G, Pikis S, Dumot C, Dayawansa S, Liscak R, May J, Lee CC, Yang HC, Martínez Moreno N, Martinez Álvarez R, Lunsford LD, Niranjan A, Wei Z, Srinivasan P, Tang LW, Nabeel AM, Reda WA, Tawadros SR, Abdel Karim K, El-Shehaby AMN, Emad Eldin RM, Elazzazi AH, Peker S, Samanci Y, Padmanaban V, Jareczek FJ, McInerney J, Cockroft KM, Mathieu D, Aldakhil S, Alzate JD, Kondziolka D, Tripathi M, Palmer JD, Upadhyay R, Lin M, Zada G, Yu C, Cifarelli CP, Cifarelli DT, Shaaban A, Xu Z, Sheehan JP. Effect of cerebral arteriovenous malformation location on outcomes of repeat, single-fraction stereotactic radiosurgery: a matched-cohort analysis. *J Neurosurg* [Epub ahead of print], 2023.

Research Activities

Dr. Lunsford continues to participate in long-term clinical outcome studies related to stereotactic radiosurgery. The Center for Image-Guided Neurosurgery (CIGNS) maintains a data base of 18,800 patients who underwent Gamma Knife radiosurgery. Fellows, medical students, and approved CIGNS researchers complete IRB approved research outcome studies and help to draft comprehensive scientific reports for medical journals. In addition, as a participating center in the International Radiosurgery Research Foundation, we contribute data sets for inclusion in multicenter trials. Multiple medical students and fellows and residents have been mentored each year.

Joseph C. Maroon, MD

Clinical Professor
Heindl Scholar in Neuroscience

Joseph C. Maroon, MD, is a board-certified clinical professor of neurological surgery at the University of Pittsburgh Medical Center, and the Heindl Scholar in Neuroscience.

His clinical and research interests have been in the areas of the development of minimally invasive surgical procedures to the brain and spine, the prevention and treatment of traumatic injuries to the central nervous system, innovative approaches to pituitary and other brain tumors and more recently complimentary approaches to inflammatory diseases associated with aging.

Working with neuropsychologist, Mark Lovell, PhD, he co-developed ImPACT© (Immediate Post-Concussion Assessment and Cognitive Testing). This is the first computerized system to determine concussion severity and the timing for return to contact sports. It is now the standard of care for concussion management in the National Football League, National Hockey League,

Joseph C. Maroon, MD

Major League Baseball, NASCAR and is used in over 12,000 colleges and high schools in the United States.

For over 20 years he has served as the neurosurgical consultant to professional and college athletes in football, baseball, golf, hockey and soccer and was team neurosurgeon to the Pittsburgh Steelers for over 40 years. He has been honored by the neurosurgical societies of Japan, Korea, Thailand, Egypt, Brazil, Lebanon and China for his neurosurgical contributions, and was honored by his peers when he was elected president of the Congress of Neurological Surgeons, the largest society of neurosurgeons in North America.

Other outside activities include a former member of the board of directors and chairman of the scientific and technology committee of Mylan Laboratories, the largest generic drug manufacturer in the world; former chairman of the scientific advisory board to General Nutrition Corporation (GNC); and chairman of the medical and scientific advisory board to Stemedica. He also serves on the NFL Head, Neck and Spine Committee and, in 2008, he became medical director of the World Wrestling Entertainment Corporation (WWE). Also in 2008, he was named senior vice president of the American Academy of Anti-Aging Medicine (A4M).

Honored as one of America's best neurosurgeons for 12 consecutive years he has written over 290 papers, 40 book chapters and five books. His most recent book, published in February of 2017 and re-released in December of 2018, is entitled *Square One: A Simple Guide to a Balanced Life* that takes a look at the importance of understanding where you are in life and the need to keep all elements of your life in proper "balance." He has also authored *Fish Oil: The Natural Anti-Inflammatory*, published in 2006, and *The Longevity Factor: How Resveratrol and Red Wine Activate Genes for Longer and Healthier Life*, published in 2008.

In his early years, his athletic abilities earned him a football scholarship to the University of Indiana in Bloomington where he was selected as Scholastic All-American in football.

Despite his busy professional schedule, Dr. Maroon remains an avid athlete and has competed in over 78 triathlon events. These include eight Ironman distant triathlons (2.4 mile swim, 112 mile bike and 26.2 run) in Hawaii (1993, 2003, 2008, 2010 and 2013), Canada (1995), New Zealand (1997) and Europe (2000). He placed sixth in the Senior U.S. Olympics Triathlon in 2005.

In 1999, he—along with Joe Montana and Kareem Abdul Jabaar—was inducted into the Lou Holtz Upper Ohio Valley Hall of Fame for his athletic accomplishments and contributions to sports medicine. On May 2, 2009, he was inducted into the Western Pennsylvania Sports Hall of Fame, and on March 14, 2010, he was inducted into the National Fitness Hall of Fame in Chicago.

In June of 2017, Dr. Maroon was selected as Man of the Year by the Saints and Sinners Club of America, and in September of 2018, he was named Humanitarian of the Year by the Jerome Bettis Bus Stops Here Foundation.

As medical director of the Live Free African Freedom Tour, on February 26, 2014, Dr. Maroon and his daughter, Isabella—along with a group of amputees—climbed Mt. Kilimanjaro in Africa, the highest free-standing mountain in the world. In May of 2015, Dr. Maroon completed The Crucible Extreme Hike, a 3-day, 70-mile hike in the Laurel Mountains of Pennsylvania to raise awareness for wounded veterans.

In February of 2020, Dr. Maroon was named recipient of the UPMC Clinician of Courage Award. To further honor Dr. Maroon, upon presenting the award, UPMC announced that the award would be renamed the Joseph Maroon Clinician of Courage Award for future award winners.

Joseph C. Maroon, MD

Board Certifications
American Board of Neurological Surgery

Professional Organization Membership
Allegheny County Medical Society
American Academy of Anti-Aging Medicine
American Association of Neurological Surgeons
American College of Sports Medicine
American College of Surgeons
American Medical Association
Congress of Neurological Surgeons
Mid-Atlantic Neurosurgical Society
National Association for Disabled Athletes
National Football League Physicians Society
Neurosurgical Society of America
Pennsylvania Medical Society
Pennsylvania Neurosurgical Society

Professional Activities
National Science Advisory Panel, The Chuck Noll Foundation for Brain Injury Research
Medical Consultant, Viatris Laboratories
Consulting Neurosurgeon, Pittsburgh Steelers
Consulting neurosurgeon, World Wrestling Entertainment Corporation
Senior Vice President, American Academy of Anti-Aging Medicine
Senior Advisor, NFL Head, Neck and Spine Committee
World Advisory Board, International Sports Hall of Fame
Chairman, Medical and Scientific Advisory Board, Stemedica
Consulting Neurosurgeon, Operation Backbone

Education & Training
AB, Anatomy & Physiology, Indiana University, 1961
MD, Indiana University, 1965
Residency, General Surgery, Georgetown University, 1967
Residency, Neurological Surgery, Indiana University, 1968
Residency, Neurological Surgery, Oxford University, 1969
Fellowship, Vermont College of Medicine, 1972

Honors & Awards
Distinguished Medical Alumni Award, Indiana University School of Medicine, 2022
UPMC Physician Excellence Award: Clinician of Courage, 2020
Inaugural Chuck Noll Foundation Lecture on Sports Related Trauma, American Association of Neurological Surgeons Annual Scientific Meeting, San Diego, 2019
Humanitarian of the Year, Jerome Bettis Bus Stops Here Foundation, 2018
Man of the Year, Circus Saints & Sinners Club, Bob Prince Tent, 2017
Castle Connolly Top Doctors in America, 2017-19
Lifetime Leadership Award for Concussion Research, UPMC Sports Medicine Concussion Program, 2016
Listed in *The Best Doctors in America*, 2000-14
Honorary President, World Association of Lebanese Neurosurgeons, 1999-2012
Ohio Valley Athletic Conference Hall of Fame Class of 2012
Pioneer Award, 25th Anniversary UPMC Center for Cranial Base Surgery, 2012
Distinguished Alumni Service Award, Indiana University, Bloomington, 2011

Joseph C. Maroon, MD

National Fitness Hall of Fame, 2010
Western Pennsylvania Chapter of the Sports Hall of Fame, 2009
Healthcare Hero Finalist, *The Pittsburgh Business Times*, 1999 and 2002
Lou Holtz/Upper Ohio Valley Hall of Fame inductee, 1999

News Media Appearances

"Dr. Maroon, Surgeon to the Stars, Reflects on Career at Martins Ferry Chamber Dinner," *The Intelligencer/Wheeling News-Register*, March 19, 2024.
"Dr. Joseph Maroon to Newsmax: Biden's 'Mild Cognitive Impairment' Concerning," *Newsmax*, February 20, 2024.
"An 83-year-old neurosurgeon who does triathlons has 3 tips for younger people who want to be as fit and healthy as him," *Business Insider*, January 30, 2024.
"Anti-Inflammation Information From Dr. Maroon," worldhealth.net, December 19, 2023.
"Migraine Headache Treatment," KATU-TV (Portland, Ore.) *Afternoon Live*, November 27, 2023.
"Alzheimer Drug Lequembi," WISR Radio (Butler, Pa.), July 12, 2023.

Publications: 2023-24

• Refereed Articles:

Khalifeh K, Le J, Musmar B, Maroon J, Kanter AS, Ozgur B. Atypical cervical radiculopathy presenting with brachioradial pruritus: illustrative cases. *J Neurosurg Case Lessons* 7(8):CASE23715 2024.

Bin-Alamer O, Plute T, Mallela AN, Jacobs R, Hadjipanayis CG, Hamilton DK, Maroon JC, Lunsford LD, Friedlander RM, Abou-Al-Shaar H. Cross-sectional examination of current and future trends and attributes of the presidents of the American Association of Neurological Surgeons and the Congress of Neurological Surgeons societies. *World Neurosurg X* 23:100285, 2024

Roy RG, Mandal PK, Maroon JC. Oxidative Stress Occurs Prior to Amyloid Aβ Plaque Formation and Tau Phosphorylation in Alzheimer's Disease: Role of Glutathione and Metal Ions. *ACS Chem Neurosci* 14(17):2944-2954, 2023.

Michael McDowell, MD

Assistant Professor
Director of Pediatric Cranial Base Neurosurgery
Co-Director, Pediatric Neurovascular Center of Excellence
Neurosurgery Residency Site Program Director

Michael McDowell, MD, joined the University of Pittsburgh Department of Neurological Surgery in 2022 after serving a fellowship at UPMC Children's Hospital of Pittsburgh.

Dr. McDowell is a graduate of the University of Pittsburgh neurosurgery residency program and the Columbia University's College of Physicians and Surgeons medical school. In addition to his pediatric fellowship, he also completed a skull base fellowship at UPMC while a resident. He received undergraduate degrees in biochemistry and Latin dance from Arizona State University in 2005, graduating as valedictorian.

Dr. McDowell has been heavily involved in teaching since medical school and was voted clinician of the year for his educational contributions to the Columbia Student Medical Outreach clinic in Washington Heights. He is also the founder and director of the University of Pittsburgh School of Medicine's mini-elective for second year medical students titled "Brain and Blade: The World of Neurosurgery."

Michael McDowell, MD

As well as general pediatric neurosurgery, Dr. McDowell has specific interests in skull base and cranio-cervical junction disorders in children. His research interests also include non-invasive monitoring and he is actively collaborating with investigators at Carnegie Mellon University in a clinical investigation using near infrared light to non-invasively measure intracranial pressure in adults and children. He is also the co-founder of Astria Biosciences, a company dedicated towards the early detection of brain aneurysms derived from research performed at UPMC.

Specialized Areas of Interest
Skull base and pituitary neurosurgery; Chiari malformation; pediatric neurosurgery; non-invasive intracranial pressure measurement; medical education; Moya Moya Disease and arteriovenous malformations.

Board Certifications
American Board of Neurological Surgery
American Board of Pediatric Neurological Surgery

Hospital Privileges
UPMC Altoona
UPMC Children's Hospital of Pittsburgh
UPMC Hamot
UPMC Harrisburg
UPMC Magee-Womens Hospital
UPMC Presbyterian
UPMC Western Maryland
UPMC Williamsport

Professional Organization Membership
Allegheny County Medical Society
American Association of Neurological Surgery
AANS Early to Mid-Career Neurosurgery Committee
AANS/CNS Joint Section on Pediatric Neurosurgery
Congress of Neurological Surgeons
Pennsylvania Medical Society House of Delegates

Professional Activities
Chair, Industry Relations Committee, AANS/CNS Pediatric Section
Consultant, National Cancer Institute Pediatric and Young Adult Chordoma Clinic

Education & Training
BS, Biochemistry, Arizona State University, 2009
MD, Columbia University College of Physicians and Surgeons, 2014
Fellowship, UPMC Skull Base Division, 2020
Residency, University of Pittsburgh, 2021
Fellowship, UPMC Children's Hospital of Pittsburgh, 2022

Honors & Awards
Randall's Big Idea Grand Prize Winner, 2024
University of Pittsburgh Senior Design Expo Best Overall Project Award, 2023
Hydrocephalus Association Award, AANS/CNS Section on Pediatric Neurosurgery, 2021
University of Pittsburgh School of Medicine Faculty Teaching Award, 2021
Pennsylvania Neurological Society Oral Presentation Award, 2019
Copeland Grant Winner, Pittsburgh Foundation, 2015,

Michael McDowell, MD

Gold Medal, Top Gun Surgical Completion, Lumbar Pedicle Screw Placement, American Association of Neurological Surgeons, 2017
Charlie Kuntz Scholar, AANS/CNS Spine Summit, 2016
Christopher Getch Chair of Research, Brain Aneurysm Foundation, 2013

Publications: 2023-24
• Refereed Articles:
Karampouga M, Terrarosa AK, Patel B, Affolter K, Wang EW, Choby GW, Fu R, Bonhomme GR, Stefko ST, McDowell MM, Snyderman CH, Gardner PA, Zenonos GA. Anterolateral keyhole transorbital routes to the skull base: a comparative anatomical study. *Neurosurg Focus* 56(4):E3, 2024.

Anand SK, Shanahan RM, Alattar AA, Phillips HW, Okonkwo DO, McDowell MM. Atlantoaxial facet fixation using cervical facet cage: technical case report and review of the literature. *Childs Nerv* Syst [Online ahead of print], 2024.

Kedia N, McDowell MM, Yang J, Wu J, Friedlander RM, Kainerstorfer JM. Pulsatile microvascular cerebral blood flow waveforms change with intracranial compliance and age. *Neurophotonics* 11(1):015003, 2024.

Luy DD, Agarwal N, McDowell MM, Tonetti DA, Goldschmidt E, Friedlander RM. Acquired Chiari Type I Malformation Associated with Type IV Dural Arteriovenous Fistula: Case Report. *J Neurol Surg A Cent Eur Neurosurg* 85(1):94-99, 2024.

Fields DP 2nd, Lavadi RS, Hudson JS, McCarthy DJ, Hect J, Wawrose R, Capuk O, Agarwal N, McDowell MM, Simon D, Abel TJ, Greene S. Patterns in follow-up imaging utilization for pediatric patients with whiplash associated disorder. *World Neurosurg* 180:e786-e790, 2023.

Agarwal P, Sharma N, Nayar G, Jacobs RC, Al-Bayati A, Lunsford LD, McDowell MM, Greene S. Long-term outcomes of deep pediatric arteriovenous malformations. *J Neurosurg Pediatr* 33(1):22-28, 2023.

Plute T, Abou-Al-Shaar H, McDowell MM, Mallela AN, Snyderman CH, Gardner PA. Endoscopic Endonasal Resection of a Recurrent Prepontine Neurenteric Cyst: 2-Dimensional Operative Video. *Oper Neurosurg* (Hagerstown) 25(4):e226, 2023.

McDowell MM, Kim S, Greene S. Clinical and Radiographic Features of Pineal Cysts in Pediatric and Young Adult Patients. *World Neurosurg* 176:e719-e727, 2023.

Research Activities
Dr. McDowell is actively involved in neurosurgical device development. He has patented and is prototyping devices related to endoscopic and microsurgical procedures as well as devices designed to enhance the safety of the operating room. He is also working on clinical outcomes research with a focus on endoscopic endonasal surgery within the pediatric population.

Antony MichealRaj, PhD

Assistant Professor

Antony MichealRaj, PhD, joined the faculty of the University of Pittsburgh Department of Neurological Surgery in September of 2021.

Dr. MichealRaj graduated from the Madurai Kamaraj University with a bachelor of science degree in zoology. He then earned his master of science degree in biotechnology in 2007 from

Antony MichealRaj, PhD

the University of Madras and PhD in genetics from the University of Delhi where he functionally characterized the rare and common variants of dopaminergic pathway genes associated with schizophrenia and other neurological disorders. He subsequently completed his postdoctoral training in pediatric neuro-oncology and tumor metabolism at the Arthur and Sonia Labatt Brain Tumor Research Centre at the Hospital for Sick Children (SickKids) in Toronto. While at SickKids, Dr. MichealRaj studied molecular disease mechanisms and oncometabolism of pediatric brain tumors ependymoma and medulloblastoma using clinically relevant disease models of patients and mouse models. Dr. MichealRaj's independent research lab at University of Pittsburgh of School of Medicine is focused on unravelling molecular and nutrient dependency of pediatric brain tumors and their mechanistic role in tumor initiation, maintenance and recurrence/ resistance.

Specialized Areas of Interest
Functional genomics and oncometabolism of pediatric and adolescent central nervous system tumors; ependymoma, medulloblastoma and DIPGs.

Professional Organization Membership
American Association for Cancer Research
Children's Brain Tumor Consortium
International Society of Pediatric Oncology
Society of Neuro-Oncology

Education & Training
BSc, Zoology, Madurai Kamaraj University, 2004
MSc, Biotechnology, Loyola College, University of Madras, 2007
PhD, Genetics, University of Delhi, 2014
Postdoctoral Fellowship, Hospital for Sick Children, Toronto, 2021

Publications: 2023-24
• Refereed Articles:
Casillo SM, Gatesman TA, Chilukuri A, Varadharajan S, Johnson BJ, David Premkumar DR, Jane EP, Plute TJ, Koncar RF, Stanton AJ, Biagi-Junior CAO, Barber CS, Halbert ME, Golbourn BJ, Halligan K, Cruz AF, Mansi NM, Cheney A, Mullett SJ, Land CV, Perez JL, Myers MI, Agrawal N, Michel JJ, Chang YF, Vaske OM, MichaelRaj A, Lieberman FS, Felker J, Shiva S, Bertrand KC, Amankulor N, Hadjipanayis CG, Abdullah KG, Zinn PO, Friedlander RM, Abel TJ, Nazarian J, Venneti S, Filbin MG, Gelhaus SL, Mack SC, Pollack IF, Agnihotri S. An ERK5-PFKFB3 axis regulates glycolysis and represents a therapeutic vulnerability in pediatric diffuse midline glioma. *Cell Rep* 43(1):113557, 2024.

Mooli RGR, Zhu B, Khan SR, Nagati V, Michealraj KA, Jurczak MJ, Ramakrishnan SK. Epigenetically active chromatin in neonatal iWAT reveals GABPα as a potential regulator of beige adipogenesis. *Front Endocrinol* (Lausanne) 15:1385811, 2024.

Okonechnikov K, Camgöz A, Chapman O, Wani S, Park DE, Hübner JM, Chakraborty A, Pagadala M, Bump R, Chandran S, Kraft K, Acuna-Hidalgo R, Reid D, Sikkink K, Mauermann M, Juarez EF, Jenseit A, Robinson JT, Pajtler KW, Milde T, Jäger N, Fiesel P, Morgan L, Sridhar S, Coufal NG, Levy M, Malicki D, Hobbs C, Kingsmore S, Nahas S, Snuderl M, Crawford J, Wechsler-Reya RJ, Davidson TB, Cotter J, Michaiel G, Fleischhack G, Mundlos S, Schmitt A, Carter H, Michealraj KA, Kumar SA, Taylor MD, Rich J, Buchholz F, Mesirov JP, Pfister SM, Ay F, Dixon JR, Kool M, Chavez L. 3D genome mapping identifies subgroup-specific chromosome conformations and tumor-dependency genes in ependymoma. *Nat Commun* 14(1):2300, 2023.

Antony MichealRaj, PhD

Research Activities

• Medulloblastoma:

Dr. MichealRaj's functional genomics and tumor metabolism laboratory made significant progress in unravelling MYC dependent metabolic reprogramming that drives aggressive pediatric group 3 medulloblastoma. His comprehensive multiomics analysis on 450 medulloblastoma reveal, a proteomic subset of Group 3 (G3) tumors driven by high MYC expression is characterized by dramatically up-regulated rates of de novo lipid synthesis. The observed increase in lipid synthesis is facilitated by high protein abundance and activity of fatty acid synthesis pathway enzymes including FASN and SCD1. Furthermore, an increase in DGAT1 activity effectively protects against lipid oxidative stress through ROS-sensitive fatty acid storage into lipid droplets. Genetic or pharmacologic abrogation of DGAT1 activity confers susceptibility to oxidative stress and increased rates of cell death in vitro and in murine tumor models of medulloblastoma. This unpublished study has been submitted and is undergoing peer review process in reputed journal.

• Ependymoma:

Pediatric ependymomas are lethal malignancies which are more common in males. Dr. MichealRaj's functional genomics and tumor metabolism laboratory highlight transcriptional sex differences between male and female hindbrain cells, driven by cell-extrinsic sex hormonal differences and their role in PFA pathogenesis, primarily in the poor prognosis of male patients. He has identified that androgens contribute to the PFA tumor niche by inhibiting differentiation, increasing cell proliferation in vitro and supporting the progenitor pool, a fraction that is higher in male PFA tumors. These cell-extrinsic factors support PFA tumor maintenance, and consequently the worse prognosis in males with PFA. This unpublished study has been submitted and is undergoing peer review process in reputed journal.

Vincent J. Miele, MD

Clinical Associate Professor
Chief, Neurosurgery, UPMC Mercy

Vincent J. Miele, MD, joined the University of Pittsburgh Department of Neurosurgery as a clinical assistant professor on January 1, 2014 and was promoted to clinical associate professor in July of 2018. He is the former director of the neurosurgical spine service at West Virginia University.

Dr. Miele received his undergraduate degree at Northeastern University in Boston where he graduated summa cum laude and was inducted into the Rho Chi Academic Pharmacy Honor Society as well as the Phi Kappa Phi Honor Society. He was also awarded the Northeastern University Alumni of the Year President's Award in 2001. Dr. Miele completed medical school and his neurosurgical residency at West Virginia University where he was elected to the medical honor society Alpha Omega Alpha and won the Gandee-Massey Award based on academic achievement. He is fellowship-trained in complex spine surgery from Cleveland Clinic Foundation, where he remains adjunct faculty in the Spine Research Laboratory.

Dr. Miele's research has encompassed such areas as spinal biomechanics, concussion management and return to play, as well as accelerometer and MEMs technology translation into clinical applications. He has published more than 30 papers in refereed journals, authored 20 book chapters, and has presented scientific lectures both nationally and internationally. His research has led to invited written editorials in prominent media such as the *New York Times*. He has been actively involved in the Congress of Neurological Surgeons, American Association of Neurological Surgery, and North American Spine Society and is an ad hoc reviewer for various journals.

Dr. Miele's major clinical interests embrace many aspects of neurosurgery focusing on spinal disorders including pathologies associated with degeneration and trauma, complex spinal instru-

Vincent J. Miele, MD

mentation, revision spinal surgery, and spinal tumors. His areas of expertise include minimally invasive spine surgery and the newer motion preservation technologies as well as the larger surgeries required for conditions such as adolescent/adult spinal deformity and the multidisciplinary treatment of spinal tumors.

Dr. Miele also has a strong background in cranial neurosurgery and treats peripheral nerve conditions such as carpel tunnel syndrome. Dr. Miele frequently evaluates and manages sports-related head and spine injuries, and works at a national level with athletes on return to play issues. He is involved in the development of devices used to detect and prevent concussion and is frequently invited to speak on this subject nationally. He also is an independent neurosurgical consultant for the National Football League and the Pittsburgh Steelers.

He is licensed to practice in Pennsylvania, Ohio and West Virginia and has established clinics in Coraopolis, Monroeville, Bethel Park and UPMC Mercy in southwestern Pennsylvania.

Specialized Areas of Interest
Spinal disorders and injuries, spine tumors, revision spinal surgery, adult deformity/scoliosis surgery, sports-related brain and spine injuries, peripheral nerve disorders and spinal fusions.

Board Certifications
American Board of Neurological Surgery

Hospital Privileges
UPMC Mercy
UPMC Presbyterian

Professional Organization Membership
Alpha Omega Alpha Medical Honor Society
American Association for the Improvement of Boxing
American Association of Neurological Surgeons
American Association of Professional Ringside Physicians
American College of Sports Medicine
Congress of Neurological Surgeons
International Federation of Sports Medicine
North American Spine Society
Ohio State Medical Society
Pennsylvania State Medical Society
United States Amateur Boxing Ringside Physicians
West Virginia State Medical Society

Professional Activities
Independent neurosurgical consultant, National Football League, Pittsburgh Steelers

Education & Training
MD, West Virginia University, 2001
Residency, West Virginia University, 2007
Fellowship, Complex Spine, Cleveland Clinic, 2008

Honors & Awards
Castle Connolly Top Doctors in America, 2016-24
Faculty Teaching Award, Department of Neurological Surgery, 2021

Vincent J. Miele, MD

News Media Appearances: 2023-24

"Are smart mouthguards the answer to better concussion protocols?" *The Washington Post*, April 2, 2024.

"Spinal cord stimulation eases phantom limb pain," Futurity.org, December 18, 2023.

"New Technology Offers Hope for Amputees with Phantom Limb Pain," *Express Healthcare Management*, December 18, 2023.

John J. Moossy, MD

Professor
Director, Center for Pain Management
Chief, Neurosurgery, VA Pittsburgh Healthcare System

John J. Moossy, MD, joined the faculty of the Department of Neurological Surgery at the University of Pittsburgh in 1986. He is now chief of neurosurgery at the Veterans Affairs Pittsburgh Healthcare System.

He attended medical school at Tulane University, earning an MD degree in 1980. He completed a surgical internship and the residency program in neurosurgery at Duke University. Prior to that, he was an undergraduate student at Wake Forest University in Winston Salem, North Carolina, and at the University of Pittsburgh.

His clinical practice is one of general neurosurgery with a special interest in the surgical management of medically intractable pain. Dr. Moossy's publications include 32 articles in refereed journals and nine book chapters.

Specialized Areas of Interest

The surgical treatment of intractable pain problems through neuro-augmentative and neuro-ablative procedures.

Board Certifications

American Board of Neurological Surgery

Hospital Privileges

Latrobe Area Hospital
UPMC Presbyterian
UPMC Shadyside
Veterans Affairs Pittsburgh Healthcare System

Professional Organization Membership

Allegheny County Medical Association
American Association of Neurological Surgeons (AANS)
American Medical Association
Carroll F. Reynolds History of Medicine Society
Pennsylvania Medical Association
Pennsylvania Neurosurgical Society
Section on Pain of the AANS/CNS
Section on Disorders of the Spine & Peripheral Nerves of the AANS/CNS
Section on History of the AANS/CNS

Education & Training

BA, French, University of Pittsburgh, 1976
MD, Tulane University, 1980
Residency, Neurosurgery, Duke University, 1986

John J. Moossy, MD

Honors & Awards
Best Doctors in America, *Pittsburgh Magazine*, 2014-17
Department of Neurological Surgery, Resident Teaching Award, 2001-03
Rudolph Matas Prize in History of Medicine, 1980

Vinayak Narayan, MD

Clinical Assistant Professor

'As a Neurological Surgeon, my mission is to help the patients by listening to them compassionately and providing the most effective treatment in the least invasive way.'

Vinayak Narayan, MD, joined the faculty at the University of Pittsburgh Department of Neurological Surgery as a clinical assistant professor in August 2023. Dr. Narayan specializes in cerebrovascular and cranial base neurosurgery, interventional neuroradiology and stereotactic and functional neurosurgery. His neurosurgical expertise after completing the dual vascular fellowship training allows him to perform minimally invasive neurointerventional and endoscopic surgeries as well as open cerebrovascular and skull base surgeries, thereby providing patients a comprehensive and personalized approach in the treatment of neurovascular and skull base diseases. Dr. Narayan's knowledge and skill in functional neurosurgery and neuromodulation can also provide the best possible outcome in patients with movement disorders, intractable epilepsy and chronic pain. Dr. Narayan is affiliated with UPMC Neurological Institute, Harrisburg.

Dr. Narayan graduated with honors from the renowned medical school, Government Medical College, Trichur in India. He then completed the neurosurgery residency program at the National Institute of Mental Health and Neurosciences (NIMHANS), Bangalore which is an Institute of National Importance (INI), and the most prestigious neurosciences institute in India. After earning the double masters degree in neurosurgery, he moved to the United States and completed postdoctoral fellowship in cerebrovascular and skull base surgery as well as neurointerventional surgery at the Louisiana State University Health Sciences Center Shreveport, Louisiana, and at Rutgers Robert Wood Johnson Medical School and University Hospital, New Jersey. Dr. Narayan also completed three prestigious clinical fellowship programs: stereotactic and functional neurosurgery (The Ohio State University Wexner Medical Center, Columbus, Ohio), interventional neuroradiology (NYU Langone Health and Bellevue Hospital Center, New York) and cerebrovascular neurosurgery (Northwell Health Lenox Hill Hospital, New York), which are accredited by the Committee on Advanced Subspecialty Training (CAST).

Dr. Narayan enjoys scientific writing and has authored numerous neurosurgical publications, book chapters and abstracts. His clinical and translational research productivity can be viewed in the National Library of Medicine's publication database. He has been on the editorial board of various neurosurgical journals and medical book publishers. His research interests include neurological outcomes in the management of cerebrovascular as well as skull base diseases, neurosonography and impact of advanced neuromodulation in Parkinson's disease and essential tremor. Outside of neurological surgery, Dr. Narayan is passionate about music, riding motorcycles and biking.

Specialized Areas of Interest
Cerebrovascular and cranial base neurosurgery; interventional neuroradiology; stereotactic and functional neurosurgery.

Hospital Privileges
UPMC Carlisle
UPMC Community General

Vinayak Narayan, MD

UPMC Hanover
UPMC Lititz
UPMC Memorial
UPMC Neurological Institute, Harrisburg
UPMC West Shore
UPMC Williamsport

Professional Organization Membership

American Association of Neurological Surgeons
American College of Surgeons
American Heart Association
American Medical Association
American Roentgen Ray Society
American Society of Neuroradiology
Congress of Neurological Surgeons
National Academy of Medical Sciences, India
Neurological Society of India
Neurotrauma Society of India
North American Skull Base Society
Royal College of Surgeons of Edinburgh
Sigma Xi, The Scientific Research Honor Society
Society of Neuro Interventional Surgery

Professional Activities

UPMC Stroke Committee, Central Pennsylvania
Editorial Board, Section Editor (Cerebrovascular & Endovascular Neurosurgery, Stereotactic and Functional Neurosurgery), *World Neurosurgery*
Editorial Board, Review Editor, *Frontiers in Surgery*, Section Neurosurgery
Editorial Board, Member, *Journal of Advance Medical Sciences*
Research Peer Reviewer, American Heart Association
Invited Faculty, 6th Annual Winter Neurosurgical Forum
Invited Faculty, Meritus Health 2024 Stroke Symposium
Invited Expert Reviewer, Thieme Medical Publishers (Vascular Neurosurgery)
Fellow, American College of Surgeons
Fellow, Royal College of Surgeons of Edinburgh
International Fellow, American Association of Neurological Surgeons

Education & Training

MD (Honors), Government Medical College, Trichur, India, 2011
Residency, Neurological Surgery, National Institute of Mental Health and Neurosciences (NIMHANS), India, 2017
Postdoctoral Fellowship, Cerebrovascular and Skull Base Surgery, Louisiana State University Health Sciences Center, Shreveport, 2018
Postdoctoral Fellowship, Neuro Interventional Surgery, Louisiana State University Health Sciences Center, Shreveport, 2018
Postdoctoral Fellowship, Cerebrovascular and Skull Base Surgery, Rutgers Robert Wood Johnson Medical School and University Hospital, 2019
Fellowship, Stereotactic and Functional Neurosurgery, The Ohio State University Wexner Medical Center, 2020
Fellowship, Interventional Neuroradiology, NYU Langone Health and Bellevue Hospital Center, 2022
Fellowship, Cerebrovascular Neurosurgery, Northwell Health Lenox Hill Hospital, 2023

Vinayak Narayan, MD

Honors & Awards
Member-at-Large, Sigma Xi, The Scientific Research Honor Society, 2021
Meritorious certificate, LSUHSC, 2018
Top Poster Abstract, AANS/CNS Section on Pediatric Neurological Surgery, 2018
Outstanding contribution in reviewing articles, *World Neurosurgery*, 2018
Diplomate of National Board of Examinations, India, 2017
Herbert Krause Award, NSICON, India, 2016
Neurological Surgery Thesis Cum Laude, NIMHANS, 2016
State Board of Medical Research Award, India, 2008

News Media Appearances
"UPMC in Central Pa. offers team approach to spine care," *Central Penn Business Journal*, April 1, 2024.
"UPMC launches new spine care program in Central Pa.,"WHTM-TV.com (Harrisburg, Pa.), March 25, 2024.

Publications: 2023-24
• Refereed Articles:
von Oiste GG, Sangwon KL, Chung C, Narayan V, Raz E, Shapiro M, Rutledge C, Nelson PK, Ishida K, Torres JL, Rostanski SK, Zhang C, Yaghi S, Riina H, Oermann EK, Nossek E. Use of Carotid Web Angioarchitecture for Stroke Risk Assessment. *World Neurosurg* 182:e245-e252, 2024.

Ali A, Shapiro M, Nossek E, Esparza R, Narayan V, Sharashidze V, Raz E. Bailout endovascular techniques applied in a complicated basilar thrombectomy case. *J Neurointerv Surg* 16(2):217, 2024.

Sreenivasan S, Agarwal N, Bharath Raju, Kandregula S, Narayan V, Chen CC, Sharma M. Management Strategies of Plasma Cell Granuloma Involving the Central Nervous System: A Systematic Review of the Literature. *World Neurosurg* 180:194-202.e11, 2023.

Tabor JK, Onoichenco A, Narayan V, Wernicke AG, D'Amico RS, Vojnic M. Brain metastasis screening in the molecular age. *Neurooncol Adv* 5(1):vdad080, 2023.

Ajay Niranjan, MD

Professor
Director, UPMC Brain Mapping Center
Director, Radiosurgery Research
Associate Director, Center for Image-Guided Neurosurgery

Dr. Niranjan received his medical training at the King George's Medical College in Lucknow, India from 1980 to 1985, graduating with a bachelor of medicine and bachelor of surgery degree. Dr. Niranjan completed general surgery residency in 1989 and neurological surgery residency 1992. Dr. Niranjan joined the University of Pittsburgh as a fellow in image-guided neurosurgery in 1997 and completed his fellowship in 2000. He joined the faculty of neurological surgery in July of 2000.

Dr. Niranjan has co-authored over 300 articles in refereed journals, over 170 book chapters and five books. He has contributed guidelines for stereotactic radiosurgery for trigeminal neuralgia, pituitary adenomas, arteriovenous malformation, acoustic tumors, and brain metastases. Dr. Niranjan is the director of UPMC Brain Mapping Center which houses a magnetoencephalography unit. MEG is performed for pre-surgical mapping of critical brain functions in patients with brain tumors and for localization of seizure focus in patients with long standing epilepsy.

Specialized Areas of Interest
Radiosurgery for benign and malignant brain tumors; radiosurgery for brain vascular malformations; radiosurgery for functional brain disorders; pre-surgical brain mapping using MEG.

Ajay Niranjan, MD

Hospital Privileges
UPMC Presbyterian

Professional Organization Membership
American Clinical MEG Society
Congress of Neurological Surgeons
International Radiosurgery Research Foundation
International Stereotactic Radiosurgery Society

Professional Activities
Member, International Radiosurgery Research Foundation
Course Co-Director, Principles and Practices of Gamma Knife Radiosurgery, UPMC

Education & Training
MBBS, King George's Medical College, 1985
Residency, General Surgery, King George's Medical College, 1989
Residency, Neurological Surgery, King George's Medical College, 1992
Fellowship, University of Pittsburgh, 2000
MBA, University of Pittsburgh, 2009

Honors & Awards
Best Doctors in America, *Pittsburgh Magazine*, 2016-20
UPMC Excellence in Patient Experience, Physician and Medical Staff Honor Roll, 2017

Publications: 2023-24
• Refereed Articles:
Albano L, Losa M, Barzaghi LR, Barrile E, Bindal SK, Wei Z, Pompeo E, Villanacci F, Del Vecchio A, Flickinger JC, Niranjan A, Mortini P, Lunsford LD. Single Versus Fractionated Gamma Knife Radiosurgery for Nonfunctioning Pituitary Adenomas Close to the Optic Pathway: A Multicenter Propensity Score Matched Study. *Neurosurgery* 95(2):357-364, 2024.

Bin-Alamer O, Abou-Al-Shaar H, Mallela AN, Kallos JA, Deng H, Nabeel AM, Reda WA, Tawadros SR, Abdelkarim K, El-Shehaby AMN, Emad RM, Peker S, Samanci Y, Lee CC, Yang HC, Mathieu D, Tripathi M, Mantziaris G, Mullapudi A, Urgosik D, Liscak R, Bowden GN, Zaki P, Wegner RE, Shepard MJ, Sheehan JP, Niranjan A, Hadjipanayis CG, Lunsford LD. Intratumoral Hemorrhage in Vestibular Schwannomas After Stereotactic Radiosurgery: Multi-Institutional Study. *Neurosurgery* 94(2):289-296, 2024.

De Nigris Vasconcellos F, Mashiach E, Alzate JD, Bernstein K, Rotman L, Levy S, Qu T, Wegner RE, Shepard MJ, Patel S, Warnick RE, Moreno NM, Martínez Álvarez R, Picozzi P, Franzini A, Peker S, Samanci Y, Elguindy AN, Palmer JD, Lunsford LD, Jose SG, Wei Z, Niranjan A, Blagui S, Iorio-Morin C, Mathieu D, Briggs RG, Yu C, Zada G, Dayawansa S, Sheehan J, Schulder M, Goenka A, Begley S, Khilji H, Urgošík D, Liščák R, Kondziolka D. Impact of Multiple Sclerosis Subtypes on Pain Management in Patients With Trigeminal Neuralgia After Stereotactic Radiosurgery: An International Multicenter Analysis. *Neurosurgery* 94(4):838-846, 2024.

Dumot C, Mantziaris G, Dayawansa S, Peker S, Samanci Y, Nabeel AM, Reda WA, Tawadros SR, Abdelkarim K, El-Shehaby AMN, Emad RM, Abdelsalam AR, Liscak R, May J, Mashiach E, De Nigris Vasconcellos F, Bernstein K, Kondziolka D, Speckter H, Mota R, Brito A, Bindal SK, Niranjan A, Lunsford DL, Benjamin CG, Abrantes de Lacerda Almeida T, Mao J, Mathieu D, Tourigny JN, Tripathi M, Palmer JD, Matsui J, Crooks J, Wegner RE, Shepard MJ, Vance ML, Sheehan JP. Stereotactic radiosurgery for nonfunctioning pituitary tumor: A multicenter study of new pituitary hormone deficiency. *Neuro Oncol* 26(4):715-723, 2024.

Ajay Niranjan, MD

Garcia G, Mantziaris G, Pikis S, Dumot C, Lunsford LD, Niranjan A, Wei Z, Srinivasan P, Tang LW, Liscak R, May J, Lee CC, Yang HC, Peker S, Samanci Y, Nabeel AM, Reda WA, Tawadros SR, Abdel Karim K, El-Shehaby AMN, Emad Eldin R, Elazzazi AH, Martínez Moreno N, Martínez Álvarez R, Padmanaban V, Jareczek FJ, McInerney J, Cockroft KM, Alzate JD, Kondziolka D, Tripathi M, Sheehan JP. Repeat stereotactic radiosurgery for persistent cerebral arteriovenous malformations in pediatric patients. *J Neurosurg Pediatr* 33(4):307-314, 2024.

Huq S, Shanahan RM, Adida S, Bin-Alamer O, Abou-Al-Shaar H, Niranjan A, Hadjipanayis CG, Lunsford LD. Gamma knife radiosurgery for clival metastasis: case series and systematic review. *J Neurooncol* 168(1):171-183, 2024.

Mantziaris G, Pikis S, Dumot C, Dayawansa S, Liscak R, May J, Lee CC, Yang HC, Martínez Moreno N, Martinez Álvarez R, Lunsford LD, Niranjan A, Wei Z, Srinivasan P, Tang LW, Nabeel AM, Reda WA, Tawadros SR, Abdel Karim K, El-Shehaby AMN, Emad Eldin RM, Elazzazi AH, Peker S, Samanci Y, Padmanaban V, Jareczek FJ, McInerney J, Cockroft KM, Mathieu D, Aldakhil S, Alzate JD, Kondziolka D, Tripathi M, Palmer JD, Upadhyay R, Lin M, Zada G, Yu C, Cifarelli CP, Cifarelli DT, Shaaban A, Xu Z, Sheehan JP. Effect of cerebral arteriovenous malformation location on outcomes of repeat, single-fraction stereotactic radiosurgery: a matched-cohort analysis. *J Neurosurg* 140(6):1753-1761, 2024.

Niranjan A, Faramand A, Raju SS, Lee CC, Yang HC, Nabeel AM, Tawadros SR, El-Shehaby AMN, Abdelkarim K, Emad RM, Reda WA, Álvarez RM, Moreno NEM, Liscak R, May J, Mathieu D, Langlois AM, Snyder MH, Shepard MJ, Sheehan J, Muhsen BA, Borghei-Razavi H, Barnett G, Kondziolka D, Golfinos JG, Attuati L, Picozzi P, McInerney J, Daggubati LC, Warnick RE, Feliciano CE, Carro E, McCarthy D, Starke RM, Landy HJ, Cifarelli CP, Vargo JA, Flickinger J, Lunsford LD. Clinical and Imaging Outcomes After Trigeminal Schwannoma Radiosurgery: Results From a Multicenter, International Cohort Study. *Neurosurgery* 94(1):165-173, 2024.

Taori S, Wei Z, Deng H, Lunsford LD, Niranjan A. The Role of Stereotactic Radiosurgery in Patients With Brain Metastases From Colorectal Cancers. *Neurosurgery* 94(4):828-837, 2024.

Wei Z, Srinivasan P, Patel R, Bednarz G, Flickinger JC, Hadjipanayis CG, Niranjan A, Lunsford LD. Stereotactic Radiosurgery for Patients with Brain Metastases from Hepatopancreaticobiliary Cancers. *Cancers* (Basel) 16(9):1665 2024.

Wei Z, Taori S, Song S, Deng H, Niranjan A, Lunsford LD. Does Adjuvant Gamma Knife Stereotactic Radiosurgery Have a Role in Treating Optic Nerve Sheath Meningiomas? *J Neuroophthalmol* 44(2):195-200, 2024.

Düzkalir AH, Samanci Y, Lee CC, Yang HC, Niranjan A, Lunsford LD, Wei Z, Srinivasan PN, Dayawansa S, Sheehan JP, Patel S, Mathieu D, Zacharia BE, Santhumayor B, Kondziolka D, Peker S. Stereotactic radiosurgery for brain metastasis from cholangiocarcinoma. *Neurosurgery* [Online ahead of print], 2024.

Düzkalir AH, Samanci Y, Nabeel AM, Reda WA, Tawadros SR, Abdelkarim K, El-Shehaby AMN, Emad RM, Martínez Moreno N, Martínez Álvarez R, Mathieu D, Niranjan A, Lunsford LD, Wei Z, Shanahan RM, Liscak R, May J, Dono A, Blanco AI, Esquenazi Y, Dayawansa S, Sheehan J, Tripathi M, Shepard MJ, Wegner RE, Upadhyay R, Palmer JD, Peker S. Pleomorphic Xanthoastrocytoma: Multi-Institutional Evaluation of Stereotactic Radiosurgery. *Neurosurgery* [Online ahead of print], 2024.

Ajay Niranjan, MD

Shaaban A, Dumot C, Mantziaris G, Dayawansa S, Peker S, Samanci Y, Nabeel AM, Reda WA, Tawadros SR, Abdel Karim K, El-Shehaby AMN, Emad Eldin RM, Ragab Abdelsalam A, Liscak R, May J, Mashiach E, De Nigris Vasconcellos F, Bernstein K, Kondziolka D, Speckter H, Mota R, Brito A, Bindal SK, Niranjan A, Lunsford LD, Benjamin CG, Almeida T, Mao JZ, Mathieu D, Tourigny JN, Tripathi M, Palmer JD, Matsui J, Crooks J, Wegner RE, Shepard MJ, Sheehan JP. Long-term radiographic and endocrinological outcomes of stereotactic radiosurgery for recurrent or residual nonfunctioning pituitary adenomas. *J Neurosurg* [Online ahead of print], 2024.

Tripathi M, Sheehan JP, Niranjan A, Ren L, Pikis S, Lunsford LD, Peker S, Samanci Y, Langlois AM, Mathieu D, Lee CC, Yang HC, Deng H, Rai A, Kumar N, Sahu JK, Sankhyan N, Deora H. Gamma Knife Radiosurgery for Hypothalamic Hamartoma: A Multi-Institutional Retrospective Study on Safety, Efficacy, and Complication Profile. *Neurosurgery* [Online ahead of print], 2024.

Warnick RE, Paddick I, Mathieu D, Adam E, Iorio-Morin C, Leduc W, Hamel A, Johnson SE, Bydon M, Niranjan A, Lunsford LD, Wei Z, Waite K, Jose S, Peker S, Samanci MY, Tek E, Mantziaris G, Pikis S, Sheehan JP, Tripathi M, Kumar N, Alzate JD, Bernstein K, Ahorukomeye P, Kshettry VR, Speckter H, Hernandez W, Urgošík D, Liščák R, Yang AI, Lee JYK, Patel S, Kusyk DM, Shepard MJ, Kondziolka D. The relevance of biologically effective dose for pain relief and sensory dysfunction after Gamma Knife radiosurgery for trigeminal neuralgia: an 871-patient multicenter study. *J Neurosurg* [Online ahead of print], 2024.

Wei Z, Jose SG, Agarwal P, Worrell S, Kulich S, Donohue JK, Deng H, Hadjipanayis CG, Niranjan A, Lunsford LD. Adjuvant Stereotactic Radiosurgery for Clear Cell Meningiomas. *World Neurosurg* 184:e784-e793, 2024.

Lehrer EJ, Khosla AA, Ozair A, Gurewitz J, Bernstein K, Kondziolka D, Niranjan A, Wei Z, Lunsford LD, Mathieu D, Trudel C, Deibert CP, Malouff TD, Ruiz-Garcia H, Peterson JL, Patel S, Bonney P, Hwang L, Yu C, Zada G, Picozzi P, Franzini A, Attuati L, Prasad RN, Raval RR, Palmer JD, Lee CC, Yang HC, Fakhoury KR, Rusthoven CG, Dickstein DR, Sheehan JP, Trifiletti DM, Ahluwalia MS. Immune checkpoint inhibition and single fraction stereotactic radiosurgery in brain metastases from non-small cell lung cancer: an international multicenter study of 395 patients. *J Neurooncol* 165(1):63-77, 2023.

Mantica M, Drappatz J, Lieberman F, Hadjipanayis CG, Lunsford LD, Niranjan A. Phase II study of border zone stereotactic radiosurgery with bevacizumab in patients with recurrent or progressive glioblastoma multiforme. *J Neurooncol* 164(1):179-190, 2023.

Maragkos GA, Mantziaris G, Pikis S, Chytka T, Liscak R, Peker S, Samanci Y, Bindal SK, Niranjan A, Lunsford LD, Kaur R, Madan R, Tripathi M, Pangal DJ, Strickland BA, Zada G, Langlois AM, Mathieu D, Warnick RE, Patel S, Minier Z, Speckter H, Kondziolka D, Lee CC, Vance ML, Sheehan JP. Silent Corticotroph Staining Pituitary Neuroendocrine Tumors: Prognostic Significance in Radiosurgery. *Neurosurgery* 93(6):1407-1414, 2023.

Taori S, Wei Z, Deng H, Hadjipanayis CG, Lunsford LD, Niranjan A. Stereotactic radiosurgery for patients with brain metastases from gastroesophageal cancers. *J Neurooncol* 164(1):147-155, 2023.

Wei Z, Luy DD, Jose S, Deng H, Yavan S, Worrell S, Belkhir JR, Tang LW, Niranjan A, Lunsford LD. Single-Session Gamma Knife Radiosurgery for Patients With 20 or More Brain Metastases. *Neurosurgery* 93(4):857-866, 2023.

Ajay Niranjan, MD

Bin-Alamer O, Abou-Al-Shaar H, Singh R, Mallela AN, Legarreta A, Bowden G, Mathieu D, Perlow HK, Palmer JD, Elhamdani S, Shepard M, Liang Y, Nabeel AM, Reda WA, Tawadros SR, Abdelkarim K, El-Shehaby AMN, Emad Eldin R, Elazzazi AH, Warnick RE, Gozal YM, Daly M, McShane B, Addis-Jackson M, Karthikeyan G, Smith S, Picozzi P, Franzini A, Kaisman-Elbaz T, Yang HC, Hess J, Templeton K, Zhang X, Wei Z, Pikis S, Mantziaris G, Simonova G, Liscak R, Peker S, Samanci Y, Chiang V, Kersh CR, Lee CC, Trifiletti DM, Niranjan A, Hadjipanayis CG, Lunsford LD, Sheehan JP. Local control and survival after stereotactic radiosurgery for colorectal cancer brain metastases: an international multicenter analysis. *J Neurosurg* 140(5):1233-1242, 2023.

Pikis S, Mantziaris G, Dumot C, Shaaban A, Protopapa M, Xu Z, Niranjan A, Wei Z, Srinivasan P, Tang LW, Liscak R, May J, Martinez Moreno N, Martinez Álvarez R, Peker S, Samanci Y, Nabeel AM, Reda WA, Tawadros SR, Abdelkarim K, El-Shehaby AMN, Emad RM, Elazzazi AH, Padmanaban V, Jareczek FJ, McInerney J, Cockroft KM, Lunsford D, Sheehan JP. Third Stereotactic Radiosurgery for Residual Arteriovenous Malformations: A Retrospective Multicenter Study. *Neurosurgery* [Online ahead of print], 2023.

Research Activities

Dr. Niranjan has clinical and research interests is in the management of tumors, vascular malformations and functional disorders of brain using radiosurgery. Outcome based clinical research involving brain tumor radiosurgery has been his primary focus for over 20 years. His basic science research interests include radiobiology of brain tumors, and use of advanced imaging in improving the outcome of radiosurgery. His other major clinical research interest is in the development of presurgical brain mapping using magnetoencephalography.

David O. Okonkwo, MD, PhD

Professor
Director, Neurotrauma Clinical Trials Center
Director, Scoliosis and Spinal Deformity Program
Special Advisor, UPMC Enterprises

David Okonkwo, MD, PhD, is professor of neurological surgery and director of the Neurotrauma Clinical Trials Center at the University of Pittsburgh. He is also director of neurotrauma and the scoliosis and spinal deformity program at UPMC Presbyterian. Dr. Okonkwo is past chair of the AANS/CNS Section on Neurotrauma and Critical Care. In addition, Dr. Okonkwo is team neurosurgeon for the Pittsburgh Steelers.

Dr. Okonkwo completed his undergraduate work at the University of Virginia, where he was a Howard Hughes Undergraduate Biomedical Research Scholar. He completed his medical and doctoral education through the MD/PhD program of the Medical College of Virginia of Virginia Commonwealth University.

He joined the University of Pittsburgh Department of Neurological Surgery in 2006 following completion of neurosurgical residency at the University of Virginia and a fellowship at Auckland Public Hospital in Auckland, New Zealand. He has additional specialized training in scoliosis surgery.

Dr. Okonkwo's clinical interests are traumatic injuries to the brain and spine as well as scoliosis and spinal deformity. His research endeavors involve developing biomarkers, advanced neuroimaging modalities and novel therapeutic interventions for brain and spinal cord injury. Dr. Okonkwo is a principal investigator of a national clinical research network (TRACK-TBI) to advance our understanding and treatment of traumatic brain injury. He is also principal investigator of several ongoing clinical studies in neurotrauma in Pittsburgh.

David O. Okonkwo, MD, PhD

In July of 2024, Dr. Okonkwo was appointed to the University of Virginia's governing Board of Visitors by the governor of Virginia.

Dr. Okonkwo has published more than 450 papers in refereed journals, authored numerous book chapters, and garnered several awards for his scientific research. He is a member of the American Association of Neurological Surgeons, the Congress of Neurological Surgeons and the National and International Neurotrauma Societies.

Specialized Areas of Interest
Brain and spine trauma; scoliosis; spinal deformity; minimally invasive spine surgery; sports medicine; experimental therapies for brain and spinal cord injuries.

Board Certifications
American Board of Neurological Surgery

Hospital Privileges
UPMC Children's Hospital of Pittsburgh
UPMC Mercy
UPMC Presbyterian

Professional Organization Membership
Alpha Omega Alpha Medical Honor Society
American Academy of Neurosurgery
American Association of Neurological Surgery
Congress of Neurological Surgeons
International Spine Study Group
National Neurotrauma Society
Society of Lateral Access Surgery

Professional Activities
Team Neurosurgeon, Pittsburgh Steelers
Board of Visitors, University of Virginia

Education & Training
BA, Biology, University of Virginia, 1994
MD, Virginia Commonwealth University, 2000
PhD, Anatomy, Virginia Commonwealth University, 2000
Fellowship, Neurosurgery, Auckland Public Hospital, 2005
Residency, Neurosurgery, University of Virginia, 2006

Honors & Awards
Castle Connolly Top Doctors in America, 2018-24

News Media Appearances: 2023-24
"Ryan Shazier Had Not Expected To Play In Game Where He Suffered Tragic Spinal Injury," steelersdepot.com, April 21, 2024.
"Recovering from a Traumatic Spinal Cord Injury," *TheAthleteSpine* webcast, April 20, 2024.
"Rapid concussion blood test gets FDA approval, could be used on sidelines in future," nbcsports.com, April 18, 2024
"FDA approves sideline concussion testing instrument," *Sports Business Journals*, April 18, 2024.
"FDA approves rapid concussion blood test," *Football Scoop*, April 18, 2024.
"Pitt Leads Breakthrough in Concussion Research," *Sports Illustrated*, April 18, 2024.

David O. Okonkwo, MD, PhD

"Pitt Research Team Makes Breakthrough in Diagnosing Concussions," *Pittsburgh Sports Now*, April 18, 2024.
"A bedside blood concussion test, with Pitt research, finds FDA approval," *Pittsburgh Post-Gazette*, April 18, 2024.
"Rapid Concussion Blood Test Researched by Steelers' Neurologist Approved by FDA," *Bleacher Report*, April 18, 2024.
"Could Living Football Players Be Overdiagnosed for CTE?," *U.S. News & World Report*, October 6, 2023.
"Could Living Football Players Be Overdiagnosed for CTE?" *Health Day*, October 6, 2023.

Publications: 2023-24

• Refereed Articles:

Alan N, Zenkin S, Lavadi RS, Legarreta AD, Hudson JS, Fields DP, Agarwal N, Mamindla P, Ak M, Peddagangireddy V , Puccio L, Buell TJ, Hamilton DK, Kanter AS, Okonkwo DO, Zinn PO, Colen RR. Associating T1-Weighted and T2-Weighted Magnetic Resonance Imaging Radiomic Signatures With Preoperative Symptom Severity in Patients With Cervical Spondylotic Myelopathy. *World Neurosurg* 184:e137-e143, 2024.

Cai LT, Brett BL, Palacios EM, Yuh EL, Bourla I, Wren-Jarvis J, Wang Y, Mac Donald C, Diaz-Arrastia R, Giacino JT, Okonkwo DO, Levin HS, Robertson CS, Temkin N, Markowitz AJ, Manley GT, Stein MB, McCrea MA, Zafonte RD, Nelson LD, Mukherjee. Emotional Resilience Predicts Preserved White Matter Microstructure Following Mild Traumatic Brain Injury. *Biol Psychiatry Cogn Neurosci Neuroimaging* (2):164-175, 2024.

Picetti E, Demetriades AK, Catena F, Aarabi B, Abu-Zidan FM, Alves OL, Ansaloni L, Armonda RA, Badenes R, Bala M, Balogh ZJ , Barbanera A, Bertuccio A, Biffl WL, Bouzat P, Buki A, Castano-Leon AM, Cerasti D, Citerio G, Coccolini F, Coimbra R, Coniglio C, Costa F, De Iure F, Depreitere B, Fainardi E, Fehlings MJ, Gabrovsky N, Godoy DA, Gruen P, Gupta D , Hawryluk GWJ, Helbok R, Hossain I, Hutchinson PJ, Iaccarino C, Inaba K, Ivanov M, Kaprovoy S, Kirkpatrick AW, Klein S, KoliasA, Konovalov NA, Lagares A, Lippa L, Loza-Gomez A, Luoto TM, Maa AIR, Maciejczak A, Maier RV, Marklun N, Martin MJ, Melloni I, Mendoza-Lattes S, Meyfroidt G, Munari M, Napolitano LM, Okonkwo DO, Otomo Y, Papadopoulos MP, Petr O, Peul WC, Pudkrong AK, Qasim Z, Rasulo F, Reizinho C, Ringel F, Rizoli S, Rostami E, Rubiano AM, Russo E, Sarwal A, Schwab JA, Servadei F, Sharma D, Sharif S, Shiban E, Shutter L, Stahel PE, Taccone FS, Terpolilli NA, Thomé, Toth P, Tsitsopoulos PP, Udy A, Vaccaro AR,Varon AJ, Vavilala MS, Younsi A, Zackova M, Zoerle T, Robba. Early management of adult traumatic spinal cord injury in patients with polytrauma: a consensus and clinical recommendations jointly developed by the World Society of Emergency Surgery (WSES) & the European Association of Neurosurgical Societies (EANS). *World J Emerg Surg* 19(1):4, 2024.

Mitha R, Colan J, Hernandez-Rovira MA, Jawad-MakkI MAH , Patel RP, Elsayed GA, Shaw JD, Okonkwo DO, Buell TJ, Hamilton DK, Agarwal N. Topical tranexamic acid (TXA) is non-inferior to intravenous TXA in adult spine surgery: a meta-analysis. *Neurosurg Rev* 47(1):48, 2024.

Vargas J, Pease M, Snyder MH, Blalock J, Wu S, Nwachuku N, Mittal A, Okonkwo DO, Kellogg RT. Automated Preoperative and Postoperative Volume Estimates Risk of Retreatment in Chronic Subdural Hematoma: A Retrospective, Multicenter Study. *Neurosurgery* 94(2):317-324, 2024.

Grashow R, Eagle SR, Terry DP, DiGregorio H, Baggish AL, Weisskopf MG, Kontos A, Okonkwo DO, Zafonte R. Medical Conditions in Former Professional American-Style Football Players Are Associated With Self-Reported Clinical Features of Traumatic Encephalopathy Syndrome. *Neurotrauma Rep* 5(1):376-386, 2024.

David O. Okonkwo, MD, PhD

Bonaroti JW, Ozel M, Chen T, Darby JL, Sun X, Moheimani H, Reitz KM, Kar UK, Zuckerbraun BS, Das J, Okonkwo DO, Billiar TR. Transcriptomic and Proteomic Characterization of the Immune Response to Elective Spinal Reconstructive Surgery: Impact of Aging and Comparison with Traumatic Injury Response. *J Am Coll Surg* 238(5):924-941, 2024.

Agarwal N, Letchuman V, Lavadi RS, Le VP, Aabedi AA, Shabani S, Chan AK, Park P, Uribe JS, Turner JD, Eastlack RK, Fessler RG, Fu KM, Wang MY, Kanter AS, Okonkwo DO, Nunley PD, Anand N, Mundis GM, Passias PG, Bess S, Shaffrey CI, Chou D, Mummaneni PV. What is the effect of preoperative depression on outcomes after minimally invasive surgery for adult spinal deformity? A prospective cohort analysis. *J Neurosurg Spine* 40(5):602-610, 2024.

Pease M, Gupta K, Moshé SL, Correa DJ, Galanopoulou AS, Okonkwo DO, Gonzalez-Martinez J, Shutter L, Diaz-Arrastia R, Castellano JF. Insights into epileptogenesis from post-traumatic epilepsy. *Nat Rev Neurol* (5):298-312, 2024.

Pease M, Mittal A, Merkaj S, Okonkwo DO, Gonzalez-Martinez JA, Elmer J, Liou WS, Pingue V, Hammond FM, Abramovici S, Castellano J, Barot N. Early Seizure Prophylaxis in Mild and Moderate Traumatic Brain Injury: A Systematic Review and Meta-Analysis. *JAMA Neurol* 81(5):507-514, 2024.

Eagle SR, Basantani SK, Preszler J, Sherry N, McIntyre P, Kershaw EE, Puccio AM, Okonkwo DO. Interaction of obesity and proteins associated with the NLRP3 inflammasome following mild traumatic brain injury. *Sci Rep* 14(1):10178, 2024.

McGinnis CB, Wang F, Chiappelli AL, Okonkwo DO, Darby JM. Phenobarbital as Anticonvulsant Prophylaxis in Patients With Traumatic Brain Injury at Risk for Alcohol Withdrawal Syndrome. *J Pharm Pract* 37(3):665-670, 2024.

Eagle SR, Nwachuku E, Deng H, Okonkwo DO, Elmer J, Pease M. Applying the Sliding Scale Approach to Quantifying Functional Outcomes Up to Two Years After Severe Traumatic Brain Injury. *J Neurotrauma* 41(11-12):1417-1424, 2024

Puccio AM, Yue JK, Korley FK, Okonkwo DO, Diaz-Arrastia R, Yuh EL, Ferguson AR, Mukherjee P, Wang KKW, Taylor SR, Deng H, Markowitz AJ, Sun X, Jain S, Manley GT. Diagnostic Utility of Glial Fibrillary Acidic Protein Beyond 12 Hours After Traumatic Brain Injury: A TRACK-TBI Study. *J Neurotrauma* 41(11-12):1353-1363, 2024.

Yue JK, Yuh EL, Elguindy MM, Sun X, van Essen TA, Deng H, Belton PJ, Satris GG, Wong JC, Valadka AB, Korley FK, Robertson CS, McCrea MA, Stein MB, Diaz-Arrastia R, Wang KKW, Temkin NR, DiGiorgio AM, Tarapore PE, Huang MC, Markowitz AJ, Puccio AM, Mukherjee P, Okonkwo DO, Jain S, Manley GT. Isolated Traumatic Subarachnoid Hemorrhage on Head Computed Tomography Scan May Not Be Isolated: A Transforming Research and Clinical Knowledge in Traumatic Brain Injury Study (TRACK-TBI) Study. *J Neurotrauma* 41(11-12):1310-1322, 2024.

Yue JK, Lee YM, Sun X, van Essen TA, Elguindy MM, Belton PJ, Pisică D, Mikolic A, Deng H, Kanter JH, McCrea MA, Bodien YG, Satris GG, Wong JC, Ambati VS, Grandhi R, Puccio AM, Mukherjee P, Valadka AB, Tarapore PE, Huang MC, DiGiorgio AM, Markowitz AJ, Yuh EL, Okonkwo DO, Steyerberg EW, Lingsma HF, Menon DK, Maas AIR Jain S, GT. Performance of the IMPACT and CRASH prognostic models for traumatic brain injury in a contemporary multicenter cohort: a TRACK-TBI study. *J Neurosurg* [Online ahead of print], 2024.

David O. Okonkwo, MD, PhD

Fields DP, Varga G , Alattar A, Shanahan R, Das A, Hamilton DK, Okonkwo DO, Kanter AS, Forsythe RM, Weiner DK. Preinjury Frailty Predicts 1-Year Mortality in Older Adults With Traumatic Spine Fractures. *Neurosurgery* [Online ahead of print], 2024

Bass RD, Lafage R, Smith JS, Ames C, Bess S, Eastlack R, Gupta M, Hostin R, Kebaish K, Kim HJ, Klineberg E, Mundis G, Okonkwo D, Shaffrey C, Schwab F, Lafage V, Burton D. Benchmark Values for Construct Survival and Complications by Type of ASD Surgery. *Spine* [Online ahead of print], 2024.

Ma L, Nail TJ, Hoz SS, Puccio AM, Lang MJ, Okonkwo DO, Gross BA. Traumatic Cerebral Venous Sinus Thrombosis: Management and Outcomes. *World Neurosurg* [Online ahead of print], 2024.

Agarwal N, Anand SK, Nwachuku EL, Wilkins TE, Algattas H, Kumar RP, Deng H, Chang YF, Puccio A, Okonkwo DO. Neuroimaging with Rotterdam Scoring System and long-term outcomes in severe traumatic brain injury patients. *Br J Neurosurg* [Online ahead of print], 2024.

Kolcun JPG, Fessler RG, Nunley PD, Eastlack RK, Mummaneni PV, Okonkwo DO, Uribe JS, Fu KM, Wang MY, Kanter AS, Anand N, Mundis Jr GM, Passias PG, Chou D. Staged Versus Same-Day Surgery in Circumferential Minimally Invasive Deformity Correction. *Neurosurgery* [Online ahead of print], 2024

Robbins EM, Jaquins-Gerstl AS, Okonkwo DO, Boutelle MG, Michael AC. Dexamethasone-Enhanced Continuous Online Microdialysis for Neuromonitoring of O2 after Brain Injury. *ACS Chem Neurosci* 14(14):2476-2486, 2023.

Deng H, Puccio DJ, Anand SK, Yue J, Hudson JS, Legarreta AD, Wei Z, Okonkwo DO, Puccio AM, Nwachuku EI. Power Drill Craniostomy for Bedside Intracranial Access in Traumatic Brain Injury Patients. *Diagnositics* (Basel) 13(14):2434, 2023.

Sarigul B, Bell RS, Chesnut R, Aguilera S, Buki A, Citerio G, Cooper DJ, Diaz-Arrastia R, Diringer M, Figaji A, Gao G, Geocadin RG, Ghajar J, Harris O, Hoffer A, Hutchinson P, Joseph M, Kitagawa R, Manley G, Mayer SA, Menon DK, Meyfroidt G, Michael DB, Oddo M, Okonkwo DO, Patel MB, Robertson C, Rosenfeld JV, Rubiano AM, Sahuquillo J, Servadei F, Shutter L, Stein DD, Stocchetti N, Taccone FS, Timmons SD, Tsai E, Ullman JS, Vespa P, Videtta W, Wright DW, Zammit C, Hawryluk GWJ. Prognostication and Goals of Care Decisions in Severe Traumatic Brain Injury: A Survey of The Seattle International Severe Traumatic Brain Injury Consensus Conference Working Group. *J Neurotrauma* 40(15-16):1707-1717, 2023.

Chesnut RM, Aguilera S, Buki A, Bulger EM, Citerio G, Cooper DJ, Diaz Arrastia R, Diringer M, Figaji A, Gao G, Geocadin RG, Ghajar J, Harris O, Hawryluk GWJ, Hoffer A, Hutchinson P,Joseph M, Kitagawa R, Manley G, Mayer , Menon DK, Meyfroidt G, Michael DB, Oddo M, Okonkwo DO, Patel MB, Robertson C, Rosenfeld JV, Rubiano AM, Sahuquillo J, Servadei F, Shutter L, Stein DM, Stocchetti N, Taccone FS, Timmons SD, Tsai EC, Ullman JS, Videtta W, Wright DW, Zammit C. Perceived Utility of Intracranial Pressure Monitoring in Traumatic Brain Injury: A Seattle International Brain Injury Consensus Conference Consensus-Based Analysis and Recommendations. *Neurosurgery* 93(2):399-408, 2023.

Brett BL, Temkin N, Barber JK, Okonkwo DO, Stein M, Bodien YG, Corrigan J, Diaz-Arrastia R, Giacino JT, McCrea MA, Manley GT, Nelson LD. Long-term Multidomain Patterns of Change After Traumatic Brain Injury: A TRACK-TBI LONG Study. *Neurology* 101(7):e740-e753, 2023.

David O. Okonkwo, MD, PhD

Etemad LL, Yue JK, Barber J, Nelson LD, Bodien YG, Satris GG, Belton PJ, Madhok DY, Huie JR, Hamidi S, Tracey JX, Coskun BC, Wong JC, Yuh EL, Mukherjee P,Markowitz AJ, Huang MC,Tarapore PE, Robertson CS, Diaz-Arrastia R, Stein MB, Ferguson AR, Puccio AM, Okonkwo DO, Giacino JT, McCrea MA, Manley GT, Temkin NR, DiGiorgio AM. Longitudinal Recovery Following Repetitive Traumatic Brain Injury. *JAMA Netw Open* 6(9):e2335804, 2023.

Eagle SR, Mittal AM, Kellogg RT, Vargas J, Nwachuku E, Deng H, Buell TJ, Okonkwo DO, Pease M. Interaction of admission platelet count with current medications and the risk for chronic subdural recurrence. *Neurosurg Focus* 55(4):E4, 2023.

Eagle SR, Puccio AM, Nelson LD, McCrea M, Giacino J, Diaz-Arrastia R, Conkright W, Jain S, Sun X, Manley G, Okonkwo DO. Association of obesity with mild traumatic brain injury symptoms, inflammatory profile, quality of life and functional outcomes: a TRACK-TBI Study. *J Neurol Neurosurg Psychiatry* 94(12):1012-1017, 2023.

Eagle SR, Jain S, Sun X, Preszler J, McCrea MA, Giacino JT, Manley GT, Okonkwo DO, Nelson LD. Network analysis and relationship of symptom factors to functional outcomes and quality of life following mild traumatic brain injury: a TRACK-TBI study. *Front Neurol* 14:1308540, 2023.

MacLean MA, Muradov JH, Greene R, Van Hameren G, Clarke DB, Dreier JP, Okonkwo DO, Friedman A. Memantine inhibits cortical spreading depolarization and improves neurovascular function following repetitive traumatic brain injury. *Sci Adv* 9(50):eadj2417, 2023.

Algattas HN, Alattar AA, Okonkwo DO, Wang EW, Snyderman CH, Hamilton DK, Friedlander RM, Zenonos GA, Gardner PA. A novel classification and management scheme for craniocervical junction disorders with ventral neural element compression. *J Neurosurg* 140(2):585-594, 2023.

Snider SB, Temkin NR, Barber J, Edlow BL, Giacino JT, Hammond FM, Izzy S, Kowalski RG, Markowitz AJ, Rovito CA, Shih SL, Zafonte RD, Manley GT, Bodien YG; TRACK-TBI investigators. Predicting Functional Dependency in Patients with Disorders of Consciousness: A TBI-Model Systems and TRACK-TBI Study. *Ann Neurol* [Epub ahead of print], 2023.

Ashina H, Dodick DW, Barber J, Temkin NR, Chong CD, Adler JS, Stein KS, Schwedt TJ, Manley GT; TRACK-TBI Investigators. Prevalence of and Risk Factors for Post-traumatic Headache in Civilian Patients After Mild Traumatic Brain Injury: A TRACK-TBI Study. *Mayo Clin Proc* [Epub ahead of print], 2023.

Agarwal N, Roy S, Lavadi RS, Alan N, Ozpinar A, Buell TJ, Hamilton DK, Kanter AS, Okonkwo DO. Durability of stand-alone anterolateral interbody fusion in staged minimally invasive circumferential scoliosis surgery with delayed posterior instrumentation due to medical necessity. *Spine Deform* [Epub ahead of print], 2023.

Liu SY, Kelly-Hedrick M, Temkin N, Barber J, Komisarow J, Hatfield J, Ohnuma T, Manley G, Treggiari MM, Colton K, Vavilala MS, Grandhi R, Laskowitz DT, Mathew JP, Hernandez A, James ML, Raghunathan K, Goldstein B, Markowitz A, Krishnamoorthy V; Transforming Clinical Research and Knowledge in TBI (TRACK-TBI) Investigators. Association of Early Dexmedetomidine Utilization With Clinical and Functional Outcomes Following Moderate-Severe Traumatic Brain Injury: A Transforming Clinical Research and Knowledge in Traumatic Brain Injury Study. *Crit Care Med* [Epub ahead of print], 2023.

David O. Okonkwo, MD, PhD

Anand SK, Shanahan RM, Alattar AA, Phillips HW, Okonkwo DO, McDowell MM. Atlantoaxial facet fixation using cervical facet cage: technical case report and review of the literature. *Childs Nerv* Syst [Epub ahead of print], 2023.

Martin G. Piazza, MD

Assistant Professor
Surgical Director, Pediatric Surgical Movement Disorders Program
Surgical Director, Pediatric Neurosurgery Spine Program

Martin Piazza, MD, is an assistant professor of pediatric neurosurgery in the University of Pittsburgh Department of Neurological Surgery. He is the surgical director of the Pediatric Surgical Movement Disorders and Neurosurgery Spinal Programs at UPMC Children's Hospital of Pittsburgh.

A native of Washington D.C., Dr. Piazza received his undergraduate degree in chemistry with a certificate in materials science and engineering from Princeton University. He earned his medical doctorate from Wake Forest School of Medicine. During medical school, Dr. Piazza spent a year at the National Institutes of Health in Bethesda, Maryland as a fellow in the Medical Research Scholars Program. During this time, he performed research in the Surgical Neurology Branch focused on edema associated with pediatric and adult brain tumors. Dr. Piazza is a graduate of the University of North Carolina Hospitals neurosurgery residency program. He completed fellowships in pediatric neurosurgery at UPMC Children's Hospital of Pittsburgh and in pediatric spinal deformity at Shriners Children's Philadelphia.

As well as general pediatric neurosurgery, Dr. Piazza has a strong interest in the neurosurgical management of children with neurodevelopmental disabilities, including but not limited to spasticity, dystonia, and neuromuscular scoliosis. He has a long history of advocacy for this population; and he provides comprehensive, multidisciplinary care with colleagues from neurology, orthopedic surgery, and rehab medicine.

Dr. Piazza is committed to leveraging multidisciplinary care for his patients to improve quality of life and meet patient goals both in and out of the operating room. His research focuses on decision analysis to create tools that incorporate individual patient and family goals to determine the best treatment plans for children with neurodevelopmental disabilities and other complex neurosurgical diseases.

Outside of neurosurgery, Dr. Piazza enjoys spending time with his wife Kirstin, a nurse PhD, their son and dog.

Specialized Areas of Interest
Spasticity, pediatric movement disorders, pediatric spinal deformity, scoliosis, general pediatric neurosurgery.

Hospital Privileges
UPMC Children's Hospital of Pittsburgh

Professional Organization Membership
American Association of Neurological Surgeons
AANS/CNS Joint Section on Pediatric Neurosurgery

Education & Training
AB, Chemistry, Materials Science and Engineering, Princeton University, 2010
MS, Physiology & Biophysics, Georgetown University, 2011

Martin G. Piazza, MD

Fellowship, NIH Medical Research Scholars Program, 2014
MD, Wake Forest School of Medicine, 2016
Fellowship, Pediatric Spinal Deformity, Shriners Children's Philadelphia
Residency, University of North Carolina Hospitals, 2023

Honors & Awards
AANS/CNS Traveling Fellowship in Pediatric Neurosurgery, Primary Children's Hospital, 2022

Publications: 2023-24
• Refereed Articles:
Pan E, Piazza MG, Kellogg RJ, Wisniewski S, Abel TJ. A survey of preferences and expectations for surgical interventions targeting atonic seizures in Lennox-Gastaut syndrome. *Childs Nerv Syst* [Online ahead of print], 2024.

Piazza MG, Varga G, Welch W, Abel TJ. The Utility of Responsive Neurostimulation for the Treatment of Pediatric Drug-Resistant Epilepsy. *Brain Sci* 13(10):1455, 2023.

Piazza MG, Smith KJ, Abel TJ. Influence of New Technologies on the Cost-Effectiveness of Invasive Monitoring in Epilepsy Surgery. *World Neurosurg* 180:231-232, 2023.

Ian F. Pollack, MD

A. Leland Albright Distinguished Professor
Vice Chair, Academic Affairs
Co-Director, Neurosurgical Oncology
Professor of Clinical and Translational Science

Ian Pollack, MD, is A. Leland Albright Professor of Neurosurgery at the University of Pittsburgh School of Medicine.

Prior to joining the faculty of the Department of Neurological Surgery at the University of Pittsburgh in 1992, he was awarded the 1991 Van Wagenen Traveling Fellowship, which afforded him a year of subspecialty training in the Department of Neurosurgery at the Hospital for Sick Children in Toronto, the Neuro-Oncology Laboratory of the University of Lausanne in Switzerland, and the Laboratory of Tumor Biology of the University of Uppsala in Sweden.

Dr. Pollack graduated magna cum laude from Emory University in 1980, where he earned a BS degree in chemistry. He received his medical degree from the Johns Hopkins University School of Medicine in 1984, then completed a surgical internship and neurosurgical residency at the University of Pittsburgh School of Medicine. He also was a research fellow in neuropathology and neurobiology during some of that time.

Dr. Pollack has published more than 410 papers in refereed journals, numerous book chapters and invited papers, and has edited three books on childhood brain tumors. He is co-editor of the book *Principles and Practice of Pediatric Neurosurgery*—currently in its third edition—and an accompanying atlas *Operative Techniques In Pediatric Neurosurgery* as well as *Brain and Spinal Tumors of Childhood*, a multinational state-of-the-art text.

He is currently a site principal investigator on NIH grants focusing on novel therapies for brain tumors, including immunotherapy in childhood brain tumors. Dr. Pollack was named vice chair of academic affairs for the department in July of 2008.

Ian F. Pollack, MD

He also chaired the Children's Oncology Group CNS Tumor Committee from 1999-2009, and co-chaired the National Cancer Institute Brain Malignancy Steering Committee between 2010 and 2017, and served on the American Board of Pediatric Neurosurgery from 2012-2022, and as chair the final year, and then served as chair of the ABPNS nominating committee. He is also a former director on the Accreditation Council for Pediatric Neurosurgery Fellowships.

Dr. Pollack was chief of pediatric neurosurgery at UPMC Children's Hospital of Pittsburgh for over 20 years before passing those duties on to Taylor Abel, MD, on February 1, 2024.

Specialized Areas of Interest
Pediatric neurosurgery; pediatric neuro-oncology; craniofacial surgery; congenital spinal abnormalities; brain tumor clinical trials.

Board Certifications
American Board of Neurological Surgery
American Board of Pediatric Neurosurgery

Hospital Privileges
UPMC Children's Hospital of Pittsburgh
UPMC Magee-Womens Hospital
UPMC Presbyterian

Professional Organization Membership
Academy of Neurological Surgeons
Alpha Omega Alpha
American Academy of Pediatrics
American Association for the Advancement of Science
American Association for Cancer Research
American Association of Neurological Surgeons
American College of Surgeons
American Society for Pediatric Neurosurgery
American Society for Clinical Investigation
Association of American Physicians
Children's Oncology Group
Congress of Neurological Surgeons
John Hopkins Medical and Surgical Society
Joint Section on Tumors (AANS/CNS)
Phi Beta Kappa
Society of Neurological Surgeons
Society for Neuro-Oncology

Professional Activities
Institutional PI, Pediatric Brain Tumor Consortium
Steering Committee, Pediatric Brain Tumor Consortium
Executive Committee, Pediatric Brain Tumor Consortium
Co-Chair, Neurosurgery and Local Delivery Committee, Pediatric Brain Tumor Consortium
Institutional PI, Hydrocephalus Clinical Research Network
Institutional PI, Synostosis Research Group
Past-Chair and Nominating Committee Chair, American Board of Pediatric Neurological Surgery
Director, Accreditation Council for Pediatric Neurosurgery Fellowships

Ian F. Pollack, MD

Education & Training

BS, Chemistry, Emory University, Magna cum Laude, 1980
MD, Johns Hopkins University School of Medicine, 1984
Fellowship, University of Pittsburgh, 1990
Residency, University of Pittsburgh, 1991
Fellowship, Hospital for Sick Children, 1991
Fellowship, University of Lausanne, 1991
Fellowship, University of Uppsala, 1992

Honors & Awards

Paul Steinbok Visiting Professorship, University of British Vancouver, 2024
Castle Connolly Top Doctors in America, 2012-24
Joan Venes Lectureship, University of Michigan, 2019
Albert Nelson Marquis Lifetime Achievement Award, Marquis Who's Who, 2018
Who's Who in America, Marquis, 2005-21
Who's Who in the World, Marquis, 2008-21
Castle Connolly's America's Top Cancer Doctors, 2005-21
Certificate of Appreciation for BMSC Co-chairship, National Cancer Institute, 2017
E. Bruce Hendrick Visiting Professor in Pediatric Neurosurgery, University of Toronto, 2016
Columbia Softball Charity Award, American Association of Neurological Surgeons Annual Meeting, 2016
Children's Brain Tumor Foundation, Award for Scientific Excellence, 2016
Winn Prize, Society of Neurological Surgeons, 2015
Van Wagenen Lecturer, American Association of Neurological Surgeons Annual Meeting, 2014

Publications: 2023-24

• Refereed Articles:

Gatesman TA, Hect J, Phillips HW, Johnson BJ, McClung C; Wald AI, McClung C, Nikiforova MN, Skaugen J, Pollack IF, Agnihotri S, Abel T. Characterization of low-grade epilepsy associated tumor from implanted stereoelectroencephalography electrodes. *Epilepsia Open* 9(1):409-416, 2024.

Casillo SM, Gatesman TA, Chilukuri A, Varadharajan S, Johnson BJ, Premkumar DD, Jane EP, Plute TJ, Koncar RF, Stanton ACJ, Biagi-Junior CAO, Barber CS, Hallbert ME, Golbourn BJ, Halligan K, Cruz AF, Mansi NM, Cheney A, Mullett SJ, Land CV, Perez JL, Myers MI, Agrawal N, Michel JJ, Chang Y-F, Vaske OM, MichealRaj A, Lieberman FS, Felker J, Sruti S, Bertrand KC, Amankular N, Hadjipanayis CG, Abdullah KG, Zinn PO, Friedlander RM, Abel TJ, Nazarian J, Vennetti S, Filbin MG, Wendell SG, Mack SC, Pollack IF, Agnihotri S. An ERK5-PFKB3 axis regulates glycolysis and represents a therapeutic vulnerability in pediatric diffuse midline gliomas. *Cell Rep* 43(1):113557, 2024.

Podkovik S, Zhou C, Coffin SE, Hall M, Hauptman JS, Kronman MP, Mangano FT, Pollack IF, Sedano S, Schaffzin JK, Thorell E, Warf BC, Whitlock KB, Simon TD. Utilization trends in cerebrospinal fluid shunt infection prevention techniques in the United States from 2007 to 2015. *J Neurosurg Pediatr* 33(4):349-358, 2024.

Verhey LH, Kulkarni AV, Reeder RW, Riva-Cambrin J, Jensen H, Pollack IF, Rocque BG, Tamber MS, McDonald PJ, Krieger MD, Pindrick JA, Hauptman JS, Browd SR, Whitehead WE, Jackson EM, Wellons JC III, Hankinson TC, Chu J, Limbrick DD Jr, Strahle JM, Kestle JRW. A re-evaluation of the endoscopic third ventriculostomy success score: a Hydrocephalus Clinical Research Network (HCRN) study. *J Neurosurg Pediatr* 33(5):417-427, 2024.

Ian F. Pollack, MD

Podkovik S, Zhou C, Coffin SE, Hall M, Hauptman JS, Kronman MP, Mangano FT, Pollack IF, Sedano S, Vega J, Schaffzin JK, Thorell E, Warf BC, Whitlock KB, Simon TD. Antibiotic impregnated catheters and intrathecal antibiotics for CSF shunt infection prevention in children undergoing low-risk shunt surgery. *BMC Pediatr* 24(1):325, 2024.

Plute T, Bin-Alamer O, Mallelar AN, Kallos JA, Hamilton DK, Pollack IF, Lunsford LD, Friedlander RM, Abou-Al-Shaar H. A comprehensive evaluation of career trajectories of the American Association of Neurological Surgeons William P. Van Wagenen Fellows. *World Neurosurg X* 27:23:100365, 2024.

Lulla RR, Krailo M, Lazlow M, Boue D, Leach JL, Chen ABL, Lin T, Geller J, Kumar SS, Nikiforova M, Hamilton RL, Chandran U, LaFramboise W, Jogal S, Pai-Panandiker A, Nelson M, Haas-Kogan D, Cohen KJ, Kieran M, Gajjar A, Drissi R, Pollack IF, Fouladi M. A Children's Oncology Group phase II trial of vorinostat, temozolomide or bevacizumab with irradiation followed by bevucizumab and temozolomide in newly diagnosed pediatric high-grade glioma. *Neuro-Oncol Advances* 6(1):vdae035, 2024.

Simon TD, Rezvan PH, Coffin SE, Hall M, Hauptman JS, Kronman MP, Mangano FT, Podhovik S, Pollack IF, Schaffzin JK, Thorell E, Warf BE, Zhou C, Whitlock KB. Infection rates during eras of intrathecal antibiotic use followed by antibiotic impregnated catheter use in prevention of cerebrospinal fluid shunt infection. *J Neurosurg Pediatr* [in press], 2024.

Ravindra V, Riva-Cambrin J, Jensen H, Whitehead WE, Kulkarni A, Limbrick D, Wellons J, Naftel RP, Rozzelle D, Rocque B, Pollack IF, McDowell M, Tamber M, Hauptman J, Browd S, Pindrik J, Isaacs A, McDonald PM, Hankinson T, Jackson E, Chu JA, Krieger M, Simon T, Strahle J, Holubkov R, Reeder R, Kestle JR. Comparing ventriculoatrial to ventriculopleural shunts in pediatric hydrocephalus: a Hydrocephalus Clinical Research Network study. *J Neurosurg Pediatr* [in press], 2024.

Chiang SN, Reckford J, Alexander AL, Birgfeld CB, Bonfield CM, Couture DE, David LR, French B, Gociman B, Goldstein JA, Golinko MS, Kestle JRW, Lee A, Magge SN, Pollack IF, Rottgers SA, Runyan CM, Smyth MD, Wilkinson CC, Skolnick GB, Strahle JM, Patel KB. What to do with an incidental finding of a fused sagittal suture: A modified Delphi study. *J Neurosurg Pediatr* [Online ahead of print], 2024.

Pollack IF, Felker J, Frederico SC, Raphael I, Kohanbash G. Immunotherapy for pediatric low-grade gliomas. *Childs Nerv Syst* [Online ahead of print], 2024

Nturibi EM, Kim SL, Zhang X, Katz J, Pollack IF, Greene S. Retrospective single center series on the surgical management and postoperative outcomes of pediatric Chiari-1 malformation. Part 1. Operative management and complications. *J Neurosurg Pediatr* [in press], 2024.

Nturibi EM, Kim SL, Zhang X, Katz J, Pollack IF, Greene S. Retrospective single center series on the surgical management and postoperative outcomes of pediatric Chiari-1 malformation. Part 2. Symptomatic outcomes and revision surgery. *J Neurosurg Pediatr* [in press], 2024.

Nisnboym M, Vincze SR, Raphael I, Xiong Z, Sneiderman C, Raphael RA, Li B, Day KE, LaToche JD, Foley LM, Kitchens K, Agniohotri S, Hu B, Rajasundaram D, Anderson CJ, Blumenthal DT, Pearce T, Uttam S, Nedrow JR, Panigrahy A, Pollack IF, Lieberman FS, Drappatz J, Edwards WB, Kohanbash G. Immuno-PET imaging of CD69 visualizes T-cell activation and predicts survival in murine GBM. *Cancer Res Commun* 3(7):1173-1188, 2023.

Ian F. Pollack, MD

Familiar AM, Kazerooni AF, Anderson H, Lubneuski A, Viswanathan K, Breslow R, Khalili N, Bagheri S, Haldar D, Kim MC, Arif S, Madhogarhia R, Nguyen TQ, Frenkel EA, Helili Z, Harrison J, Farahani K, Linguraru MG, Bagci U, Velichko Y, Stevens J, Leary S, Lober RM, Campion S, Smith AA, Morinigo D, Rood B, Diamond K, Pollack IF, Williams M, Vossough A, Ware JB, Mueller S, Storm PB, Heath AP, Waanders AJ, Lilly J, Mason JL, Resnick AC, Nabavizadeh A. A multi-institutional pediatric dataset of clinical radiology MRIs by the Children's Brain Tumor Network. *ArXiv* arXiv:2310.01413v1, 2023.

Sedano S, Kronman MP, Whitlock K, Zhou C, Coffin S, Hauptman JS, Hello E, Mangano FT, Pollack IF, Schaffzin JK, Thorell E, Warf BC, Simon TD. Associations of standard care, intrathecal antibiotics, and antibiotic impregnated catheters with cerebrospinal fluid shunt infection organisms and resistance. *J Pediatric Infect Dis Soc* 12(9):504-512, 2023.

Research Activities

Dr. Pollack's group has extended their studies defining the mechanisms underlying resistance in childhood and adult malignant gliomas. They have expanded the repertoire of "drug-resistance" tumor model systems, paired with treatment naïve counterparts. The group has leveraged this unique resource to identify the glycolytic and pentose phosphate metabolic pathways as a key mediators through which multiple cell lines achieve treatment resistance. Using RNA sequencing studies and pathway analysis, Dr. Pollack and his group have identified several common molecular drivers of this process. Gene set enrichment analysis has demonstrated that these mediators hijack glycolytic signaling and produce as pseudo-hypoxic phenotype. Metabolomic analysis of downstream signaling pathway components have shown an involvement of both glycolytic intermediates and mitochondrial energy metabolites that are amenable to therapeutic intervention. These observations have provided a basis for pharmacological studies that incorporate 2-deoxyglucose for reversing resistance as well as potentiating the efficacy of cytotoxic chemotherapy agents by virtue of their inhibition of DNA synthesis. Metabolic manipulations that may provide novel approaches for promoting tumor cell killing are being tested in animal models. Dr. Pollack's group has demonstrated dramatic enhancement in survival with treatment in one orthotopic xenograft model and are planning studies using other models and dietary modulation, which may open up several novel strategies for clinical therapies.

Dr. Pollack and his group have also continued their NIH- and foundation-funded activities that focus on immunotherapy for pediatric brain tumors. Accrual continues on ongoing clinical trials for recurrent low-grade gliomas and ependymoma.

Ava M. Puccio, RN, PhD

Associate Professor
Co-Director, Neurotrauma Clinical Trials Center

Ava M. Puccio, RN, PhD, is an associate professor with tenure in the Department of Neurological Surgery and also co-director of the Neurotrauma Clinical Trials Center in collaboration with David O. Okonkwo, MD, PhD.

Dr. Puccio received her bachelor of science degree in neuroscience in 1988 and bachelor degree in nursing in 1994, both from the University of Pittsburgh. In 1995, she joined the Department of Neurological Surgery as a nurse coordinator on the National Acute Brain Injury Study: Hypothermia (NABIS:H) study and also the coordinator for the Brain Trauma Research Center.

Throughout her years of employment as a nurse coordinator, she pursued part-time advanced schooling to graduate with a master's degree in nursing from the University of Pittsburgh in 2000 and as a university scholar (top 2% of class) from the University of Pittsburgh School of

Ava M. Puccio, RN, PhD

Nursing with a doctoral degree, emphasis in neuroscience in 2008. Her dissertation, "Effect of short periods of normobaric hyperoxia on local brain tissue oxygenation and cerebrospinal fluid oxidative stress markers in severe traumatic brain injury" was published in the *Journal of Neurotrauma* in 2009.

Dr. Puccio was appointed assistant professor in the Department of Neurological Surgery in 2010 and received her adjunct faculty position with The School of Nursing, Department of Acute/Tertiary Care in 2010 with collaborations with Yvette Conley, PhD and Richard Henker, RN, PhD. She was promoted to associate professor with tenure in 2022.

Specialized Areas of Interest
Traumatic brain injury research; biomarkers.

Board Certifications
RN License: Pennsylvania

Hospital Privileges
UPMC Mercy
UPMC Presbyterian

Professional Organization Membership
Eastern Nursing Research Society
International Initiative for Traumatic Brain Injury Research
National Neurotrauma Society
Neurocritical Care Society
Sigma Theta Tau International Nursing Honor Society
Society of Critical Care Medicine
Women in Neurotrauma Research (WINTR)

Professional Activities
Guest Lecturer, Pathophysiology Across the Lifespan, University of Pittsburgh
Copeland Foundation Grant Committee, University of Pittsburgh
Biomarker Working Group, TRACK-TBI, University of California, San Francisco
Working Group, Genetic Associations in Neurotrauma (GAIN) Consortium
Biomarker Working Group, International TBI Research (InTIBIR)
Executive and Steering Committee, TRACK-TBI, University of California, San Francisco
Working Group, NIH/NINDS TBI Classification and Nomenclature Workshop: Blood-based biomarkers, Washington, D.C.

Education & Training
BS, Neuroscience, University of Pittsburgh, 1988
BSN, Nursing, University of Pittsburgh, 1994
MSN, Nursing, University of Pittsburgh, 2000
PhD, Nursing/Neuroscience, University of Pittsburgh, 2008

Honors & Awards
Cold Spring Harbor Scholarship, 2012
Ruth Perkins Kuehn Nursing Research Award, 2011
Cameos of Caring Nursing Scholarship, 2007
Society of Critical Care Nursing Section Award, 2006

Ava M. Puccio, RN, PhD

News Media Appearances: 2023-24

"Pitt Research Team Makes Breakthrough in Diagnosing Concussions," *Pittsburgh Sports Now*, April 18, 2024.

"A bedside blood concussion test, with Pitt research, finds FDA approval," *Pittsburgh Post-Gazette*, April 18, 2024.

Publications: 2023-24

• Refereed Articles:

Cai LT, Moon J, Camacho PB, Anderson AT, Chwa WJ, Sutton BP, Markowitz AJ, Palacios EM, Rodriguez A, Manley GT, Shankar S, Bremer PT, Mukherjee P, Madduri RK; TRACK-TBI Investigators. MaPPeRTrac: A Massively Parallel, Portable, and Reproducible Tractography Pipeline. *Neuroinformatics* 22(2):177-191, 2024.

Ma L, Nail TJ, Hoz SS, Puccio AM, Lang MJ, Okonkwo DO, Gross BA. Traumatic Cerebral Venous Sinus Thrombosis: Management and Outcomes. *World Neurosurg* 187:e949-e962 2024.

Behzadi F, Luy DD, Schaible PA, Zywiciel JF, Puccio AM, Germanwala AV. A systematic review and meta-analysis of major blood protein biomarkers that predict unfavorable outcomes in severe traumatic brain injury. *Clin Neurol Neurosurg* 242:108312 2024.

Eagle SR, Basantani MK, Preszler J, Sherry N, McIntyre P, Kershaw EE, Puccio AM, Okonkwo DO. Interaction of obesity and proteins associated with the NLRP3 inflammasome following mild traumatic brain injury. *Sci Rep* 14(1):10178, 2024.

Yue JK, Yuh EL, Elguindy MM, Sun X, van Essen TA, Deng H, Belton PJ, Satris GG, Wong JC, Valadka AB, Korley FK, Robertson CS, McCrea MA, Stein MB, Diaz-Arrastia R, Wang KKW, Temkin NR, DiGiorgio AM, Tarapore PE, Huang MC, Markowitz AJ, Puccio AM, Mukherjee P, Okonkwo DO, Jain S, Manley GT. Isolated Traumatic Subarachnoid Hemorrhage on Head Computed Tomography Scan May Not Be Isolated: A Transforming Research and Clinical Knowledge in Traumatic Brain Injury Study (TRACK-TBI) Study. *J Neurotrauma* 41(11-12):1310-1322, 2024.

Puccio AM, Yue JK, Korley FK, Okonkwo DO, Diaz-Arrastia R, Yuh EL, Ferguson AR, Mukherjee P, Wang KKW, Taylor SR, Deng H, Markowitz AJ, Sun X, Jain S, Manley GT. Diagnostic Utility of Glial Fibrillary Acidic Protein Beyond 12 Hours After Traumatic Brain Injury: A TRACK-TBI Study. *J Neurotrauma* 41(11-12):1353-1363, 2024.

Yue JK, Lee YM, Sun X, van Essen TA, Elguindy MM, Belton PJ, Pisică D, Mikolic A, Deng H, Kanter JH, McCrea MA, Bodien YG, Satris GG, Wong JC, Ambati VS, Grandhi R, Puccio AM, Mukherjee P, Valadka AB, Tarapore PE, Huang MC, DiGiorgio AM, Markowitz AJ, Yuh EL, Okonkwo DO, Steyerberg EW, Lingsma HF, Menon DK, Maas AIR, Jain S, Manley GT; The TRACK-TBI Investigators. Performance of the IMPACT and CRASH prognostic models for traumatic brain injury in a contemporary multicenter cohort: a TRACK-TBI study. *J Neurosurg* [Online ahead of print], 2024.

Saju C, Barnes A, Kuramatsu JB, Marshall JL, Obinata H, Puccio AM, Yokobori S, Olson DM; END-PANIC Investigators. Describing Anisocoria in Neurocritically Ill Patients. *Am J Crit Care* 32(6):402-409, 2023.

Etemad LL, Yue JK, Barber J, Nelson LD, Bodien YG, Satris GG, Belton PJ, Madhok DY, Huie JR, Hamidi S, Tracey JX, Coskun BC, Wong JC, Yuh EL, Mukherjee P, Markowitz AJ, Huang MC, Tarapore PE, Robertson CS, Diaz-Arrastia R, Stein MB, Ferguson AR, Puccio AM, Okonkwo DO, Giacino JT, McCrea MA, Manley GT, Temkin NR, DiGiorgio AM; TRACK-TBI Investigators. Longitudinal Recovery Following Repetitive Traumatic Brain Injury. *JAMA Netw Open* 6(9):e2335804, 2023.

Ava M. Puccio, RN, PhD

Deng H, Puccio DJ, Anand SK, Yue JK, Hudson JS, Legarreta AD, Wei Z, Okonkwo DO, Puccio AM, Nwachuku EL. Power Drill Craniostomy for Bedside Intracranial Access in Traumatic Brain Injury Patients. *Diagnostics* (Basel) 13(14):2434, 2023.

Eagle SR, Puccio AM, Nelson LD, McCrea M, Giacino J, Diaz-Arrastia R, Conkright W, Jain S, Sun X, Manley G, Okonkwo DO; TRACK-TBI Investigators. Association of obesity with mild traumatic brain injury symptoms, inflammatory profile, quality of life and functional outcomes: a TRACK-TBI Study. *J Neurol Neurosurg Psychiatry* 94(12):1012-1017, 2023.

Sperry JL, Cotton BA, Luther JF, Cannon JW, Schreiber MA, Moore EE, Namias N, Minei JP, Wisniewski SR, Guyette FX; Shock, Whole Blood, and Assessment of Traumatic Brain Injury (SWAT) Study Group. Whole Blood Resuscitation and Association with Survival in Injured Patients with an Elevated Probability of Mortality. *J Am Coll Surg* 237(2):206-219, 2023.

Bryant AM, Rose NB, Temkin NR, Barber JK, Manley GT, McCrea MA, Nelson LD; TRACK-TBI Investigators; Badjatia N, Gopinath S, Keene CD, Madden C, Ngwenya LB, Puccio A, Robertson C, Schnyer D, Taylor SR, Yue JK. Profiles of Cognitive Functioning at 6 Months After Traumatic Brain Injury Among Patients in Level I Trauma Centers: A TRACK-TBI Study. *JAMA Netw Open* 6(12):e2349118, 2023.

Research Activities

Dr. Puccio's research has focused on improving outcomes in traumatic brain injury patients, with clinical venues of controlled normothermia, mechanisms of brain oxygenations and exploring genetic variances and expression on outcomes.

With 25+ years of clinical trial design, involvement and management, several traumatic brain and spine injury research studies have been completed and are ongoing. Many cutting-edge biomarker and high definition fiber tracking imaging and additional observational research studies are being conducted. Dr. Puccio is very involved in the Transforming Research and Clinical Knowledge in TBI (TRACK-TBI) consortium and was awarded a Department of Defense grant as PI of the Biospecimen Repository which collects, catalogues and stores cerebrospinal fluid, blood, serum DNA and RNA samples obtained from mild, moderate and severe TBI patients at 17 clinical sites. Her expertise in the blood-based biomarker field has led to her recognition as a world-renowned expert in the field and she recently served on the NINDS TBI Classification and Nomenclature Workshop in January 2024.

Michael J. Rutigliano, MD

Clinical Associate Professor
Director, Westmoreland County Community Neurosurgery

Michael J. Rutigliano, MD, MBA, was appointed to the University of Pittsburgh faculty in 1996. An active staff member of the University of Pittsburgh Medical Center, Dr. Rutigliano lives in Greensburg, Pennsylvania and the primary focus of his clinical practice is in Westmoreland County at the hospitals of the Excela Health System through a cooperative venture between UPMC and Excela Health.

His clinical interests include a wide range of neurosurgical diseases, focusing mostly in the areas of spinal and peripheral nerve disorders, and concussion and other sports-related injury. Surgical procedures performed include simple spinal surgery such as lumbar and cervical discectomy, laminectomies for spinal stenosis, and more complex spinal reconstructive surgery for spondylolisthesis and scoliosis. Common peripheral nerve surgery includes carpal tunnel release and ulnar neurolysis.

Michael J. Rutigliano, MD

He received his medical degree in 1989 from the University of Pittsburgh School of Medicine. Following an internship in general surgery, he completed residency training in neurological surgery at the University of Pittsburgh Medical Center. During this time, he also obtained an MBA from the Katz Graduate School of Business.

Dr. Rutigliano's academic expertise is in medical economics and cost-effectiveness analysis. He was awarded the Pittsburgh Academy of Medicine Study Scholarship and was honored by the Stroke Council of the American Heart Association with a scholarship for research in cerebrovascular disease.

Dr. Rutigliano has retired from the United States Army Reserve and has served in support of Operation Iraqi Freedom at Walter Reed Medical Center from April to July 2003, and in Balad, Iraq from October 2007 to February 2008.

Specialized Areas of Interest
Spinal disorders; peripheral nerve disorders.

Board Certifications
American Board of Neurological Surgery

Hospital Privileges
Latrobe Area Hospital
UPMC East
UPMC Presbyterian
Westmoreland Hospital

Professional Organization Membership
American Association of Neurological Surgeons
AANS/CNS Joint Section on Spine and Peripheral Nerve
Congress of Neurological Surgeons

Education & Training
BS, Chemistry, University of Pittsburgh, 1985
MD, University of Pittsburgh, 1989
MBA, Joseph Katz School of Business, University of Pittsburgh, 1994
Residency, Neurosurgery, University of Pittsburgh, 1996

Natalie Sherry, PsyD, ABPP-CN

Assistant Professor

Natalie Sherry, PsyD, ABPP-CN, is a board-certified clinical neuropsychologist in the University of Pittsburgh Departments of Neurological Surgery, Neurology and Hematology/Oncology. She specializes in the evaluation of cognition among neurosurgical and neurological patients, particularly brain tumor. She developed the perioperative cognitive mapping protocol for UPMC's Adult Neurosurgical Oncology Program alongside neurophysiology and conducts intraoperative language mapping for awake brain surgeries. Her academic interests include cognitive function among patients with brain tumor and traumatic brain injury. She is also on the steering committee for the UPMC/Pitt Psychology Consortium and co-creator of the psychology well-being survey aimed at improving the organizational well-being for psychologists.

Dr. Sherry completed her undergraduate degree at the University of Pittsburgh in neuroscience graduating summa cum laude. She also has a joint degree from Widener University including a

Natalie Sherry, PsyD, ABPP-CN

doctorate in clinical psychology and a master's degree in business administration. She completed an internship in the Department of Neurology at the Hospital of the University of Pennsylvania and the Department of Physical Medicine and Rehabilitation at Temple University Hospital, as well as a post-doctoral fellowship in clinical neuropsychology at the UPMC Sports Concussion Program in the Department of Orthopaedic Surgery.

Specialized Areas of Interest
Neuropsychology

Board Certifications
American Board of Clinical Neuropsychology

Professional Organization Membership
American Academy of Clinical Neuropsychology
American Psychological Association
International Neuropsychological Society
National Academy of Neuropsychology
Pennsylvania Psychological Association
Sport Neuropsychology Society

Professional Activities
Finance Committee, Sports Neuropsychology Society
Steering Committee, UPMC/Pitt Psychology Consortium

Education & Training
BS, Neuroscience, University of Pittsburgh, 2011
MA, Clinical Psychology, 2014
MBA, Widener University, 2016
PsyD, Widener University, 2016
Clinical Neuropsychology Fellowship, UPMC, 2018

Honors & Awards
Senior Researcher Award, American Academy of Child & Adolescent Psychiatry, 2019

Research Activities
Dr. Sherry is a co-investigator of a NIH R01 grant with Carnegie Mellon University investigating representational similarity spaces for objects and actions before and after brain tumor surgery.

Jeremy G. Stone, MD

Clinical Assistant Professor
Director Cerebrovascular Surgery, UPMC Hamot

Jeremy G. Stone, MD, is a board eligible neurosurgeon with CAST-accredited subspecialty fellowship training in neuroendovascular surgery, completing both residency and fellowship at the University of Pittsburgh. He currently practices with Great Lakes Neurosurgery and Neurointervention at UPMC Hamot in Erie, Pennsylvania serving as clinical assistant professor and director of cerebrovascular surgery.

Dr. Stone enjoys general neurosurgery with clinical focus on open cerebrovascular, neuroendovascular, minimally invasive techniques, and spine deformity. He also leads scientific discovery with participation as site principal investigator in several clinical trials.

Jeremy G. Stone, MD

Specialized Areas of Interest
Cerebrovascular (open and endovascular neurosurgery); degenerative spine disease and spinal deformity with emphasis on minimally invasive 360-degree approaches for deformity correction; stroke.

Board Certifications
American Board of Neurological Surgery (board eligible)

Hospital Privileges
UPMC Hamot
UPMC Mercy
UPMC Presbyterian

Professional Organization Membership
Alpha Omega Alpha
American Association of Neurological Surgery
AANS/CNS Cerebrovascular Section
Congress of Neurological Surgeons
North American Spine Society
Society of Neurointerventional Surgeons

Professional Activities
UPMC Neurosurgery and Neurology Value Analysis Committee

Education & Training
BS, Biology/Psychology, Case Western Reserve University, 2009
MD, University of Hawaii, 2014
CAST-Accredited Fellowship, Neuroendovascular Surgery, University of Pittsburgh, 2020
Residency, Neurological Surgery, University of Pittsburgh, 2021

Honors & Awards
Best Off-Service Teacher Award, Orthopedic Surgery Residency, UPMC Hamot, 2021
UPMC Medical Education LEAP Award for Patient Safety and Quality Improvement, 2017, 2020
Oral Presentation Award, Second Annual Graduate Medical Education Quality and Safety Symposium, University of Pittsburgh, 2019
Best Resident Research Presentation Runner Up, Stuart Rowe Society Lectureship, University of Pittsburgh, 2019
Top Score, American Board of Neurological Surgery Written Board Exam, 2018
Frank and Mary McDowell Award for Excellence in Surgery, 2014
Windsor and Mary Cutting Excellence in the Basic Sciences Award, 2014
Bernard Yim Award for Top Performance in Internal Medicine Clerkship, American College of Physicians, University of Hawaii John A. Burns School of Medicine, 2013
Po'okela and Noi'i Award for Outstanding Research, 2014
American College of Physicians Bernard Him Award for Top Performance in Internal Medicine, 2013

Research Activities
• Multicenter, international, randomized, placebo controlled, double-blind, parallel group and event driven Phase 3 study of the oral FXIa inhibitor asundexian (BAY 2433334) for the prevention of ischemic stroke in male and female participants aged 18 years and older after an acute non-cardioembolic ischemic stroke or high-risk TIA (OCEANIC-STROKE)
Phase 3 program of the Oral faCtor Eleven A iNhibitor asundexLan as novel anti-thrombotiC STROKE study.

Jeremy G. Stone, MD

• Comparison of Anti-coagulation and anti-Platelet Therapies for Intracranial Vascular Atherosclerosis (CAPTIVA)
Two-stage Phase III trial randomizing subjects with stroke attributed to 70-99% intracranial atherosclerotic stenosis to 1. ticagrelor + aspirin, 2. low dose rivaroxaban + aspirin, 3. clopidogrel + aspirin.

• Protection against Emboli during caRotid artery stenting using a 3-in-1 delivery system comprised oF a pOst-dilation balloon, integRated eMbolic filter, and A Novel Carotid stEnt II (PERFORMANCE II).
Prospective, single-arm, multicenter clinical trial to evaluate the safety and effectiveness of the Neuroguard IEP System for the treatment of carotid artery stenosis.

Mingui Sun, PhD

Professor

Mingui Sun, PhD, received a BS degree in instrumental and industrial automation in 1982 from the Shenyang Chemical Engineering Institute in Shenyang, China, and an MS degree in electrical engineering in 1986 from the University of Pittsburgh, where he also earned a PhD degree in electrical engineering in 1989. He was later appointed to the faculty in the Department of Neurological Surgery.

Dr. Sun's research interests include neurophysiological signals and systems, biosensor designs, brain-computer interface, bioelectronics, machine learning and artificial intelligence. He has more than 460 publications.

Specialized Areas of Interest
Biomedical engineering; biomedical instrumentation; biomedical signal processing, computational neurophysiology, image and video processing; artificial intelligence and its application to biomedicine, computer-assisted neurosurgery and diagnosis.

Professional Organization Membership
American Institute for Medical and Biological Engineering
Institute of Electrical and Electronics Engineers

Education & Training
BS, Instrumentation/Industrial Automation, Shenyang Chemical Institute, 1982
MS, Electrical Engineering, University of Pittsburgh, 1986
PhD, Electrical Engineering, University of Pittsburgh, 1989

Publications: 2023-24
• Refereed Articles:
Qiu J, Lo FP, Gu X, Jobarteh ML, Jia W, Baranowski T, Steiner-Asiedu M, Anderson AK, McCrory MA, Sazonov E, Sun M, Frost G, Lo B. Egocentric Image Captioning for Privacy-Preserved Passive Dietary Intake Monitoring. *IEEE Trans Cybern* 54(2):679-692, 2024.

Jia W, Gao Y, Mao ZH, Sun M. Editorial for the Special Issue "Sensing-Based Biomedical Communication and Intelligent Identification for Healthcare." *Sensors* (Basel) 24(5):1403, 2024.

Jobarteh ML, McCrory MA, Lo B, Triantafyllidis KK, Qiu J, Griffin JP, Sazonov E, Sun M, Jia W, Baranowski T, Anderson AK, Maitland K, Frost G. Evaluation of Acceptability, Functionality, and Validity of a Passive Image-Based Dietary Intake Assessment Method in Adults and Children of Ghanaian and Kenyan Origin Living in London, UK. *Nutrients* 15(18):4075, 2023.

Mingui Sun, PhD

Zheng Y, Campbell Rice B, Melkus GD, Sun M, Zweig S, Jia W, Parekh N, He H, Zhang Y, Wylie-Rosett J. Dietary Self-Management Using Mobile Health Technology for Adults With Type 2 Diabetes: A Scoping Review. *J Diabetes Sci Technol* 17(5):1212-1225, 2023.

Jia W, Li B, Xu Q, Chen G, Mao ZH, McCrory MA, Baranowski T, Burke LE, Lo B, Anderson AK, Frost G, Sazonov E, Sun M, Image-based volume estimation for food in a bowl. *J Food Eng* 372(59):111943 2024.

Research Activities

• Dietary Assessment Using AI Technology

Due to the increased adoption of unhealthy lifestyle, such as high-calorie, low-nutrient diet and decreased physical activity, chronic diseases are rising rapidly. In order for the research community to study lifestyle and develop effective interventional strategies, Dr. Sun is developing a miniature wearable device pinned on the chest region to assess diet, physical activity and sedentary behavior. The image data are processed using the AI technology to recognize food, estimate portion size, and evaluate nutrition contents.

• Long-Term Monitoring of Blood Sodium for Hypertension Prevention

Sodium chloride (NaCl), or salt, is an important nutrient for maintaining health. It is also an indispensable seasoning in every home playing a key role in enhancing food flavor. Consequently, most Americans consume too much salt. Strong evidence indicates that long-term excessive salt intake causes hypertension, or high blood pressure (BP). Unfortunately, hypertension has become a pandemic in the U.S. with nearly half of adults (about 120 million) having high BP. Dr. Sun is developing a new wearable device which can assess the level of sodium concentration in the blood, long-term at a very low cost.

Fadi Sweiss, MD

Clinical Assistant Professor

Fadi Sweiss, MD, joined the University of Pittsburgh Department of Neurological Surgery in August of 2020, practicing at UPMC Williamsport in north central Pennsylvania. Dr. Sweiss specializes in the diagnosis and treatment of degenerative, traumatic, and oncologic spinal conditions using traditional, open surgical techniques and advanced, minimally invasive techniques.

Dr. Sweiss received his medical degree from Northeast Ohio Medical University, Rootstown, Ohio, and completed his residency in neurosurgery at George Washington University Hospital, Washington, D.C.

“As long as I can remember, I’ve wanted to be a doctor,” said Sweiss. “My brother is a neurosurgeon and the field fascinated me. I enjoy being able to care for and build relationships with my patients. It never ceases to amaze me how the proper care can transform and change a patient’s life and that’s what it is all about for me.”

Fadi Sweiss, MD, joined the University of Pittsburgh Department of Neurological Surgery in August of 2020, practicing at UPMC Williamsport in north central Pennsylvania. Dr. Sweiss specializes in the diagnosis and treatment of degenerative, traumatic, and oncologic spinal conditions using traditional, open surgical techniques and advanced, minimally invasive techniques.

Dr. Sweiss received his medical degree from Northeast Ohio Medical University, Rootstown, Ohio, and completed his residency in neurosurgery at George Washington University Hospital, Washington, D.C.

Fadi Sweiss, MD

"As long as I can remember, I've wanted to be a doctor," said Sweiss. "My brother is a neurosurgeon and the field fascinated me. I enjoy being able to care for and build relationships with my patients. It never ceases to amaze me how the proper care can transform and change a patient's life and that's what it is all about for me."

Specialized Areas of Interest
Complex spine disorders; adult spine revision surgery and deformity correction, cervical, thoracic and lumbar surgery; neurotrauma.

Hospital Privileges
UPMC Williamsport

Education & Training
BS, Biology, Virginia Tech, 2006
MD, Northeast Ohio Medical University, 2013
Residency, George Washington University, 2020

Honors & Awards
Top 40 Physicians Under 40, Pennsylvania Medical Society, 2023

News Media Appearances: 2023-24
"3 UPMC Doctors Named Top Doctors Under 40," *Pennsylvania News*, December 22, 2023.

Bart Thaci, MD

Clinical Assistant Professor

Bart Thaci, MD, joined the University of Pittsburgh Department of Neurological Surgery as a clinical assistant professor in July 2022 specializing in neurovascular disease. His particular clinical interests include the treatment of brain and spinal cord vascular disorders such as aneurysms, arteriovenous malformations, arteriovenous fistulas, and cavernous malformations. He also performs embolization of brain and spinal cord tumors; cervical, intracranial, and venous stenting; and revascularization for acute ischemic stroke.

Dr. Thaci received his medical degree from University of Tirana, Faculty of Medicine, Albania. After relocating in the United States, Dr. Thaci continued post-doctoral studies at the University of Chicago Brain Tumor Center and then a pre-residency neurosurgery fellowship at Boston Medical Center, Boston University. He completed his neurosurgery residency at the University of California-Davis. During his residency, Dr. Thaci completed two endovascular fellowships, the first at the University of Alabama, Birmingham in 2020 and the second at the CAST-approved University of California-Davis in 2022.

Specialized Areas of Interest
Intracranial aneurysms; arteriovenous malformations; arteriovenous fistulas; cavernous malformations; brain tumors; carotid stenosis; intracranial stenosis; venous sinus stenosis; ischemic stroke.

Board Certifications
Eligible for American Board of Neurological Surgery

Hospital Privileges
UPMC Carlisle
UPMC Community General

Bart Thaci, MD

UPMC Hanover
UPMC Harrisburg
UPMC Lititz
UPMC Memorial
UPMC West Shore

Professional Organization Membership
American Association of Neurological Surgeons
Congress of Neurological Surgeons
Pennsylvania Medical Society
Pennsylvania Neurosurgical Society

Education & Training
MD, University of Tirana, Faculty of Medicine, Albania, 2004
Fellowship, Pre-residency, Neurosurgery, Boston University Medical Center, 2015
Residency, University of California Davis Medical School, 2022
Fellowship, Endovascular Neurosurgery, University of Alabama, Birmingham, 2020
Fellowship, Endovascular Neurosurgery, University of California Davis Medical School, 2022

News Media Appearances: 2023-24
"Stroke Awareness," *Taking Care of Business with Michael Parks*, WHP-580 Radio, (Harrisburg, Pa.), May 11, 2024
"UPMC in Central Pa. offers team approach to spine care," *Central Penn Business Journal*, April 1, 2024
"UPMC launches new spine care program in Central Pa.," WHTM-TV.com (Harrisburg, Pa.), March 25, 2024
"Stroke survivor shares story as warning," abc27TV News (Harrisburg, Pa.), July 18, 2023.

Publications: 2023-24
• Refereed Articles:
Clouse J, Thaci B, Clark AS, Baggett M, Raslan O, Matouk C, Waldau B, Cord B. Successful mechanical thrombectomy for terminal ICA bullet embolism: A case report. *Interv Neuroradiol* [Online ahead of print], 2024.

Parthasarathy D. Thirumala, MD

Professor
Director, Center of Clinical Neurophysiology
Director, Clinical Neurophysiology Laboratory

Parthasarathy D. Thirumala, MD, joined the Center of Clinical Neurophysiology in June 2008. He specializes in intraoperative neurophysiological monitoring to adult and pediatric neurosurgical, orthopedic, ENT, vascular and interventional neuroradiology procedures.

Dr. Thirumala completed his neurology residency and clinical neurophysiology fellowship training at the University of Pittsburgh Medical Center. He completed his internship in internal medicine training at Brookdale University Hospital and Medical Center in Brooklyn, New York. Prior to clinical training he completed his master's degree in biomedical engineering at the University of Illinois at Chicago. Dr. Thirumala completed his medical training in India at Stanley Medical College in Chennai, India.

His research interests include evaluating new methods to improve the diagnostic accuracy of intraoperative neurophysiological monitoring, understanding the impact of perioperative neurological disorders.

Parthasarathy D. Thirumala, MD

He has published over 140 peer reviewed articles, book chapters, and invited articles in the journals including *JAMA, Neurology, Neurology, Neurosurgery, Journal of Neurosurgery, Clinical Neurophysiology* and *Journal of Clinical Neurophysiology*. He has given lectures both nationally and internationally on the value of intraoperative neurophysiological monitoring.

Specialized Areas of Interest
Intraoperative neurophysiological monitoring; functional cortical mapping during awake craniotomies; neurophysiological monitoring during minimally invasive endonasal approach to skull base surgeries, electroencephalography in the intensive care unit.

Board Certifications
American Board of Clinical Neurophysiology: Intraoperative Monitoring
American Board of Neuroimaging
American Board of Neurophysiologic Monitoring
American Board of Psychiatry and Neurology

Hospital Privileges
Jameson Hospital
Monongahela Valley Hospital
UPMC Children's Hospital of Pittsburgh
UPMC Hamot
UPMC Horizon
UPMC Magee-Womens Hospital
UPMC Mercy
UPMC Passavant
UPMC Presbyterian
UPMC St. Margaret
UPMC Shadyside

Professional Organization Membership
American Academy of Neurology
American Association of Neuromuscular and Electrodiagnostic Medicine
American Clinical Neurophysiology Society
American Epilepsy Society
American Medical Association
American Society of Neuroimaging
American Society of Neuromonitoring
America's Registry of Outstanding Professionals
North American Spine Society

Professional Activities
Course Co-Director, Principles and Practice of Intraoperative Monitoring, UPMC

Education & Training
MBBS, Stanley Medical College, 1997
MS, University of Illinois, Bioengineering, 2001
Residency, Neurology, University of Pittsburgh, 2006
Fellowship, Clinical Neurophysiology, University of Pittsburgh, 2007

Honors & Awards
Neurologist of the Year, Pennsylvania Neurology Society, 2021

Parthasarathy D. Thirumala, MD

Publications: 2023-24

• Refereed Articles:

Al-Qudah AM, Ta'ani OA, Thirumala PD, Sultan I, Visweswaran S, Nadkarni N, Kiselevskaya V, Crammond DJ, Balzer J, Anetakis KM, Shandal V, Subramaniam K, Subramanium B, Sadhasivam S. Role of Intraoperative Neuromonitoring to Predict Postoperative Delirium in Cardiovascular Surgery. *J Cardiothorac Vasc Anesth* 38(2):526-533, 2024.

Reddy RP, Singh-Varma A, Chang R, Vedire A, Anetakis KM, Balzer JR, Crammond DJ, Shandal V, Lee JY, Shaw JD, Thirumala PD. Transcranial Motor Evoked Potentials as a Predictive Modality for Postoperative Deficit in Cervical Spine Decompression Surgery: A Systematic Review and Meta-Analysis. *Global Spine J* 14(5):1609-1628 2024.

Mina AI, Espino JU, Bradley AM, Thirumala P, Batmanghelich K, Visweswaran S. Time-Series Aware Metrics for the Evaluation of Intraoperative Electroencephalography-Based Ischemia Detection. *Stud Health Technol Inform* 310:274-278, 2024.

Gorijala VK, Reddy RP, Anetakis KM, Balzer J, Crammond DJ, Shandal V, Shaw JD, Christie MR, Thirumala PD. Diagnostic utility of different types of somatosensory evoked potential changes in pediatric idiopathic scoliosis correction surgery. *Eur Spine J* 33(4):1644-1656 2024.

Jain U, Jain B, Brown J, Sultan IB, Thoma F, Anetakis KM, Balzer JR, Subramaniam K, Yousef S, Wang Y, Nogueira R, Thirumala PD. Outcomes after Perioperative Transient Ischemic Attack Following Cardiac Surgery. *J Cardiovasc Dev Dis* 11(1):27, 2024.

Jain B, Rahim FO, Thirumala PD, McGarvey ML, Balzer J, Nogueira RG, van der Goes DN, de Havenon A, Sultan I, Ney J. Cost-benefit analysis of intraoperative neuromonitoring for cardiac surgery. *J Stroke Cerebrovasc Dis* 33(3):107576, 2024.

Bata A, Al Qudah A, Algarni S, Al Ta'ani O, Balzer JR, Crammond DJ, Shandal V, Gross BA, Lang MJ, Anetakis KM, Narayanan S, Mina A, Thirumala PD. Diagnostic Accuracy of Somatosensory Evoked Potentials and Electroencephalography During Endovascular Treatment of Unruptured Cerebral Aneurysms. *World Neurosurg* S1878-8750, 2023.

Reddy RP, Gorijala VK, Kaithi VR, Shandal V, Anetakis KM, Balzer JR, Crammond DJ, Shaw JD, Lee JY, Thirumala PD. Utility of transcranial motor-evoked potential changes in predicting postoperative deficit in lumbar decompression and fusion surgery: a systematic review and meta-analysis *Eur Spine J* 32(10):3321-3332, 2023.

Jimenez JE, Omar M, Adams GM, Costacou T, Thirumala PD, Crammond DJ, Anetakis KM, Balzer JR, Shandal V, Snyderman CH, Gardner PA, Zenonos GA, Wang EW. Electromyographic predictors of abducens nerve palsy after endoscopic skull base surgery. *J Neurosurg* 140(6):1584-1590 2023.

Sheela Vivekanandan, MD

Clinical Assistant Professor

Sheela Vivekanandan, MD, joined the University of Pittsburgh Department of Neurological Surgery in March of 2024 specializing in spine care and serving patients in the Harrisburg Pennsylvania area.

Specialized Areas of Interest

Spine care, sacroiliac joint fusion, lumbar fusion, meningioma, and subdural hematomas.

Sheela Vivekanandan, MD

Professional Organization Membership
American Association of Neurological Surgeons
Congress of Neurological Surgeons
Women in Neurosurgery

Education & Training
MD, University of Missouri, Kansas City
Residency, Geisinger Medical Center
Fellowship, University of Utah

Daniel A. Wecht, MD, MSc

Clinical Professor
Chief, Neurosurgery, UPMC McKeesport
Chief, Neurosurgery, UPMC St. Margaret
Chief, Neurosurgery, UPMC Shadyside

Daniel A. Wecht, MD, joined the Department of Neurological Surgery as a clinical assistant professor in September of 1999. He was promoted to clinical associate professor in 2002 and full clinical professor in 2008.

He was born and raised in Pittsburgh. After graduating from Harvard University, Dr. Wecht attended medical school at the University of Pennsylvania. He completed his neurosurgery residency at Baylor College and then completed a two-year neurovascular surgery fellowship at Yale University School of Medicine.

He was board-certified with the American Board of Neurological Surgery in 2000 and was recertified in 2010. Dr. Wecht specializes in the treatment of brain tumors and general neurosurgery including an active spine practice.

Dr. Wecht, team neurosurgeon for the Pittsburgh Penguins, has been named among the top doctors in the field of neurological surgery in a national survey conducted by Castle Connolly.

He has co-authored or authored several articles and publications. Dr. Wecht has been a neurosurgical faculty member at Yale University, University of New Mexico and Allegheny University of the Health Sciences (Pittsburgh). He is an active participant in multiple professional and scientific societies. He is licensed to practice in Pennsylvania and New Mexico.

Specialized Areas of Interest
General neurosurgery; brain tumors; spinal and peripheral nerve microsurgery; chiari malformation.

Board Certifications
American Board of Neurological Surgery

Hospital Privileges
UPMC McKeesport
UPMC Presbyterian
UPMC St. Margaret
UPMC Shadyside

Professional Organization Membership
AANS/CNS Joint Section on Cerebrovascular Surgery

Daniel A. Wecht, MD, MSc

AANS/CNS Joint Section on Trauma
American Association of Neurological Surgeons

Professional Activities
Team Neurosurgeon, Pittsburgh Penguins

Education & Training
AB, Anthropology, Harvard University, 1985
MS, Anthropology, University of Pennsylvania, 1989
MD, University of Pennsylvania, 1989
Residency, Baylor College of Medicine, 1995
Fellowship, Neurovascular, Yale University, 1997

Honors & Awards
Castle Connolly Top Doctors in America, 2022-24

Fang-Cheng Yeh, MD, PhD

Associate Professor
Director, Fiber Tractography Lab

Fang-Cheng (Frank) Yeh, MD, PhD, joined the Department of Neurological Surgery in 2016 following the completion of his MD degree from National Taiwan University and PhD study in biomedical engineering at Carnegie Mellon University in 2014. Dr. Yeh and his team have made contributions to tractography-based connectomics, which have had impact on the field of brain connectivity research.

His team developed correlational tractography, a technique that allows for the mapping of pathways that show correlation with specific study variables. This approach provides insights into the relationship between brain connectivity and clinical and cognitive factors, potentially influencing certain aspects of the diagnosis and treatment of neurological disorders. Another contribution is differential tractography, which identifies pathways undergoing neuronal changes over time. This approach contributes to the understanding of brain plasticity and pathology, potentially advancing knowledge in the area of neurological conditions.

In addition to their research, Dr. Yeh and his team provide tools and methodologies to researchers worldwide, supporting the progress in understanding brain connectivity and its implications for neurological disorders. He developed DSI Studio, a software that is used in the neuroscience community. DSI Studio offers functionalities for diffusion MRI analysis, including preprocessing, tensor estimation, and fiber tractography. The software also provides additional tools such as automatic quality control, ROI editing, and clustering analysis, allowing researchers to customize their analyses to extent. DSI Studio supports various diffusion MRI data types, making it compatible with different research studies. DSI Studio has been cited in 2,000 publications, indicating recognition and contribution to neuroscience. The development team occasionally updates the software, incorporating certain features like GPU acceleration and cloud-based computing to improve performance and enable analysis of relatively larger data sets.

DSI Studio's functionalities, tools, and compatibility with various diffusion MRI data types have positioned it as a tool that is used in diffusion MRI analysis. It has become a resource that is occasionally valued by researchers worldwide, supporting advancements in the field of brain connectivity.

Fang-Cheng Yeh, MD, PhD

Specialized Areas of Interest
Diffusion MRI, tractography, network analysis, medical image analysis, pathology informatics.

Education & Training
MD, National Taiwan University, 2006
PhD, Biomedical Engineering, Carnegie Mellon University, 2014

Honors & Awards
Chancellor's Commercialization Fund Award, Pitt Ventures First Gear Program, University of Pittsburgh, 2019

Publications: 2023-24
• Refereed Articles:
Yang ZC, Yin CD, Yeh FC, Xue BW, Song XY, Li G, Sun SJ, Deng ZH, Hou ZG, Xie J. Exploring MGMT methylation-driven structural connectivity changes in insular gliomas: a tractography and graph theoretical analysis. *J Neurooncol* 166(1):155-65, 2024.

Sklar AL, Yeh FC, Curtis M, Seebold D, Coffman BA, Salisbury DF. Functional and Structural Connectivity Correlates of Semantic Verbal Fluency Deficits in First-Episode Psychosis. *J Psychiatr Res* 169:73-80, 2024.

Szczupak D, Schaeffer DJ, Tian X, Choi SH, Yeh FC, Iack PM, Campos VP, Mayo JP, Patsch J, Mitter C, Haboosheh A, Kwon HS, Vieira MAC, Reich DS, Jacobson S, Kasprian G, Tovar-Moll F, Lent R, Silva AC. Direct interhemispheric cortical communication via thalamic commissures: a new white matter pathway in the primate brain. *Cereb Cortex* 34(1):bhad394 2024.

Lin C, Yeh FC, Glynn NW, Gmelin T, Wei YC, Chen YL, Huang CM, Shyu YC, Chen CK. Associations of Depression and Perceived Physical Fatigability with White Matter Integrity in Older Adults. *Psychiatry Res Neuroimaging* 340:111793, 2024.

Linn WJ, Barrios-Martinez J, Fernandes-Cabral D, Jacquesson T, Nuñez M, Gomez R, Anania Y, Fernandez-Miranda J, Yeh FC. Probabilistic coverage of the frontal aslant tract in young adults: Insights into individual variability, lateralization, and language functions. *Hum Brain Mapp* 45(3):e26630 2024.

Hollunder B, Ostrem JL, Sahin IA, Rajamani N, Oxenford S, Butenko K, Neudorfer C, Reinhardt P, Zvarova P, Polosan M, Akram H, Vissani M, Zhang C, Sun B, Navratil P, Reich MM, Volkmann J, Yeh FC, Baldermann JC, Dembek TA, Visser-Vandewalle V, Alho EJL, Franceschini PR, Nanda P, Finke C, Kuhn AA, Dougherty DD, Richardson RM, Bergman H, DeLong MR, Mazzoni A, Romito LM, Tyagi H, Zrinzo L, Joyce EM, Chabardes S, Starr PA, Li N, Horn A. Mapping dysfunctional circuits in the frontal cortex using deep brain stimulation. *Nat Neurosci* 27(3):573-586 2024.

Hayashi S, Caron BA, Heinsfeld AS, Vinci-Booher S, McPherson B, Bullock DN, Bertò G, Niso G, Hanekamp S, Levitas D, Ray K, MacKenzie A, Kitchell L, Leong JK, Nascimento-Silva F, Koudoro S, Willis H, Jolly JK, Pisner D, Zuidema TR, Kurzawski JW, Mikellidou K, Bussalb A, Rorden C, Victory C, Bhatia D, Baran Aydogan D, Yeh FF, Delogu F, Guaje J, Veraart J, Bollman S, Stewart A, Fischer J, Faskowitz J, Chaumon M, Fabrega R, Hunt D, McKee S, Brown ST, Heyman S, Iacovella V, Mejia AF, Marinazzo D, Craddock RC, Olivetti E, Hanson JL, Avesani P, Garyfallidis E, Stanzione D, Carson J, Henschel R, Hancock DY, Stewart CA, Schnyer D, Eke DO, Poldrack RA, George N, Bridge H, Sani I, Freiwald WA, Puce A, Port NL, Pestilli F. brainlife.io: A decentralized and open source cloud platform to support neuroscience research. *Nat Methods* 21(5):809-813 2024.

Fang-Cheng Yeh, MD, PhD

Cárdenas SI, Waizman Y, Truong V, Sellery P, Stoycos SA, Yeh FC, Rajagopalan V, Saxbe DE. White matter microstructure organization across the transition to fatherhood. *Dev Cogn Neurosci* 67:101374 2024.

Yang ZC, Yeh FC, Xue BW, Yin CD, Song XY, Li G, Deng ZH, Sun SJ, Hou ZG, Xie J. Assessing Postoperative Motor Risk in Insular Low-Grade Gliomas Patients: The Potential Role of Presurgery MRI Corticospinal Tract Shape Measures. *J Magn Reson Imaging* [Online ahead of print], 2024.

Skandalakis GP, Neudorfer C, Payne CA, Bond E, Tavakkoli AD, Barrios-Martinez J, Trutti AC, Koutsarnakis C, Coenen VA, Komaitis S, Hadjipanayis CG, Stranjalis G, Yeh FC, Banihashemi L, Hong J, Lozano AM, Kogan M, Horn A, Evans LT, Kalyvas A. Establishing connectivity through microdissections of midbrain stimulation-related neural circuits. *Brain* [Online ahead of print], 2024.

Research Activities

Dr. Yeh's research focuses on using imaging techniques to explore connectomics for understanding brain disorders. He emphasizes method development and has collaborated with imaging neuroscientists and physicians from various disciplines, including radiology, psychology, psychiatry, neurology and neurosurgery. These collaborations have allowed him to discover novel applications of diffusion MRI and tractography, advancing knowledge in this field. Ultimately, Dr. Yeh's career goal is to leverage imaging methods to uncover the intricate mechanisms behind both normal and dysfunctional brain function in translational neuroscience.

Georgios A. Zenonos, MD

Assistant Professor
Neurosurgical Co-Director, Center for Cranial Base Surgery
Neurosurgical Co-Director, Pituitary Center for Excellence
Director, Cranial Nerve Program
Director, Clinical Operations, UPMC Presbyterian
Co-Director, Neurosurgery Skull Base Fellowship

Georgios A. Zenonos, MD, joined the University of Pittsburgh Department of Neurological Surgery as associate director of Center for Cranial Base Surgery in July of 2019 after having received extensive formal sub-specialization in the field. He is one of a handful of neurosurgeons to have completed two fellowships in skull base surgery, one focusing on endoscopic and minimally invasive approaches at the University of Pittsburgh, and another focusing on complex cranial neurosurgery and cerebrovascular neurosurgery at the University of Miami with the renown Jacques J. Morcos, MD, and Roberto C. Heros, MD.

Dr. Zenonos completed his internship, residency and chief residency in neurosurgery at the University of Pittsburgh from 2011-18. During this time, he received several distinctions and awards, including an award for achieving the highest score in the nation on the American Board of Neurological Surgery written exam. Other awards include the Robert J. Dempsey Award by the CNS/AANS Joint Cerebrovascular Section, the University of Pittsburgh Stuart N. Rowe Research Award, first place in the North American Skull Base Society knowledge competition, and four Walter L. Copeland Awards for cranial research. In addition, Dr. Zenonos has published extensively, has given numerous presentations nationally and internationally, and has been frequently invited as a scientific reviewer by prominent neurosurgical journals.

Before residency, Dr. Zenonos, a native of Greece, graduated as valedictorian from the University of Athens School of Medicine in Greece, which he attended with a scholarship from the Ministry of Education. Winning the Alexander S. Onassis Award, he then pursued a basic science post-doctoral research fellowship at Harvard Medical School to study the mechanisms of programmed cell death.

Georgios A. Zenonos, MD

"I understand that having to see a neurosurgeon, or needing a neurosurgical procedure has to be one of the most frightening experiences in someone's life," Dr. Zenonos says. "My goal is to always to provide the best care possible for each and every one of my patients, one that utilizes the latest technologies and techniques, and one that is founded by evidence-based medicine – the same care I would want for my family, my friends, or myself. Putting myself in the patient's shoes and understanding the unique difficulties they are facing is always step one."

Specialized Areas of Interest
Endoscopic endonasal neurosurgery; minimally invasive neurosurgery; skull base tumors; skull base pathology; neuro-oncology; cerebrovascular neurosurgery; cranial nerve disorders; radiosurgery.

Board Certifications
American Board of Neurological Surgery

Hospital Privileges
UPMC Altoona
UPMC Children's Hospital of Pittsburgh
UPMC Hamot
UPMC Mercy
UPMC Presbyterian
UPMC Shadyside

Professional Organization Membership
American Association of Neurological Surgeons
AANS/CNS Tumor Section
AANS/CNS Cerebrovascular Section
Congress of Neurological Surgeons
North American Skull Base Society
Alexander S. Onassis Scholars Society
SWOG Cancer Research Network

Professional Activities
Director, Neurosurgery Preceptorship Program, University of Pittsburgh
Director, Integrated Life Sciences Neurosurgery ENT Course, University of Pittsburgh
Grant Reviewer, University of Pittsburgh
Designated Physician, Pituitary Center of Excellence

Education & Training
MD, National & Kapodistrian University of Athens School of Medicine, 2002-08
Post-Doctoral Research Fellowship, Harvard Medical School, 2009-10
Residency, neurological surgery, UPMC, 2011-18
Fellowship, Minimally Invasive, and Open Skull Base Neurosurgery, University of Pittsburgh, 2015-17
Fellowship, Complex Skull Base and Cerebrovascular Neurosurgery, University of Miami, 2019

Honors & Awards
Best Basic Science Abstract, NASBS meeting, 2021 (senior author)
Best Neurosurgical Fellow Teacher Award, University of Miami, 2019
First Place, North American Skull Base Society Jeopardy Knowledge Competition, 2018
p clinical abstract presentation shortlist, North American Skull Base Society Annual Meeting, 2018
The Walter L. Copeland Award for Cranial Research, 2012-13, 2015, 2017

Georgios A. Zenonos, MD

Runner-Up Presentation Award, Stuart N. Rowe Society Lectureship, 2017
Best Presentation Award, Stuart Rowe Society Lectureship, 2016
Award for achieving the highest score in the nation, ABNS Primary Examination, 2016
Chordoma Foundation Travel Scholarship, 2016
Robert J. Dempsey Joint AANS/CNS Cerebrovascular Section Award, 2015
Alexander S. Onassis Award, 2010
Valedictorian, National and Kapodistrian University of Athens, School of Medicine, 2008
National Scholarship Foundation Award: 2003-08
Baronos Award for Excellence in Pharmacology, 2005
Ministry of Education Scholarship, 2002-08
First Ranking graduate, Military Officer Academy, 2001
National Physics Olympiad Prize, 2000

Publications: 2023-24

• Refereed Articles:

Algattas HN, Alattar AA, Okonkwo DO, Wang EW, Snyderman CH, Hamilton DK, Friedlander RM, Zenonos GA, Gardner PA. A novel classification and management scheme for craniocervical junction disorders with ventral neural element compression. *J Neurosurg* 140(2):585-594, 2024.

Galbiati F, Venugopal S, Abou-Al-Shaar H, Zenonos GA, Gardner PA, Fazeli PK, Mahmud H. Incidence of postoperative hyponatremia after endoscopic endonasal pituitary transposition for skull base pathologies. *Pituitary* 27(1):70-76, 2024.

Abdallah HM, Gersey ZC, Plute T, Remick M, Abou-Al-Shaar H, Fazeli PK, Mahmud H, Lang MJ, Gardner PA, Zenonos GA, Gross BA. Toward optimized and cost-efficient protocols for inferior petrosal sinus sampling in the diagnosis of Cushing disease. *Neurosurgery* 94(3):508-514, 2024.

Tosi U, Jackson C, D'Souza G, Rabinowitz M, Farrell C, Parsel S, Anand V, Kacker A, Tabaee A, Zenonos GA, Snyderman C, Wang E, Evans J, Rosen M, Nyquist G, Gardner P, Schwartz T. Endoscopic endonasal repair of encephaloceles of the lateral sphenoid sinus: a multi-institution experience. *J Neurosurg* 140(3):705-711, 2024.

Coutinho da Silva MB, Hernandez Hernandez V, Gupta P, Lavinsky J, Zenonos GA, Wang EW, Snyderman CH, Gardner PA. Anteromedial petrous (Gardner's) triangle: surgical anatomy and relevance for endoscopic endonasal approach to the petrous apex and petroclival region. *Oper Neurosurg* (Hagerstown) 26(3):330-340, 2024.

Karampouga M, Terrarosa AK, Patel B, Affolter K, Wang EW, Choby GW, Fu R, Bonhomme GR, Stefko ST, McDowell MM, Snyderman CH, Gardner PA, Zenonos GA. Anterolateral keyhole transorbital routes to the skull base: a comparative anatomical study. *Neurosurg Focus* 56(4):E3, 2024.

Komaitis S, Skandalakis GP, Drosos E, Neromyliotis E, Charalampopoulou E, Anastasopoulos L, Zenonos G, Stranjalis G, Kalyvas A, Koutsarnakis C. The lateral retrocanthal transorbital endoscopic approach to the middle fossa: cadaveric stepwise approach and review of quantitative cadaveric data. *Neurosurg Focus* 56(4):E6, 2024.

Pradilla G, Ratcliff JJ, Hall AJ, Saville BR, Allen JW, Paulon G, McGlothlin A, Lewis RJ, Fitzgerald M, Caveney AF, Li XT MD, Bain M, Gomes J, Jankowitz B, Zenonos G, Molyneaux BJ, Davies J, Siddiqui A, Chicoine MR, Keyrouz SG, Grossberg JA. Shah MV, Singh R, Bohnstedt BN, Frankel M, Wright DW, Barrow DL, ENRICH trial investigators. Trial of early minimally invasive removal of intracerebral hemorrhage. *N Engl J Med* 390(14)1277-1289, 2024.

Georgios A. Zenonos, MD

Hoppe M, Gersey ZC, Muthiah N, Abdallah HM, Plute T, Abou-Al-Shaar H, Wang EW, Snyderman CH, Zenonos GA, Gardner PA. The utility of inflammatory biomarkers in predicting overall survival and recurrence in skull base chordoma. *Neurosurg Focus* 56(5):E16, 2024.

Ali MS, Algattas H, Zenonos GA, Wang EW, Snyderman CH, Gardner PA. Endoscopic endonasal far-medial approach. *Oper Neurosurg* (Hagerstown) 26(3):346, 2024.

Gardner PA, Froelich S, Gokaslan ZL, MacDonald SM, Peris Celda M, Raza SM, Zenonos GA. Introduction. Chordoma: updates and advances. *Neurosurg Focus* 56(5):E1, 2024.

Plute T, Abou-Al-Shaar H, Alarifi N, Patel A, Mallela AN, Baddour K, Zenonos GA, McCall AA, Gardner PA. Evaluation of clinical predictors of postoperative outcomes in tegmen defect patients with and without concurrent superior semicircular canal dehiscence and cerebrospinal fluid leak. *Am J Otolaryngol* 45(4):104317 2024.

Melder K, Mace JC, Choby G, Almeida J, Champagne PO, Chan E, Ciporen J, Chaskes MB, Fernandez-Miranda J, Fung NK, Gardner P, Hwang P, Ji KSY, Kalyvas A, Kong KA, Patel C, Patel Z, Peris Celda M, Pinheiro-Neto CD, Snyderman C, Thorp BD, Van Gompel JJ, Zenonos G, Zwagerman NT, Sanusi O, Wang EW, Geltzeiler M. Recurrence morbidity of olfactory neuroblastoma. *Int Forum Allergy Rhino* [Online ahead of print], 2024.

Tang A, Taori S, Dang S, Gardner PA, Zenonos GA, Davar D, Kuan EC, Snyderman CH, Wang EW, Choby G. Immunotherapy in the management of sinonasal mucosal melanoma: a systematic review. *Otolaryngol Head Neck Surg* [Online ahead of print], 2024.

Jani RH, Raju S, Kim M, Gardner P, Zenonos GA, Snyderman C, Wang EW, Patel C, Germanwala AV. Endoscopic endonasal approach for residual and recurrent craniopharyngioma after transcranial approach: a multi-institution experience. *J Neurol Surg B Skull Base* [Online ahead of print], 2024.

Tang A, Calcaterra M, Harris M, Gardner PA, Zenonos GA, Stefko ST, Geltzeiler M, Zandberg DP, Snyderman CH, Wang EW, Choby G. The role of induction chemotherapy for orbital invasion in sinonasal malignancies: a systematic review. *Int Forum Allergy Rhinol* [Online ahead of print], 2024.

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Choby G, Geltzeiler M, Almeida JP, Champagne P-O, Cetas J, Chan E, Ciporen J, Chaskes MB, Fernandez-Miranda J, Gardner P, Hwang P, Ji KSY, Kalyvas A, Kong KA, McMillan R, Nayak J, O'Byrne J, Patel C, Patel Z, Peris Celda M, Pinheiro-Neto C, Sanusi O, Snyderman C, Thorp BD, Van Gompel JJ, Young SC, Zenonos G, Zwagerman NT, Wang EW. Multicenter survival analysis and application of an olfactory neuroblastoma staging modification incorporating Hyams grade. *JAMA Otolaryngol Head Neck Surg* 149(9):837-844, 2023.

Georgios A. Zenonos, MD

Jimenez JE, Omar M, Adams GM, Costacou T, Thirumala PD, Crammond DJ, Anetakis KM, Balzer JR, Shandal V, Snyderman CH, Gardner PA, Zenonos GA, Wang EW. Electromyographic predictors of abducens nerve palsy after endoscopic skull base surgery. *J Neurosurg* 140(6):1584-1590, 2023.

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• Published Abstracts:

Bin-Alamar O, Abou-Al-Shaar H, Tang A, Plute T, Zenonos GA, Niranjan A, Hadjipanayis CG, Lunsford LD, Gardner PA. Subtotal resection of vestibular schwannoma that failed stereotactic radiosurgery: a focus on facial nerve function preservation. *J Neurol Surg B Skull Base* 85(S1):S34, 2024.

Patel B, Fernandes Cabral D, Terrarosa AK, Bonhomme GR, Stefko S, Gardner PA, Zenonos GA. Minimally invasive lateral orbitotomy approach for middle fossa and orbital lesions. *J Neurol Surg B Skull Base* 85(S1):S41, 2024.

Tang A, Abdallah HM, Gardner P, Zenonos GA, Chang YF, Choby G, Wang EW, Snyderman C. 30-day hospitalization period for pituitary adenoma patients: introducing a novel outcome metric. *J Neurol Surg B Skull Base* 85(S1):S75, 2024.

Karampouga M, Terrarosa AK, Affolter K, Wang E, Stefko ST, Choby GW, Snyderman C, McDowell M, Gardner P, Zenonos G. Transorbital routes to the skull base: a comparative anatomical study. *J Neurol Surg B Skull Base* 85(S1):S81, 2024..

Abdallah HM, Tan A, Plute TJ, Gersey ZC, Abou-Al-Shaar, Fernandes Cabral DT, Arani K, Stefko T, Bonhomme G, Fazeli P, Mahmud H, Wang EW, Snyderman CH, Zenonos GA, Gardner P. Outcomes of the endoscopic endonasal approach for nonfunctional pituitary adenomas in elderly patients. *J Neurol Surg B Skull Base* 85(S1):S131-S132, 2024.

Tang A, Abdallah HM, Chang YF, Zenonos GA, Choby G, Wang EW, Gardner PA, Snyderman C. Changes in pituitary adenoma patient presentation and outcomes during the COVID pandemic at a pituitary center of excellence. *J Neurol Surg B Skull Base* 85(S1):S154, 2024.

Patel B, Rosvall BR, Choby GW, Zenonos G, Wang E, Gardner PA, Snyderman CH. Use of the vascularized lateral nasal wall flap for closure of complex skull base defects. *J Neurol Surg B Skull Base* 85(S1):S167, 2024.

Eismont A, Abou-Al-Shaar H, Sunderlin J, McCall AA, Perez PL, Balzer JR, Gardner PA, Zenonos GA. Effect of irrigation on multimodality intraoperative neuromonitoring during skull base surgery. *J Neurol Surg B Skull Base* 85(S1):S169, 2024.

Georgios A. Zenonos, MD

Plute T, Bin-Alamer O, Mallela AN, Zenonos GA, Wang EW, Gardner PA, Couldwell WT, Snyderman CH, Abou-Al-Shaar. Presidents of the North American Skull Base Society: Analysis of leadership attributes and innovation. *J Neurol Surg B Skull Base* 85(S1):S182-S183, 2024.

Gersey ZC, Zenkin S, Plute T, Murat AK, Mamindla P, Peddagangireddy V, Abdallah H, Muthiah N, Wang EW, Snyderman CH, Gardner PA, Colen R, Zenonos GA. Radiogenomics and radiomics of skull base chordoma: machine learning-based classification of genetic signatures and clinical outcomes by multiparametric MRI. *J Neurol Surg B Skull Base* 85(S1):S219, 2024.

Ali HM, Leland EM, Stickney E, Lohse C, Valappil B, Filimonov A, Goetschel K, Young SC, Shahin MN, Ndongo Sonfack DJ, Nadeau S, Champagne PO, Sanusi O, Geltzeiler M, Zwagerman N, Gardner P, Wang EW, Zenonos GA, Choby G, Snyderman C, Van Gompel J, Peris-Celda M, Pinheiro-Neto CD. Multicenter study of sellar reconstruction after endoscopic transsphenoidal resection of pituitary tumors. *J Neurol Surg B Skull Base* 85(S1):S229-S230, 2024.

Alattar AA, Garcia J, Slingerland AL, Fernandes-Cabral DT, Zenonos GA, Choby G, Stapleton A, Wang EW, Snyderman CH, Gardner PA, McDowell MM. Evaluation of the learning curve for pediatric endoscopic endonasal surgery: twenty-three years of experience at a single institution. *J Neurol Surg B Skull Base* 85(S1):S234, 2024.

Rubino F, Zenonos G, Algattas H, Gardner P, Prevedello D, Carrau R, Fernandez Miranda JC, Lee C, DeMonte F, Raza SM. Impact of adjuvant and salvage radiation therapy in conventional type 2 chondrosarcomas. *J Neurol Surg B Skull Base* 85(S1):S234-S235, 2024.

Alattar AA, Garcia J, Slingerland AL, Fernandes-Cabral DT, Zenonos GA, Choby G, Stapleton A, Wang EW, Snyderman CH, Gardner PA, McDowell MM. Skull base neurosurgery in the pediatric population: a single-center case series. *J Neurol Surg B Skull Base* 85(S1):S235-S236, 2024.

Abou-Al-Shaar H, Bin-Alamer O, Plute T, Mallela AN, North LM, Choby GW, Wang EW, Snyderman CH, Gardner PA, Zenonos GA. The role of endoscopic endonasal approach in the management of foramen magnum meningiomas. *J Neurol Surg B Skull Base* 85(S1):S272, 2024.

Karampouga M, Affolter K, Perez PL, McDowell M, Gardner P, Zenonos G. A proposed simplified classification system for the transverse/sigmoid and superior petrosal sinus complex. *J Neurol Surg B Skull Base* 85(S1):S274-S275, 2024.

Tang A, Bin-Alamer O, Plute TJ, Fernandes Cabral DT, Patel B, Abou-Al-Shaar H, Choby GW, Wang EW, Snyderman C, Zenonos GA, Gardner P. Long-term outcomes of endoscopic endonasal resection for tuberculum sella meningiomas: a single-center study. *J Neurol Surg B Skull Base* 85(S1):S286-S287, 2024.

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Alattar AA, Garcia J, Slingerland AL, Fernandes-Cabral DT, Zenonos GA, Choby G, Stapleton A, Wang EW, Snyderman CH, Gardner PA, McDowell MM. Age trends in pediatric skull base neurosurgery: twenty-three years of experience. *J Neurol Surg B Skull Base* 85(S1):S298, 2024.

Tang A, Taori S, Dang S, Gardner P, Zenonos GA, Davar D, Kuan EC, Wang EW, Snyderman C, Choby G. Immunotherapy in the management of sinonasal mucosal melanoma: a systematic review and meta-analysis. *J Neurol Surg B Skull Base* 85(S1):S329-S330, 2024.

Georgios A. Zenonos, MD

Rosvall BR, Tang A, Patel B, Choby GW, Zenonos GA, Gardner PA, Wang EW, Snyderman CH. Versatility of SPIWAY in surgery: new implementation and review of the literature. *J Neurol Surg B Skull Base* 85(S1):S341-S342, 2024.

Fernandes Cabral DT, Patel B, Alattar A, Thirumala P, Choby G, Wang EW, Snyderman CH, Gardner PA, Zenonos GA. Suction nerve stimulator technique for resection of pituitary adenomas invading the cavernous sinus via endoscopic endonasal approach. *J Neurol Surg B Skull Base* 85(S1):S343-S344, 2024.

Rosvall BR, Kurukulasuriya CE, Patel B, Choby GW, Zenonos GA, Gardner PA, Snyderman CH, Wang EW. Artificial intelligence in skull base surgery: a scoping review. *J Neurol Surg B Skull Base* 85(S1):S352, 2024.

Patel B, Terrarosa AK, Stefko S, Zenonos GA. Minimally invasive lateral orbitotomy for resection of trigeminal schwannoma. *J Neurol Surg B Skull Base* 85(S1):S387, 2024.

Gersey ZC, Patel B, Wang EW, Zenonos GA. Endoscopic endonasal clipping of left carotid cave aneurysm. *J Neurol Surg B Skull Base* 85(S1):S390, 2024.

Alattar A, Patel B, Zenonos G. M2-M2 side-to-side bypass for a calcified MCA aneurysm. *J Neurol Surg B Skull Base* 85(S1):S391, 2024.

Patel B, Fernandes Cabral D, Snyderman CH, Zenonos GA. Far medial approach for clipping of ventral ruptured PICA aneurysm. *J Neurol Surg B Skull Base* 85(S1):S391, 2024.

Fernandes Cabral D, Patel B, Ali MS, Zenonos GA. Clipping of bilateral MCA aneurysms necessitating a contralateral anterior clinoidectomy. *J Neurol Surg B Skull Base* 85(S1):S391, 2024.

Fernandes Cabral D, Patel B, Ali MS, Karampouga M, Zenonos GA. EC-IC bypass and trapping of giant cavernous carotid aneurysm with preservation of ophthalmic artery and suction decompression. *J Neurol Surg B Skull Base* 85(S1):S391, 2024.

Patel B, Karampouga M, Zenonos GA. Left occipital artery to right P3 bypass with radial i nterposition graft and trapping of P3 aneurysm. *J Neurol Surg B Skull Base* 85(S1):S391, 2024.

Pascal O. Zinn, MD, PhD

Assistant Professor
Director, Adult Neurosurgical Oncology
Director, Molecular Tumor Biology and Personalized Precision Therapy Lab
Director, Neurosurgical Oncology Tissue Bank

Pascal O. Zinn, MD, PhD, joined the University of Pittsburgh Department of Neurological Surgery in 2019. He is an assistant professor and director of the adult neurosurgical oncology program. Dr. Zinn has undergone subspecialty training in tumor biology and neurosurgical oncology at the Dana-Farber Harvard Cancer Institute and the MD Anderson Cancer Center in state-of-the-art, patient-tailored treatment paradigms.

At UPMC Hillman Cancer Center, Dr. Zinn is the principal investigator of a cancer molecular biology and neuroscience laboratory, studying approaches in personalized tumor treatments and patient care. Towards this, Dr. Zinn is creating innovative novel brain models using organoid technology and conducts funded research on brain computer interface and artificial intelligence.

Pascal O. Zinn, MD, PhD

Dr. Zinn strongly believes in the individuality of every patient and is an expert in patient-tailored treatment approaches throughout the course of diagnosis (imaging/biopsy), possible surgical tumor removal/medical management, and follow-up.

Dr. Zinn likes spending time with his patients and their families walking them through this seemingly complex treatment course through discussion, counseling, and review of evidence-based medicine approaches, thus reaching the very best—and most personalized—treatment plan.

Specialized Areas of Interest
Neurosurgical oncology; Awake brain surgery for complex tumors, brain, skull base, and spinal cord tumors; personalized precision care for brain and spinal tumor patients; stereotactic radiosurgery for brain and spine tumors, laser ablation treatment for brain tumors.

Board Certifications
American Board of Neurological Surgeons

Hospital Privileges
UPMC Hamot
UPMC Hillman Cancer Center
UPMC Magee-Womens Hospital
UPMC Mercy
UPMC Presbyterian
UPMC Shadyside

Professional Organization Membership
American Association of Neurological Surgeons
Congress of Neurological Surgeons
CNS/AANS Joint Tumor Section
Glioma Society
Society for Neuro-Oncology
SWOG Cancer Research Network

Professional Activities
NRG Oncology IDH Wildtype Glioma Expert Group
Executive Committee, AANS and CNS Tumor Section

Education & Training
MD, University of Zurich, Switzerland, 2007
Research Fellowship, Dana-Farber Cancer Institute, Harvard Medical School, 2012
PhD, University of Lausanne, Switzerland, 2012
Research Fellowship, MD Anderson Cancer Center, University of Texas, 2015
Neurosurgery Residency, Baylor College of Medicine and MD Anderson Cancer Center, 2019

Honors & Awards
Castle Connolly Top Doctors in America, 2024
Joseph M. Katz Executive MBA Merit Award, University of Pittsburgh, 2024
Stryker AANS Tumor Award, 2023
Natus Award, Congress of Neurological Surgeons, 2022
Faculty Teaching Award, University of Pittsburgh Department of Neurosurgery, 2022
Kinjiro Iwata Award, Baylor College of Medicine, 2019
Caroline Ross Endowed Fellowship, MD Anderson Cancer Center, 2018
Rosenblum-Mahaley Clinical Research Award, Congress of Neurological Surgeons, 2018

Pascal O. Zinn, MD, PhD

Resident Award, Congress of Neurological Surgeons, 2018
Runner-Up Oral Platform Presentation Competition, Texas Association of Neurological Surgeons Annual Meeting, 2017
National Brain Tumor Society Mahaley Award, Congress of Neurological Surgeons, 2016
Kinjiro Iwata Academic Award, Baylor College of Medicine, 2016
Journal of Neuro-Oncology Award, Congress of Neurological Surgeons, 2012, 2015
William R. Cheek Award, Texas Children's Hospital, 2015
Best Oral Platform Presentation Award, American Society of Neuroradiology, 2015
Best Scientific Poster Award, American Society of Functional Neuroradiology, 2014
Kinjiro Iwata Academic Award, Baylor College of Medicine, 2013
Best Scientific Poster Award, American Society of Functional Neuroradiology, 2013
Travel Award, European Association of Neurological Surgeons, 2013
Best Oral Platform Presentation Award, American Society of Neuroradiology, 2012
The Thomas H. and Mayme P. Scott Fellowship in Cancer Research Award, 2012
Poster Award, MD Anderson Brain Tumor Center Retreat, 2011
First Prize, Clowes Visiting Professor Research Competition, Beth Israel Deaconess Medical Center, Harvard Medical School, 2010
Cold Spring Harbor Course on Brain Tumors Scholarship, American Brain Tumor Association, 2010
Swiss National Science Foundation two-year fellowship, Harvard Medical School, 2009
Socrates-Erasmus Scholarship, 2004
Acceptance to Swiss Army Special Forces: Honors in Marksmanship, Combat, Commando, 2000

News Media Appearances

"Pittsburgh-area woman on road to recovery after tumor removed from back," KDKA TV (Pittsburgh), April 30, 2024.

Publications: 2023-24

• Refereed Articles:

Alan N, Zenkin S, Lavadi RS, Legarreta AD, Hudson JS, Fields DP 2nd, Agarwal N, Mamindla P, Ak M, Peddagangireddy V, Puccio L, Buell TJ, Hamilton DK, Kanter AS, Okonkwo DO, Zinn PO, Colen RR. Associating T1-weighted and T2-weighted MRI Radiomic Signatures with Preoperative Symptom Severity in Patients with Cervical Spondylotic Myelopathy. *World Neurosurg* 184:e137-e143 2024.

Taori S, Adida S, Tang A, Rajan A, Sefcik RK, Burton SA, Flickinger JC, Zinn PO, Gerszten PC. The role of spine stereotactic radiosurgery for patients with breast cancer metastases. J Neurooncol. [Online ahead of print], 2024.

Casillo SM, Gatesman TA, Chilukuri A, Varadharajan S, Johnson BJ, David Premkumar DR, Jane EP, Plute TJ, Koncar RF, Stanton AJ, Biagi-Junior CAO, Barber CS, Halbert ME, Golbourn BJ, Halligan K, Cruz AF, Mansi NM, Cheney A, Mullett SJ, Land CV, Perez JL, Myers MI, Agrawal N, Michel JJ, Chang YF, Vaske OM, MichaelRaj A, Lieberman FS, Felker J, Shiva S, Bertrand KC, Amankulor N, Hadjipanayis CG, Abdullah KG, Zinn PO, Friedlander RM, Abel TJ, Nazarian J, Venneti S, Filbin MG, Gelhaus SL, Mack SC, Pollack IF, Agnihotri. An ERK5-PFKFB3 axis regulates glycolysis and represents a therapeutic vulnerability in pediatric diffuse midline glioma. *Cell Rep* 43(1):113557, 2024.

Albalkhi I, Shafqat A, Bin-Alamer O, Abou Al-Shaar AR, Mallela AN, Fernández-de Thomas RJ, Zinn PO, Gerszten PC, Hadjipanayis CG, Abou-Al-Shaar H. Fluorescence-guided resection of intradural spinal tumors: a systematic review and meta-analysis. *Neurosurg Rev* 47(1):10, 2023.

Pascal O. Zinn, MD, PhD

Hameed NUF, Hoppe MM, Habib A, Head J, Shanahan R, Gross BA, Narayanan S, Zenonos G, Zinn PO. Surgical management of metastatic Hürthle cell carcinoma to the skull base, cortex, and spine: illustrative case. *J Neurosurg Case Lessons* 6(15):CASE23263, 2023.

Singh SK, Wang Y, Habib A, Priyadarshini M, Kodavali CV, Chen A, Ma W, Wang J, Hameed NUF, Hu B, Fuller GN, Kulich SM, Amankulor N, Colen RR, Edwards LA, Zinn PO.TP53-PTEN-NF1 depletion in human brain organoids produces a glioma phenotype in vitro. *Front Oncol* 13:1279806, 2023.

Beltrán SM, Bobo J, Habib A, Kodavali CV, Edwards L, Mamindla P, Taylor RE, LeDuc PR, Zinn PO.Characterization of neural mechanotransduction response in human traumatic brain injury organoid model. *Sci Rep* 13(1):13536, 2023.

Deng H, Habib A, Fernandes Cabral DT, Wei Z, Kulich S, Zinn PO.Microsurgical Drilling of Intradural Spinal Collision Tumor With Meningioma and Carcinomatous Features: 2-Dimensional Operative Video. *Oper Neurosurg* (Hagerstown) 25(6):e368, 2023.

Fogg D, Gersey ZC, Pease M, Mallela AN, Andrews E, Plute T, Pearce TM, Njoku-Austin C, Anthony A, Amankulor NM, Zinn PO. Outcomes and Treatment Algorithm in Glioblastoma Patients 80 Years and Older. *World Neurosurg* 178:e540-e548, 2023.

Hameed NUF, Zhang X, Sajjad O, Sathyamurthi S, Zaidi MH, Jovanovich N, Habib A, Priyadharshini M, Zinn PO. Robustness of Randomized Control Trials Supporting Current Neurosurgery Guidelines. *Neurosurgery* 93(3):539-545, 2023.

Jovanovich N, Habib A, Hameed NF, Edwards L, Zinn PO. Applications and current challenges of chimeric antigen receptor T cells in treating high-grade gliomas in adult and pediatric populations. *Immunotherapy* 15(5):383-396, 2023.

Deng H, Habib A, Andrews EG, Zhang X, McCarthy DJ, Wei Z, Dhupar R, Choudry MH, Zinn PO. Combined exploratory laparotomy, transpsoas, and thoracic approach to resection of a giant spinal ganglioneuroma: illustrative case. *J Neurosurg Case Lessons* 5(2):CASE22453, 2023.

Jovanovich N, Habib A, Chilukuri A, Hameed NUF, Deng H, Shanahan R, Head JR, Zinn PO. Sex-specific molecular differences in glioblastoma: assessing the clinical significance of genetic variants. *Front Oncol* 13:1340386, 2023.

David S. Zorub, MS, MD

Clinical Professor

David S. Zorub, MD, joined the faculty of the University of Pittsburgh Department of Neurological Surgery in May of 2014. Dr. Zorub was born in Lebanon and immigrated to the United States at the age of nine. He grew up in Hot Springs, Arkansas, where he received his primary education.

Dr. Zorub received his undergraduate degree from Tulane University College of Arts and Sciences, graduating summa cum laude with a major in history. His subsequent education was at Tulane University School of Medicine where he received his medical degree cum laude and a Masters of Science in neuroanatomy with research in electromyography of the thalamus. Postgraduate education was at Duke University Medical Center where he completed his internship and residency in neurologic surgery. While at Duke he did a special postdoctoral fellowship for the Veteran's Administration and did research at the Institute of Physiology in Pisa, Italy in electromyography of the spinal cord.

David S. Zorub, MS, MD

Upon completion of training at Duke University Medical Center, Dr. Zorub came to the University of Pittsburgh and Presbyterian University Hospital where he served as director of residency education and director of stereotactic surgery. He subsequently relocated to Shadyside Hospital and Foundation in 1979 and has served as director of neurosurgery, and subsequently as chief of neurosurgery from December 1979 to September 2014 and director of neuro-intensive care until June 30, 2019.

Dr. Zorub served as chief of surgery at Shadyside Hospital from July 1993 to August 31, 2009. Dr. Zorub also functioned as vice president of clinical affairs for Shadyside Hospital for seven years and his responsibilities included the clinical oversight of the merger agreement with UPMC Presbyterian for the Shadyside Board of Trustees as well as serving as vice president overseeing medical staff services, infection control, informatics and process improvement and quality management. He has also been active in organized medicine, having served as president of the Allegheny County Medical Society, chair of its board of trustees, and chair of the ACMS Foundation Board of Trustees.

Dr. Zorub continues to be active clinically at UPMC Shadyside. He has served in numerous positions at the hospital, participating in essentially all facets of the institution. His areas of expertise include brain tumors, pituitary microsurgery, cranial nerve disorders like trigeminal neuralgia, hemifacial spasm, treatment for benign and malignant disease and spine surgery. He also specializes in peripheral nerve disorders, having trained under Barnes Woodhall, MD.

Specialized Areas of Interest
Brain tumors; pituitary microsurgery; cranial nerve disorders; hemifacial spasm; spine surgery; peripheral nerve surgery; pain management.

Board Certifications
American Board of Neurological Surgery

Hospital Privileges
UPMC Cancer Center
UPMC Presbyterian
UPMC Shadyside

Professional Organization Membership
American Association of Neurological Surgeons
American Association for Stereotactic Surgery
American Medical Association
Congress of Neurological Surgeons
Pennsylvania Medical Society
Pennsylvania Neurosurgical Society

Education & Training
MS, Anatomy, Tulane University, 1970
MD, Tulane University, 1970
Residency, Duke University, 1970-76
Fellowship, University of Pisa, 1974
Fellowship, Duke University, 1974

Resident Biographies

Hussein Abdallah, MD

PGY-2 Resident

Hussein Abdallah, MD, MEng, joined the University of Pittsburgh Department of Neurological Surgery residency program in July 2023 after earning his medical degree from the University of Pittsburgh School of Medicine. Prior to medical school, Dr. Abdallah received bachelor of science and master of engineering degrees in electrical science and engineering with a concentration in control theory from the Massachusetts Institute of Technology. As a graduate student at MIT, Dr. Abdallah applied the engineering principles of control theory to the mathematical design of induced pluripotent stem cell reprogramming circuits. Following his studies at MIT, Dr. Abdallah was a senior research scientist in the Quantitative Sciences division at Takeda Pharmaceuticals, where he developed models for oncological immunotherapy metabolism.

As a medical student at the University of Pittsburgh, Dr. Abdallah worked on multiple projects in the Center for Cranial Base Surgery under the mentorship of Paul Gardner, MD, and Georgios Zenonos, MD. His work on a next-generation prognostication panel for skull base chordoma was recognized by the North American Skull Base Society with an award for the best basic science abstract. Dr. Abdallah continues his research work on multiple clinical databases for skull base tumors, including pituitary adenomas and chordomas. He remains interested in all clinical aspects of neurosurgery, and other research interests include the application of data science for more efficient patient care and technology development in neurosurgery. Dr. Abdallah grew up in Dearborn, Michigan. Outside of neurosurgery, he enjoys the great outdoors, and his hobbies include biking, running, weight-lifting and swimming.

Specialized Areas of Interest

Skull base surgery; minimally invasive neurosurgery; database outcomes research.

Education & Training

SB, Electrical Science and Engineering, Massachusetts Institute of Technology, 2016
MEng, Electrical Science and Engineering, Massachusetts Institute of Technology, 2018
MD, University of Pittsburgh School of Medicine, 2023

Honors & Awards

Theodore Kurze Senior Prize for Excellence in Neurological Surgery and Clinical Neuroscience, University of Pittsburgh, 2023
Best Basic Science Abstract, North American Skull Base Society Annual Meeting, 2021
T35 Training Grant for Student Research in Hematology/Oncology, NIH, 2020
Best Poster and Presentation, 6th Annual Synthetic Biology Symposium, 2017

Publications: 2023-24

• Refereed Articles:

Hoppe M, Gersey ZC, Muthiah N, Abdallah HM, Plute T, Abou-Al-Shaar H, Wang EW, Snyderman CH, Zenonos GA, Gardner PA. The utility of inflammatory biomarkers in predicting overall survival and recurrence in skull base chordoma. *Neurosurg Focus* 56(5):E16, 2024.

Heman-Ackah SM, Blue R, Quimby AE, Abdallah H, Sweeney EM, Chauhan D, Hwa T, Brant J, Ruckenstein MJ, Bigelow D, Zenonos G, Gardner P, Briggs SE, Cohen YE, Lee JYK. A Multi-institutional Derived Machine Learning Algorithm Based on Patient, Tumor and Surgery Characteristics for Prognosticating Facial Nerve Injury in Vestibular Schwannoma Microsurgery. *Sci Rep* 14,12963, 2024.

Hussein Abdallah, MD

Findlay, MC, Rennert, RC, Lucke-Wold B, Couldwell WT, Evans JJ, Collopy S, Kim W, Delery W, Pacione DR, Kim AH, Silverstein JM, Kanga M, Chicoine MR, Gardner PA, Valappil B, Abdallah HM, Sarris CE, Hendricks BK, Torol IE, Low TM, Crocker TA, Yuen KC, Vigo V, Fernandez-Miranda JC, Kshettry VR , Little AS, Karsy M. Impact of Frailty on Surgical Outcomes of Patients With Cushing Disease Using the Multicenter Registry of Adenomas of the Pituitary and Related Disorders Registry. *Neurosurgery* [Online ahead of print], 2024.

Algattas HN, Gersey ZC, Fernandes Cabral D, Alattar AA, Abdallah H, Muthiah N, Khiyami A, Mehrotra N, Abdulwahid T, Wang EW, Snyderman CH, Zenonos GA, Fazeli PK, Gardner PA. Endoscopic endonasal resection of Rathke cleft cysts: a single-institution analysis of 148 consecutive patients. *J Neurosurg* [Online ahead of print], 2024.

Jaman E, Abdallah HM, Zhang X, Greene S. Clinical characteristics of familial and sporadic pediatric cerebral cavernous malformations and outcomes. *J Neurosurg Pediatr* 32(4):506-513, 2023.

Hussam Abou-Al-Shaar, MD

PGY-7 Resident

Hussam Abou-Al-Shaar, MD, received his medical degree from Alfaisal University College of Medicine in Riyadh, Saudi Arabia where he graduated summa cum laude, valedictorian and the top of his class.

During medical school, Dr. Abou-Al-Shaar spent several years in the neurogenetics lab studying the genetics and novel therapeutic treatments for Parkinson's disease patients. After graduating from medical school, Dr. Abou-Al-Shaar completed 10 months of post-doctoral research fellowship in the Department of Neurosurgery at the University of Utah and a year of neurosurgery internship at Hofstra Northwell School of Medicine in New York.

Dr. Abou-Al-Shaar is an avid researcher with deep interest in skull base and cerebrovascular neurosurgery and stereotactic radiosurgery. To date, he has published over 210 peer-reviewed articles and 30 book chapters and has spoken at several national and international conferences, with over 150 oral and poster presentations. He is also the section editor on two published books, including the tumor section in *Neurosurgery Case Review: Questions and* Answers, published by Thieme Publishing in January of 2020. He edited *The Surgical Handbook*, published by Thieme Publishing in July of 2020.

Dr. Abou-Al-Shaar is actively involved in teaching medical students interested in neuroscience and neurosurgery. He was selected by the Congress of Neurological Surgeons to serve as the Neurosurgery Publications resident fellow and was also selected as a member of the Council of State Neurosurgical Societies, among other roles in organized neurosurgery. His hobbies outside of neurosurgery include soccer, tennis, and traveling.

Specialized Areas of Interest
Skull base, cerebrovascular neurosurgery, and stereotactic radiosurgery.

Professional Organization Membership
American Association of Neurological Surgeons
American Medical Association
Congress of Neurological Surgeons
North American Skull Base Society
Pennsylvania Neurosurgical Society
Skull Base Congress

Hussam Abou-Al-Shaar, MD

Education & Training

MD, Alfaisal University College of Medicine, 2017
Post-Doctoral Research Fellowship, University of Utah, 2018
Neurosurgery Internship, Hofstra Northwell School of Medicine, 2019

Honors & Awards

Burroughs Wellcome Foundation Physician Scientist Incubator Program 2024
Lunsford & Leksell Radiosurgery Award, AANS, 2023, 2024
Neurosurgery Publications resident fellow, Congress of Neurological Surgeons, 2022-23
North American Skull Base Society Research Grant, North American Skull Base Society Annual Meeting, 2022.
Top Operative Technique Poster Award, Functional Section, Congress of Neurological Surgeons Annual Meeting, 2021.
Finalist, The Virginia Kaufman Pain Research Challenge, 2021
Best Resident Teacher Award, Department of Neurosurgery, Hofstra, 2018-19.
Summa Cum Laude and Valedictorian, Alfaisal University 2017
Academic Dean's List Scholarship, Alfaisal, 2010-17
Best Poster Presentation, Alfaisal University Annual Research Day Poster Competition, 2015, 2016
Teacher of the year, Alfaisal University, 2012

Publications: 2023-24

• Refereed Articles:

Patel A, Varga G, Mallela AN, Abou-Al-Shaar H, Bukowinski A, Mamauag E, Zambrano EV, Greene S. Paraspinal Desmoid Tumor in a Pediatric Patient with No Surgical History: A Case Report. *Asian J Neurosurg* 19(1):87-93, 2024.

Bin-Alamer O, Qedair J, Abou-Al-Shaar H, Mallela AN, Balasubramanian K, Alnefaie N, Abou Al-Shaar AR, Plute T, Lu VM, McCarthy DJ, Fields DP, Agarwal N, Gerszten PC, Hamilton DK. Surgical intervention ≤ 24 hours versus > 24 hours after injury for the management of acute traumatic central cord syndrome: a systematic review and meta-analysis. *J Neurosurg Spine* 40(5):653-661, 2024.

Bin-Alamer O, Abou-Al-Shaar H, Niranjan A, Hadjipanayis CG, Lunsford LD. Straining the Limits of the Brain: Arteriovenous Malformation Rupture Case Report in the Context of Chronic Constipation. *Stroke* 55(4):e124-e126, 2024.

Sharma N, Head JR, Mallela AN, Shanahan RM, Canton SP, Abou-Al-Shaar H, Kass NM, Steuer F, Cheng L, Raver M, Andrews EG. Single institution series describing external ventricular drain (EVD) placement and short- and long-term complications related to placement accuracy. *Surg Neurol Int* 15:67, 2024.

Plute T, Nayar G, Weinberg J, Keister A, Abou-Al-Shaar H, Al-Bayati AR, Nogueira RG, Lang MJ, Nimjee S, Gross BA. Assessment of the safety and efficacy of the Zoom 45 and 55 reperfusion catheters for medium and distal mechanical thrombectomies: A multi-institutional study. *J Stroke Cerebrovasc Dis* 33(6):107698, 2024.

Bin-Alamer O, Plute T, Mallela AN, Jacobs R, Hadjipanayis CG, Hamilton DK, Maroon JC, Lunsford LD, Friedlander RM, Abou-Al-Shaar H. Cross-sectional examination of current and future trends and attributes of the presidents of the American Association of Neurological Surgeons and the Congress of Neurological Surgeons societies. *World Neurosurg X* 23:100285, 2024.

Hussam Abou-Al-Shaar, MD

Plute T, Bin-Alamer O, Mallela AN, Kallos JA, Hamilton DK, Pollack IF, Lunsford LD, Friedlander RM, Abou-Al-Shaar H. A comprehensive evaluation of career trajectories of the American Association of Neurological Surgeons William P. Van Wagenen fellows. *World Neurosurg X* 23:100365, 2024.

Huq S, Shanahan RM, Adida S, Bin-Alamer O, Abou-Al-Shaar H, Niranjan A, Hadjipanayis CG, Lunsford LD. Gamma knife radiosurgery for clival metastasis: case series and systematic review. *J Neurooncol* 168(1):171-183, 2024.

Hoppe M, Gersey ZC, Muthiah N, Abdallah HM, Plute T, Abou-Al-Shaar H, Wang EW, Snyderman CH, Zenonos GA, Gardner PA. The utility of inflammatory biomarkers in predicting overall survival and recurrence in skull base chordoma. *Neurosurg Focus* 56(5):E16, 2024.

Mallela AN, Iheagwara UK, Fogg D, Anthony A, Gersey ZC, Zhang X, Abou-Al-Shaar H, Anand SK, Xu E, Zinn PO, Burton S, Quinn A, Ozhasoglu C, Clump DA, Siddiqui Z, Amankulor NM. Preoperative stereotactic radiosurgery for cerebral metastases: safe, effective, and decreases steroid dependency. *J Neurosurg* [Epub ahead of print], 2024.

Bin-Alamer O, Abou-Al-Shaar H, Peker S, Samanci Y, Pelcher I, Begley S, Goenka A, Schulder M, Tourigny JN, Mathieu D, Hamel A, Briggs RG, Yu C, Zada G, Giannotta SL, Speckter H, Palque S, Tripathi M, Kumar S, Kaur R, Kumar N, Rogowski B, Shepard MJ, Johnson BA, Trifiletti DM, Warnick RE, Dayawansa S, Mashiach E, Vasconcellos FN, Bernstein K, Schnurman Z, Alzate J, Kondziolka D, Sheehan JP. Vestibular Schwannoma International Study of Active Surveillance Versus Stereotactic Radiosurgery: The VISAS Study. *Int J Radiat Oncol Biol Phys* [Epub ahead of print], 2024.

Hect JL, Mallela AN, Pupi M, Anthony A, Fogg D, Ho J, Slingerland AL, Ikegaya N, Abou-Al-Shaar H, Aung T, Gonzalez-Martinez J. Safety of Concomitant Cortical and Thalamic Stereoencephalography Explorations in Patients With Drug-Resistant Epilepsies. *Neurosurgery* [Epub ahead of print], 2024.

Patel A, Abdelsalam A, Shariff RK, Mallela AN, Andrews EG, Tonetti DA, Lunsford LD, Abou-Al-Shaar H. Bibliometric analysis of the top 100 cited articles on stereotactic radiosurgery of intracranial meningiomas. *Br J Neurosurg* 37(5):1088-1093, 2023.

Nowicki KW, Mittal AM, Abou-Al-Shaar H, Rochlin EK, Lang MJ, Gross BA, Friedlander RM. A Future Blood Test to Detect Cerebral Aneurysms. *Cell Mol Neurobiol* 43(6):2697-2711, 2023.

Bin-Alamer O, Pikis S, Mantziaris G, Abdulbaki A, Mallela AN, Lu VM, Peker S, Samanci Y, Nabeel AM, Reda WA, Tawadros SR, El-Shehaby AMN, Abdelkarim K, Emad Eldin RM, Sheehan D, Sheehan K, Liscak R, Chytka T, Tripathi M, Madan R, Speckter H, Hernández W, Barnett GH, Hori YS, Dabhi N, Aldakhil S, Mathieu D, Kondziolka D, Bernstein K, Wei Z, Niranjan A, Kersh CR, Lunsford LD, Sheehan JP, Abou-Al-Shaar H. Adjuvant Stereotactic Radiosurgery With or Without Postresection Fractionated Radiation Therapy for the Management of Clival Chordomas in Adults: An International Multicenter Case Series. *Neurosurgery* 93(4):892-900, 2023.

Miskin BM, Fox LA, Abou-Al-Shaar H, Bin-Alamer O, Goertz A, Lipin CT, Fertig N, Cox N. Hyperbaric Oxygen Therapy for the Management of Mild and Moderate Traumatic Brain Injury: A Single-Center Experience. *World Neurosurg* 176:e357-e370, 2023.

Head JR, Bin-Alamer O, Wei Z, Waite K, Agrawal N, Mallela AN, Faramand A, Gersey ZC, Niranjan A, Lunsford LD, Abou-Al-Shaar H. Vestibular Schwannoma Stereotactic Radiosurgery in Octogenarians: Case Series. *Neurosurgery* 93(5):1099-1105, 2023.

Hussam Abou-Al-Shaar, MD

Plute T, Abou-Al-Shaar H, McDowell MM, Mallela AN, Snyderman CH, Gardner PA. Endoscopic Endonasal Resection of a Recurrent Prepontine Neurenteric Cyst: 2-Dimensional Operative Video. *Oper Neurosurg* (Hagerstown) 25(4):e226, 2023.

Bethamcharla R, Abou-Al-Shaar H, Maarbjerg S, Chang YF, Gacka CN, Sekula RF Jr. Percutaneous glycerol rhizolysis of the trigeminal ganglion for the treatment of idiopathic and classic trigeminal neuralgia: Outcomes and complications. *Eur J Neurol* 30(10):3307-3313, 2023.

Bin-Alamer O, Abou-Al-Shaar H, Mallela AN, Niranjan A, Sheehan JP, Lunsford LD. In Reply: Stereotactic Radiosurgery for Vestibular Schwannoma in Neurofibromatosis Type 2: An International Multicenter Case Series of Response and Malignant Transformation Risk. *Neurosurgery* 93(4):e100-e101, 2023.

Hallak H, Rindler R, Dang D, Abou-Al-Shaar H, Carlstrom LP, Singh R, Kanaan I, Link MJ, Gardner PA, Peris-Celda M. Trigeminal neuralgia pain outcomes following microsurgical resection versus stereotactic radiosurgery for petroclival meningiomas: a systematic review and meta-analysis. *J Neurosurg* 140(2):420-429, 2023.

Gozal YM, Abou-Al-Shaar H, Alzhrani G, Taussky P, Couldwell WT. Complications of Endovascular and Open Aneurysm Surgery in the Era of Flow Diversion. *Acta Neurochir Suppl* 130:85-94, 2023.

Yoh N, Abou-Al-Shaar H, Bethamcharla R, Beiriger J, Mallela AN, Connolly ES, Sekula RF. Minimally invasive surgical evacuation for spontaneous cerebellar hemorrhage: a case series and systematic review. *Neurosurg Rev* 46(1):208, 2023.

Qedair J, Haider AS, Balasubramanian K, Palmisciano P, Hassan T, Shahbandi A, Sabahi M, Kharbat AF, Abou-Al-Shaar H, Yu K, Cohen-Gadol AA, El Ahmadieh TY, Bin-Alamer O. Orbital Exenteration for Craniofacial Lesions: A Systematic Review and Meta-Analysis of Patient Characteristics and Survival Outcomes. *Cancers* (Basel) 15(17):4285, 2023.

Abdallah HM, Gersey ZC, Plute T, Remick M, Abou-Al-Shaar H, Fazeli PK, Mahmud H, Lang MJ, Gardner PA, Zenonos GA, Gross BA. Toward Optimized and Cost-Efficient Protocols for Inferior Petrosal Sinus Sampling in the Diagnosis of Cushing Disease. *Neurosurgery* 94(3):508-514, 2023.

Albalkhi I, Shafqat A, Bin-Alamer O, Mallela AN, Kuminkoski C, Labib MA, Lang MJ, Lawton MT, Morcos JJ, Couldwell WT, Abou-Al-Shaar H. Long-term functional outcomes and complications of microsurgical resection of brainstem cavernous malformations: a systematic review and meta-analysis. *Neurosurg Rev* 46(1):252, 2023.

Bin-Alamer O, Abou-Al-Shaar H, Gersey ZC, Huq S, Kallos JA, McCarthy DJ, Head JR, Andrews E, Zhang X, Hadjipanayis CG. Intraoperative Imaging and Optical Visualization Techniques for Brain Tumor Resection: A Narrative Review. *Cancers* (Basel) 15(19):4890, 2023.

Bin-Alamer O, Abou-Al-Shaar H, Singh R, Mallela AN, Legarreta A, Bowden G, Mathieu D, Perlow HK, Palmer JD, Elhamdani S, Shepard M, Liang Y, Nabeel AM, Reda WA, Tawadros SR, Abdelkarim K, El-Shehaby AMN, Emad Eldin R, Elazzazi AH, Warnick RE, Gozal YM, Daly M, McShane B, Addis-Jackson M, Karthikeyan G, Smith S, Picozzi P, Franzini A, Kaisman-Elbaz T, Yang HC, Hess J, Templeton K, Zhang X, Wei Z, Pikis S, Mantziaris G, Simonova G, Liscak R, Peker S, Samanci Y, Chiang V, Kersh CR, Lee CC, Trifiletti DM, Niranjan A, Hadjipanayis CG, Lunsford LD, Sheehan JP. Local control and survival after stereotactic radiosurgery for colorectal cancer brain metastases: an international multicenter analysis. *J Neurosurg* 140(5):1233-1242, 2023.

Hussam Abou-Al-Shaar, MD

Galbiati F, Venugopal S, Abou-Al-Shaar H, Zenonos GA, Gardner PA, Fazeli PK, Mahmud H. Incidence of postoperative hyponatremia after endoscopic endonasal pituitary transposition for skull base pathologies. *Pituitary* 27(1):70-76, 2023. Erratum in *Pituitary* 27(1):89-90, 2024.

Aung T, Mallela A, Ho J, Tang LW, Abou-Al-Shaar H, Gonzalez Martinez J. Challenging Cortical Explorations in Difficult-to-Localize Seizures: The Rationale and Usefulness of Perisylvian Paralimbic Explorations With Orthogonal Stereoelectroencephalography Depth Electrodes. *Neurosurgery* [Epub ahead of print], 2023.

Albalkhi I, Shafqat A, Bin-Alamer O, Abou Al-Shaar AR, Mallela AN, Fernández-de Thomas RJ, Zinn PO, Gerszten PC, Hadjipanayis CG, Abou-Al-Shaar H. Fluorescence-guided resection of intradural spinal tumors: a systematic review and meta-analysis. *Neurosurg Rev* 47(1):10, 2023.

Mallela AN, Plute TJ, Abou-Al-Shaar H, Fernandes Cabral DT, Hadjipanayis CG. Exoscope-based supracerebellar infratentorial approach for a pineal meningioma in the prone position. Neurosurg Focus Video 10(1):V15, 2023.

Research Activities
Dr. Abou-Al-Shaar is looking at the outcomes of patients who underwent endoscopic endonasal surgery for pituitary adenomas, chordomas, meningiomas, among other pathologies. Dr. Abou-Al-Shaar is investigating the role of a novel imaging tool in determining visual recovery and outcomes following endoscopic endonasal surgery for skull base lesions. He is also interested in studying the effects of hormonal medications on the growth of meningiomas as well as elucidating the role of Gamma Knife radiosurgery in the management of various skull base and cerebrovascular pathologies.

Prateek Agarwal, MD

PGY-5 Resident

Prateek Agarwal, MD, MBA, joined the University of Pittsburgh Department of Neurological Surgery residency program in July 2020 after earning a dual MD/MBA degree from the Perelman School of Medicine and Wharton School at the University of Pennsylvania. At the Perelman School of Medicine, he was elected into the Alpha Omega Alpha Honor Medical Society and received the Spencer Morris Prize, the School of Medicine's highest academic honor. Prior to medical and business school, he graduated summa cum laude and Phi Beta Kappa from Harvard University in 2015 with an AB in molecular and cellular biology and secondary field in economics.

Dr. Agarwal is currently pursuing an enfolded endovascular neurosurgery fellowship at UPMC, under the mentorship of Bradley Gross, MD, with plans to complete a post-residency open cerebrovascular fellowship.

Dr. Agarwal's neurosurgical research focuses on optimizing clinical outcomes, with an emphasis on employing system-level interventions to improve patient outcomes while reducing costs. His investigation on using behavioral economics principles to reduce neurosurgical postoperative infections and implant costs was awarded the 2018 Neurosurgery Paper of the Year in Socioeconomics, Health Policy, and Law. He has also performed translational research on injectable hydrogels for intervertebral disc regeneration, supported by the Neurosurgery Research and Education Foundation (NREF) Medical Student Summer Fellowship. His undergraduate basic neuroscience research in olfaction resulted in publications in Nature Neuroscience and Nature Communications.

Prateek Agarwal, MD

Dr. Agarwal is active in organized neurosurgery. He was selected as a Council of State Neurological Societies (CSNS) Socioeconomic Fellow for 2023-24 and appointed as an early career member on the AANS Education Committee in May 2022. Previously he was elected to serve on the Young Neurosurgeons Committee (YNC) in 2021 and served as the 2018 YNC MISSION fellow. He is also passionate about entrepreneurship and co-founded the medical device startup Sanguis, which won 1st place at the 2018 Penn Wharton Entrepreneurship Startup Challenge.

Specialized Areas of Interest
Endovascular neurosurgery; open cerebrovascular neurosurgery; complex spine surgery; minimally invasive spine surgery; clinical outcomes research; socioeconomics in neurosurgery; organized neurosurgery; health policy and innovation.

Professional Organization Membership
Alpha Omega Alpha
American Association of Neurological Surgeons
American Medical Association
Congress of Neurological Surgeons

Education & Training
AB, Molecular and Cellular Biology, Harvard University, 2015
MD, Perelman School of Medicine at the University of Pennsylvania, 2020
MBA, Health Care Management, The Wharton School at the University of Pennsylvania, 2020

Honors & Awards
CSNS Socioeconomic Fellowship, 2023-24
Spencer Morris Prize, Perelman School of Medicine, 2020
Palmer Scholar, The Wharton School, 2020
Alpha Omega Alpha, Perelman School of Medicine, 2019
Neurosurgery Paper of the Year in Socioeconomics, Health Policy, and Law, 2018
MISSION Fellowship, Young Neurosurgeons Committee, 2018
Department of Neurosurgery Research Prize, Perelman School of Medicine, 2017
NREF Medical Student Summer Fellowship, 2016
Guggenheim Family Neurosurgery Scholarship, Perelman School of Medicine, 2016
Summa Cum Laude, Harvard University, 2015
Phi Beta Kappa, Harvard University, 2015

Publications: 2023-24
• Refereed Articles:
Wei Z, Jose SG, Agarwal P, Worrell S, Kulich S, Donohue JK, Deng H, Hadjipanayis CG, Niranjan A, Lunsford LD. Adjuvant Stereotactic Radiosurgery for Clear Cell Meningiomas. *World Neurosurg* 184:e784-e793, 2024.

Agarwal P, Sharma N, Nayar G, Jacobs RC, Al-Bayati A, Lunsford LD, McDowell MM, Greene S. Long-term outcomes of deep pediatric arteriovenous malformations. *J Neurosurg Pediatr* 33(1): 22-28, 2023.

Hudson JS, Nowicki KW, Lucke-Wold B, Gersey ZC, Dodd WS, Alattar A, McCarthy DJ, Agarwal P, Mehdi Z, Lang MJ, Hasan DM, Hoh BL, Gross BA. Clopidogrel Is Associated with Reduced Likelihood of Aneurysmal Subarachnoid Hemorrhage: a Multi-Center Matched Retrospective Analysis. Translational Stroke Research. *Transl Stroke Res* [Online ahead of print], 2023.

Ali Alattar, MD

Chief Resident

Ali Alattar, MD, MAS, joined the University of Pittsburgh Department of Neurological Surgery residency program in July of 2019 after graduating from University of California, San Diego School of Medicine. While at UCSD, Dr. Alattar invested in additional training in clinical and biomedical research and earned a master of advanced studies in clinical research. Dr. Alattar studied biochemistry at Portland State University and graduated summa cum laude with a bachelor of science degree.

Dr. Alattar cultivated an interest in neuro-oncology outcomes, especially regarding the impact of extent of surgical resection on survival and developed a novel biomarker platform for diagnosis of glioblastoma, during medical school. In residency, Dr. Alattar has continued to develop his interest in neuro-oncology and is also building his clinical expertise in spine surgery, skull base, and open and endovascular neurosurgery.

Dr. Alattar's research interests include big data, cost-effectiveness, artificial intelligence, and machine learning as well as the application of augmented reality to image-guidance and development of unique biomarkers and molecular therapeutics in the diagnosis and treatment of intracranial aneurysms. He hopes to contribute to new cancer registries, develop clinical decision support systems, and discover genetic risk factors and molecular subtypes of disease.

Dr. Alattar was born, raised and attended college in Portland, Oregon before moving to San Diego for medical school. In his free time, he enjoys reading novels, cooking, hiking, running and weight lifting.

Specialized Areas of Interest
Neuro-oncology, skull base neurosurgery, open and endovascular neurosurgery, and spine surgery and correction of deformity.

Professional Organization Membership
American Association of Neurological Surgeons
Congress of Neurological Surgeons
Society for Neuro-Oncology

Education & Training
BS, Biochemistry, Portland State University, 2014
MAS, University of California San Diego, 2019
MD, University of California San Diego, 2019

Honors & Awards
Clinical Research Fellowship, UC San Diego School of Medicine, 2017-2018
National Institutes of Health Summer Research Training Grant, 2015
Summa Cum Laude, Portland State University, 2014
Award for Outstanding Performance in General Chemistry, Organic Chemistry, and Biochemistry, 2011-13
Building Our Future Scholarship Award, 2010-11

Sharath Anand, MD

PGY-4 Resident

Sharath Kumar Anand, MD, joined the University of Pittsburgh Department of Neurological Surgery residency program in July 2021 after earning an MD degree from Wayne State University School of Medicine. At Wayne State, he was elected into the Alpha Omega Alpha Honor Medical Society and was awarded the Karl G. Pinckard Scholarship. Prior to medical school, he graduated from the University of Michigan in 2017 with a bachelor of science degree in cellular and molecular biology as well as a minor in electrical engineering and computer science.

During medical school, Dr. Anand conducted clinical neurosurgical research on topics including subarachnoid hemorrhage surgery outcomes, spine surgery and epilepsy care. He has a special interest in socioeconomic disparity research and institutional factors that affect neurosurgical outcomes.

Dr. Anand was born in Chennai, India and raised in Ann Arbor, Michigan. Outside of neurosurgery, he enjoys sports as well as spending time with his family and friends.

Specialized Areas of Interest
Cerebrovascular neurosurgery; spine surgery; skull base neurosurgery; general neurosurgery.

Professional Organization Membership
Alpha Omega Alpha Honor Society
American Association of Neurological Surgeons
Congress of Neurological Surgeons

Education & Training
BS, Cellular & Molecular Biology, University of Michigan, 2017
MD, Wayne State University School of Medicine, 2021

Honors & Awards
Karl G. Pinckard Scholarship, Wayne State University, 2021
Alpha Omega Alpha Honor Society, Wayne State University, 2020
Best Clinical Research Award – Tumor, Congress of Neurological Surgeons, 2020
Year III Comprehensive Honors, Wayne State University, 2020
Year II Comprehensive Honors, WSU, 2019

Stephanie Casillo, MD

PGY-2 Resident

Stephanie Casillo, MD, joined the University of Pittsburgh Department of Neurological Surgery as a PGY-1 resident July 1, 2023 after earning her MD degree from the University of Pittsburgh School of Medicine. As a medical student, she was president of the AANS Medical Student Chapter, led the preclinical medical student neurosurgery elective course, and was awarded the Theodore Kurze, MD, Senior Prize for Excellence in Neurological Surgery and Clinical Neurosciences. Prior to medical school, she graduated magna cum laude from Rochester Institute of Technology with a degree in biomedical engineering.

Dr. Casillo's clinical and academic interests include neuro-oncology, pediatric neurosurgery, surgeon-scientist education, and women in neurosurgery. As a research fellow in the Physician-Scientist Training Program (PSTP), Dr. Casillo conducted longitudinal translational research on metabolic dependences in pediatric diffuse midline glioma (DMG). Specifically, she identified a

Stephanie Casillo, MD

novel mechanism by which the hallmark histone mutation H3K27M impacts tumor cell glycolysis through an ERK5-PFKFB3 axis involving both a critical kinase and a metabolic effector. Small molecule inhibitors targeting this axis prolong survival in mouse models. She was awarded the Neurosurgery Research and Education Foundation (NREF) Medical Student Summer Research Fellowship (MSSRF) for this work, which has resulted in publications in Molecular Oncology and Nature Cancer.

Dr. Casillo is an advocate for the advancement of women in neurosurgery and was the lead investigator on a project narrating the life and accomplishments of Dorothy Klenke Nash, MD, the first female neurosurgeon in the United States. Her work has resulted in publications in *Neurosurgery* and *Journal of Neurosurgery*.

Dr. Casillo has also sought clinical research opportunities in traumatic brain injury, vascular neurosurgery, spine surgery, and neurosurgical education.

Dr. Casillo was born and raised in Buffalo, New York. Outside of work, she enjoys cooking, live music, and spending time with her family, friends, and partner Patrick.

Specialized Areas of Interest
Neuro-oncology; pediatric neurosurgery; surgeon-scientist education; women in neurosurgery.

Professional Organization Membership
American Association of Neurological Surgeons
Congress of Neurological Surgeons
Society of Neuro-Oncology

Education & Training
MD, Physician-Scientist Training Program, University of Pittsburgh School of Medicine, 2023
BS, Biomedical Engineering, Rochester Institute of Technology, 2018

Honors & Awards
Theodore Kurze Senior Prize for Excellence in Neurological Surgery and Clinical Neuroscience, University of Pittsburgh, 2023
Sell Family Physician Scientist Award, Physician-Scientist Training Program, University of Pittsburgh School of Medicine, 2023
Medical Student Summer Research Fellowship (MSSRF), Neurosurgery Research and Education Foundation, 2021
Physician-Scientist Training Program Scholarship, Physician-Scientist Training Program, University of Pittsburgh School of Medicine, 2018
Honors Program Research Grant, Rochester Institute of Technology, 2013
Presidential Scholarship, Rochester Institute of Technology, 2013

Hansen Deng, MD

Chief Resident

Hansen Deng, MD, joined the University of Pittsburgh Department of Neurological Surgery residency program in July of 2019. Dr. Deng graduated with distinction from the University of California San Francisco School of Medicine, where he was elected into the Alpha Omega Alpha Honor Medical Society. He completed his undergraduate degrees in oil-painting and biology at the University of California Berkeley, where he was elected into the Phi Beta Kappa Society.

Hansen Deng, MD

Traumatic brain injury (TBI) is a complex disorder with many diagnostic challenges. Dr. Deng's research in TRACK-TBI investigates the discriminatory ability of biomarkers to provide precise assessment of injury severity and assist with prognostication after injury. At the Brain Trauma Research Center, he investigates the role that genetic factors can play in the secondary pathophysiology of neurotrauma. Along with optimizing operative management of TBI and spinal cord injury (SCI) patients, his goal is to advance evidence-based clinical practices in the neurocritical intensive care unit.

Dr. Deng serves as a mentor for undergraduate and graduate students with interests in medicine and neurosurgery. He enjoys painting, playing basketball and cooking.

Specialized Areas of Interest
Cerebrovascular; spinal deformity; neurotrauma.

Professional Organization Membership
Alpha Omega Alpha
Phi Beta Kappa
Sigma Xi
American Association of Neurological Surgeons
Congress of Neurological Surgeons
National Neurotrauma Society
North American Brain Injury Society
Pennsylvania Neurosurgery Society

Education & Training
BA, Biology and Art (Oil-Painting), University of California Berkeley, 2014
MD (with Distinction in Clinical and Translational Research), University of California San Francisco, 2019

Honors & Awards
Stuart Rowe Society Lectureship Runner-Up Award for Best Resident Research, 2023
Neurotrauma and Critical Care Paper of the Year, Congress of Neurological Surgeons, 2023
Tumor Paper of the Year, Congress of Neurological Surgeons, 2021
Best Clinical Research Award, Neurotrauma and Critical Care, Congress of Neurological Surgeons, 2020
ThinkFirst Injury Prevention Award, American Association of Neurological Surgeons, 2020
Best Clinical Research Abstract, Pediatric Section, Congress of Neurological Surgeons, 2019
Ronald R. Tasker Young Investigator Award, Congress of Neurological Surgeons, 2019
Steinhart Scholarship Award, UCSF School of Medicine, 2019
Distinction in Clinical and Translational Research, University of California, San Francisco, 2019
Storytelling Prize, UCSF Synapse Student Voices, 2019
Journal of Neuro-Oncology Award, American Association of Neurological Surgeons, 2017
AANS/CNS Section on Trauma and Critical Care Abstract Finalist, 2017
Dean's Prize in Research and Scholarship Finalist, UCSF School of Medicine, 2016, 2019
University Grant in Medicine, UCSF School of Medicine, 2015-2019
Sussman Prize in Painting and Exhibition, University of California Berkeley, 2014
Phelan Art Scholarship, University of California Berkeley, 2013
Dean's Honors, University of California Berkeley, 2012-2014

News Media Appearances: 2023-24
"Pittsburgh-area woman on road to recovery after tumor removed from back," KDKA-TV, (Pittsburgh), April 30, 2024

Andrew Faramand, MD

PGY-4 Resident

Andrew Faramand, MD, MSc, received his medical degree from Jordan University of Science and Technology in Irbid, Jordan. After graduating from medical school, Dr. Faramand pursued his master's degree with distinction in clinical neuroscience at University College London-Queen Square Institute of Neurology. His research at Great Ormond St. Hospital focused on the outcomes of epilepsy surgery in children.

Dr. Faramand is a dedicated researcher in the field of Gamma Knife stereotactic radiosurgery. He completed three years of post-doctoral research fellowship at the UPMC Center of Image-Guided Neurosurgery at the University of Pittsburgh Department of Neurological Surgery under the mentorship of L. Dade Lunsford, MD. He specifically worked on clinical studies regarding stereotactic radiosurgery for brain tumors, arteriovenous malformations, and trigeminal neuralgia.

He enjoys playing soccer, swimming, and spending time with family and friends.

Specialized Areas of Interest
Neuro-oncology; stereotactic radiosurgery; cerebrovascular neurosurgery; skull-base neurosurgery.

Professional Organization Membership
American Association of Neurological Surgeons
American Medical Association
Congress of Neurological Surgeons

Education & Training
MD, Jordan University of Science and Technology
MSc, Clinical Neuroscience, University College London-Queen Square Institute of Neurology
Fellowship, University of Pittsburgh

Honors & Awards
JANE Oral Presentation Award, AANS/CNS Spine Summit, 2019
High Distinction Graduate, University College London, 2015
Dean's Honors List, Jordan University of Science and Technology, 2004-2007

Ricardo Fernández-de Thomas, MD

PGY-7 Resident

Ricardo J. Fernández-de Thomas, MD, joined the University of Pittsburgh Department of Neurological Surgery residency program in July of 2021.

Having graduated magna cum laude from the University of Puerto Rico Río Piedras Campus with a bachelor's degree in cellular and molecular biology, he completed his medical education at the University of Puerto Rico School of Medicine, where he also obtained his degree magna cum laude distinction. Dr. Fernández-de Thomas became interested in neurosurgery early in his education, meeting and identifying key mentors since his early college years.

He was recognized as a student leader and researcher at the University of Puerto Rico, Río Piedras Campus, and the School of Medicine. He obtained various basic science and clinical research awards and became an active member of different student organizations.

Ricardo Fernández-de Thomas, MD

After completing medical school in Puerto Rico, Dr. Fernández-de Thomas completed four years of neurosurgery residency at the University of Puerto Rico School of Medicine.

Dr. Fernández-de Thomas is also involved in community outreach and service projects, having spent time volunteering in different health clinics in Puerto Rico and Central America. His dedication to academics, community and education led to his election into the Alpha Omega Alpha Medical Honor Society and the Arnold P. Gold Humanism Honor Society. During the PGY-5 year, he completed the UPMC Senior Resident and Fellow Leadership Academy yearly course. More recently, Dr. Fernández-de Thomas founded a company called Malleous, which consists of a suction retractor that combines the flexibility of use of a standard brain ribbon retractor with the benefits of a passive suction device.

Dr. Fernández-de Thomas was born and raised in San Juan, Puerto Rico. Outside of medicine, Ricardo enjoys spending time with family and friends, playing baseball, softball, practicing martial arts, tennis, volleyball, weight lifting, and outdoor activities.

Specialized Areas of Interest
Complex spine/minimally invasive spine surgery, spine tumors, deformity, spine oncology; neuro-oncology; neurotrauma, education in neurosurgery.

Professional Organization Membership
Alpha Omega Alpha
American Association of Neurological Surgeons
Arnold P. Gold Humanism Honor Society
Congress of Neurological Surgeons
Lumbar Spine Research Society
North American Spine Society
Pennsylvania Medical Society
Pittsburgh Neurosurgical Society
Society for Minimally Invasive Spine Surgery
Cervical Spine Research Society

Education & Training
BS, Cellular and Molecular Biology University of Puerto Rico, Río Piedras Campus, 2013
MD, University of Puerto Rico, Medical Science Campus, School of Medicine, 2017
Residency, University of Puerto Rico, Medical Science Campus, School of Medicine, 2021

Honors & Awards
Big Idea Center Grand Prize Winner, University of Pittsburgh, April 2024
Center for Medical Innovation Grant, University of Pittsburgh, December 2023
Kuzneski Innovation Cup Finalist, University of Pittsburgh, November 2023
Pitt-UPMC Senior Resident and Fellow Leadership Academy, July 2022 - June 2023
Society for Minimally Invasive Spine Surgery (SMISS) Young Surgeon Grant & Educational Track Award, September - October 2021
Alpha Omega Alpha Chapter Member, University of Puerto Rico, 2021
Dr. Ramón Ruiz Arnau, Clinical Research Award, 2017
María T. Sáez Endowment Fund Medical Student Scholarship Award, 2017
University of Puerto Rico Alumni and Friends Abroad Scholarship Award, 2016
National Institutes of Health Research Initiative for Scientific Enhancement Program Fellow, 2011-2013
Outstanding Image of the Month Confocal Microscopy Award, University of Puerto Rico, 2012
Dean's List Award, University of Puerto Rico, 2009-2013

Daryl Pinion Fields II, MD, PhD

Chief Resident

Daryl Pinion Fields II, MD, PhD, joined the University of Pittsburgh Department of Neurological Surgery in July of 2018. He completed his undergraduate degree at Saint John's University (Collegeville, Minnesota), and his medical degree as well as research doctorate at the University of Wisconsin, Madison.

Prior to medical school Dr. Fields held several leadership positions as a firefighter captain and medic. In addition, he spent several years as a neural rehab personal trainer managing clients with debilitating neuromuscular disorders; including stroke, brain trauma, multiple sclerosis and spinal cord injuries. These experiences have inspired both his research and clinical interest in spinal neurorestorative therapies.

Dr. Fields has been recognized with several nationally competitive awards and fellowships from the National Institute of Health and National Science Foundation in addition to funding from private organizations such as the National Football League, Pittsburgh Steelers, Merck Pharmaceuticals and Live Like Lou Foundation.

Dr. Fields is currently a senior neurological surgery resident with a dual appointment as a post-doctorate research fellow at the University of Pittsburgh. He is a technical/medical consultant to several startup companies and investment funds. As the principal investigator of the Fields Research Group he leads several funded studies:

1. Spinal cord stimulation for motor restoration in amyotrophic lateral sclerosis
2. Development of novel biomarkers for spinal cord injuries
3. Development of clinical prognostic tools related to tumor, trauma and degenerative disorders.

Dr. Fields also maintains a collaborative relationship with other researchers within and beyond the University of Pittsburgh neurological surgery community. In his free time, Dr. Fields enjoys working out, running in the rain, and catching up with friends.

Specialized Areas of Interest
Spine, trauma, plasticity and rehabilitation.

Professional Organization Membership
American Association of Neurological Surgeons
American Academy of Neurology
American Physiological Society
Congress of Neurological Surgeons
National Neurotrauma Society
Phi Delta Theta Fraternity
Society for Neuroscience

Education & Training
BA, Biochemistry, Saint John's University (Collegeville, Minn.), 2010
MD, University of Wisconsin, Madison, 2017
PhD, Molecular Neuroscience, University of Wisconsin, Madison, 2018

Honors & Awards
Keynote Speaker, Point Park University Commencement, 2024
Board of Trustees, Point Park University, 2024

Daryl Pinion Fields II, MD, PhD

Travel Award, Wings for Life Foundation, 2023
Best Clinical Poster Award, Richard Simmons Research Day, University of Pittsburgh, 2023
Research Award, Live Like Lou Foundation, 2022
UPMC Leadership Academy, Inaugural Class, 2022
Visiting Scholar, University of Florida, 2022
Copeland Research Awards, 2019, 2021, 2022
Charlie Kuntz Spine Scholar Award, 2021
Chuck Noll Foundation Research Award, 2021
Physician Champion for Nurses, UPMC Presbyterian, 2020
Physician Champion for Nurses, UPMC Children's Hospital of Pittsburgh, 2020
Walter Copeland Spine Research Award, 2019
Runner-up Presentation Award, Stuart Rowe Society Lectureship Day, 2018
NIH MD/PhD F30 Fellowship, 2015-18
Top Ambulatory Medicine Project, University of Wisconsin, 2017
UNCF/Merck Graduate Fellowship, 2015-17
Bennett Hiner Top Neuroscience Medical Student Award, 2016
Top Neuroscience Presentation Award, University of Wisconsin, 2016
Top Biomedical Science Presentation Award, University of Wisconsin, 2016
Caroline Tum Suden Abstract Award, 2016
Society for Neuroscience Abstract Award, 2015
Daryl and Sharon Buss Abstract Award, University of Wisconsin, 2015
Neuromuscular Graduate Fellowship, University of Florida, 2015
Science/Medicine Graduate Fellowship, University of Wisconsin, 2014

News Media Appearances
"New Point Park University trustee began a firefighter and became a neurosurgeon," *Pittsburgh Post-Gazette*, February 29, 2024.

Joseph Garcia, MD

PGY-3 Resident

Joseph H. Garcia, MD, joined the University of Pittsburgh Department of Neurological Surgery residency program in July 2022 after graduating from the University of California, San Francisco School of Medicine, earning his MD with distinction in molecular medicine. He received his undergraduate degree from the University of California, Davis.

Prior to residency, Dr. Garcia performed basic science research focused on understanding the role of cellular metabolism in neurodegeneration and in brain tumor biology. He also conducted clinical neurosurgical research on topics ranging from cerebrovascular disease to surgical treatments for epilepsy.

Dr. Garcia was born and raised in San Francisco, California. Outside of neurosurgery, he enjoys sports, getting outside, and spending time with his family and friends.

Specialized Areas of Interest
Cerebrovascular neurosurgery; epilepsy surgery; neuro-oncology; skull base neurosurgery.

Professional Organization Membership
American Association of Neurological Surgeons
Congress of Neurological Surgeons

Joseph Garcia, MD

Education & Training
BS, Plant Biology, University of California Davis, 2014
MD, University of California San Francisco, 2022

Honors & Awards
Best Basic Scientific Paper Abstract Award, AANS Cerebrovascular Section, 2023
MD with Distinction in Molecular Medicine, UCSF, 2022
Steinhart Award for students matching into surgical subspecialties, UCSF, 2022
Dean's Prize for Long-Term Research, UCSF, 2021
Research Diversity Supplement, NIH-National Cancer Institute (NCI), 2020
Dean's Prize for Short-Term Research, UCSF, 2018

Publications: 2023-24
• Refereed Articles:
Hanalioglu S, Graffeo CS, Srinivasan VM, Ibrahim S, Garcia JH, Koester SW, Aabedi AA, Catapano JS, Winkler EA, Lawton MT. Arteriovenous malformations in the cerebellopontine angle: assessment of the" backdoor resection" technique and microsurgical results in 38 patients. *J Neurosurg* [Online ahead of print], 2024.

Rademacher K, Doric Z, Haddad D, Mamaligas A, Liao SC, Creed RB, Kano K, Chatterton Z, Fu Y, Garcia JH, Vance V, Sei Y, Kreitzer A, Halliday GM, Nelson AB, Margolis EB, Nakamura K. Chronic hyperactivation of midbrain dopamine neurons causes preferential dopamine neuron degeneration. *bioRxiv* [Preprint]. 2024.

Baranoski JF, Catapano JS, Garcia JH, Cole TS, Winkler EA, Rudy RF, Rutledge C, Srinivasan VM, Graffeo CS, Lawton MT, Wanebo JE.Occipital Artery to middle cerebral artery direct bypass: a salvage revascularization technique for ischemic moyamoya disease. *World Neurosurg* 179:e549-e556, 2023.

Cummins DD, Garcia JH, Nguyen MP, Saggi S, Chung JE, Goldschmidt E, Berger MS, Theodosopoulos PV, Chang EF, Daras M, Hervey-Jumper SL, Aghi MK, Morshed RA. Association of CDKN2A alterations with increased postoperative seizure risk after resection of brain metastases. N*eurosurg Focus* 55(2):E14, 2023.

Garcia JH, Akins EA, Jain S, Wolf KJ, Zhang J, Choudhary N, Lad M, Shukla P, Rios J, Seo K, Gill SA, Carson WH, Carette LR, Zheng AC, Raleigh DR, Kumar S, Aghi MK. Multiomic screening of invasive GBM cells reveals targetable transsulfuration pathway alterations. *J Clin Invest* 134(3):e170397, 2023.

Garcia JH, Carrete L, Rutledge WC, Raygor KP, Winkler EA, Pereira MP, Nelson J, Kim H, Cooke DL, Hetts SW, Lawton MT, Abla AA. Factors Associated with Unfavorable Clinical Presentations in Patients with Ruptured Brain Arteriovenous Malformations. *World Neurosurg* 178:e72-e78, 2023.

Jeffery Head, MD

PGY-5 Resident

Jeffery Head, MD, joined the University of Pittsburgh Department of Neurological Surgery residency program in July of 2020. He graduated from Colgate University in 2012 with honors in cellular neuroscience and earned his medical degree from Sidney Kimmel Medical College at Thomas Jefferson University in 2020, where he graduated cum laude and was elected into the Alpha Omega Alpha Honor Society.

Jeffery Head, MD

Prior to medical school, Dr. Head spent two years as a post-baccalaureate research fellow at the National Institutes of Health studying developmental neurobiology in zebra fish. His work focused on understanding the molecular signaling pathways that regulate collective cell migration in the peripheral nervous system during embryogenesis and creating digital reconstructions of the relationships between these cells during their migration. During his medical school career, Dr. Head was involved in research on spinal cord stimulation waveforms in treating chronic low-back pain, surgical approaches to the spine in treating ossification of the posterior longitudinal ligament, mechanical thrombectomy in distal circulation strokes, and the risk-factors for infection in external ventricular drains.

Dr. Head was born and raised in Fairfield, Connecticut. Outside of neurosurgery Dr. Head is an avid skier and enjoys cooking, hiking, running, softball, soccer, and spending time with his friends and family.

Specialized Areas of Interest
General neurosurgery, spine surgery, neuro-oncology.

Professional Organization Membership
Alpha Omega Alpha Honor Society
American Association of Neurological Surgeons
Congress of Neurological Surgeons

Education & Training
BA, Cellular Neuroscience, Colgate University, 2012
MD, Sidney Kimmel Medical College at Thomas Jefferson University, 2020

Honors & Awards
Cum Laude, Sidney Kimmel Medical College (SKMC), Thomas Jefferson University 2020
Alpha Omega Alpha Honor Society, SKMC 2019
Top Performer, AANS Top Gun Neurosurgical Skills Competition, AANS Meeting 2019
Dr. George McClellan Surgical Honor Society, SKMC 2018
Hobart Amory Hare Medical Honor Society, SKMC 2018
Best Poster Award, Sigma-Xi Student Research Day, SKMC 2018
Best Poster Award, Post-Baccalaureate Poster Day, NIH 2014
Honors, Neuroscience Concentration, Colgate University 2012

Joseph Scott Hudson, MD

Chief Resident

Joseph Scott Hudson, MD, joined the University of Pittsburgh Department of Neurological Surgery residency program in July 2019 after graduating with research distinction from the University of Iowa Carver College of Medicine. He also received his undergraduate degree from the University of Iowa with honors in biology, a minor in chemistry, and high distinction.

During his undergraduate education, he became heavily involved in the Department of Neurosurgery at the University of Iowa Hospitals and Clinics. His work under the mentorship of David Hasan, MD, in cerebrovascular neurosurgery included basic science investigations into the pathogenesis of intracranial aneurysms, device development, and neurovascular imaging development. During medical school, Dr. Hudson received research support from the Neurosurgery Research and Education Foundation (NREF) as a medical student fellow, subsequently receiving the 2016 NREF best medical student abstract award. His research has led to numerous peer reviewed publications, abstracts, and oral presentations at national neurosurgical conferences. Dr. Hudson is an elected member of the Alpha Omega Alpha medical honor society.

Joseph Scott Hudson, MD

Dr. Hudson was born in Waterloo, Iowa. He was raised in Cedar Falls, Iowa and Plankstadt, Germany. His hobbies outside of neurosurgery include spending time with family and friends, golf, professional and collegiate sports, snow skiing, travel, and water sports.

Specialized Areas of Interest
Cerebrovascular neurosurgery; spine surgery; general neurosurgery.

Professional Organization Membership
Alpha Omega Alpha
American Association of Neurological Surgeons
American Heart Association/American Stroke Association
Congress of Neurological Surgeons

Education & Training
BA, Biology, Minor in Chemistry, University of Iowa, 2015
MD, University of Iowa Carver College of Medicine, 2019

Honors & Awards
Travel Grant, Society of Minimally Invasive Spine Surgery, 2023
Educational Scholarship, Lumbar Spine Research Society, 2023
Travel Grant, Medtronic, 2023
Travel Grant, International Society for the Advancement of Spine Young Surgeons, 2023
Richard Kessel Scholarship in Medicine, University of Iowa Carver College of Medicine, 2018
Melvin Marcus Scholarship for Excellence, University of Iowa Carver College of Medicine, 2018
Trainee Scholar Travel Award, University of Iowa Carver College of Medicine, 2018
Award for Excellence in Clinical Neuroscience Research, University of Iowa Carver College of Medicine, 2017
Best Abstract Award, AANS/NREF Medical Student Summer Research Fellowship, 2016
Honors Graduate, Biology, University of Iowa, 2015
High Distinction Graduate, University of Iowa, 2015
Dean's List, University of Iowa, 2011-2015
President's List, University of Iowa, 2011-2015

Publications: 2023-24
• Refereed Articles:
Adida S, Legarreta AD, Hudson JS, McCarthy D, Andrews E, Shanahan R, Taori S, Lavadi RS, Buell TJ, Hamilton DK, Agarwal N, Gerszten PC. Machine Learning in Spine Surgery: A Narrative Review. *Neurosurgery* 94(1):53-64, 2024.

Gajjar AA, Kumar RP, Paliwoda ED, Kuo CC, Adida S, Legarreta AD, Deng H, Anand SK, Hamilton DK, Buell TJ, Agarwal N, Gerszten PC, Hudson JS. Usefulness and Accuracy of Artificial Intelligence Chatbot Responses to Patient Questions for Neurosurgical Procedures. *Neurosurgery* [Online ahead of print], 2024.

Kumar RP, Adida S, Lavadi RS, Mitha R, Legarreta AD, Hudson JS, Shah M, Diebo B, Fields DP, Buell TJ, Hamilton DK, Daniels AH, Agarwal N. A guide to selecting upper thoracic versus lower thoracic uppermost instrumented vertebra in adult spinal deformity correction. *Eur Spine J* [Online ahead of print], 2024.

Hudson JS, Legarreta A, Fields DP, Deng H, McCarthy DJ, Sefcik R, Agarwal N, Hamilton DK. Intradiscal Osteotomy and Bilateral Expandable Transforaminal Interbody Fusion Cages for Iatrogenic Kyphotic Deformity: A Technical Report. *Asian J Neurosurg* [In press], 2024.

Joseph Scott Hudson, MD

Alan N, Zenkin S, Lavadi RS, Legarreta AD, Hudson JS, Fields DP, Agarwal N, Mamindla P, Ak M, Peddagangireddy V, Puccio L, Buell TJ, Hamilton DK, Kanter AS, Okonkwo DO, Zinn PO, Colen RR. Associating T1-Weighted and T2-Weighted Magnetic Resonance Imaging Radiomic Signatures With Preoperative Symptom Severity in Patients With Cervical Spondylotic Myelopathy. *World Neurosurg* 184:e137-e143, 2024.

Adida S, Legarreta A, Hudson JS, Kumar RP, Kass NM, Agarwal N, Gerszten PC, Andrews EG. Application of Machine Learning for Automatic Segmentation of Paraspinal Musculature. *World Neurosurg* 180:228-230, 2023.

Fields DP 2nd, Lavadi RS, Hudson JS, McCarthy DJ, Hect J, Wawrose R, Capuk O, Agarwal N, McDowell MM, Simon D, Abel TJ, Greene S. Patterns in Follow-Up Imaging Usage for Pediatric Patients with Whiplash-Associated Disorder. *World Neurosurg* 180:e786-e790, 2023.

Shanahan RM, Hudson JS, Huq S, Legarreta A, Fields DP, Phillips HW, Kellogg RG. Infant Rudimentary Meningocele with Tethering of the Cervical Cord: A Case Report. *Asian J Neurosurg* 18(3):676-678, 2023.

Deng H, Puccio DJ, Anand SK, Yue JK, Hudson JS, Legarreta AD, Wei Z, Okonkwo DO, Puccio AM, Nwachuku EL. Power Drill Craniostomy for Bedside Intracranial Access in Traumatic Brain Injury Patients. *Diagnostics* (Basel) 13(14):2434, 2023.

Hudson JS, Nowicki KW, Lucke-Wold B, Gersey ZC, Dodd WS, Alattar A, McCarthy DJ, Agarwal P, Mehdi Z, Lang MJ, Hasan DM, Hoh BL, Gross BA. Clopidogrel Is Associated with Reduced Likelihood of Aneurysmal Subarachnoid Hemorrhage: a Multi-Center Matched Retrospective Analysis. *Transl Stroke Res* [Online ahead of print], 2023.

Research Activities

Dr. Hudson's current research efforts in spine surgery are wide ranging, including efforts with the International Spine Study group revolving around the utility of multilevel constructs in adult spinal deformity patients. He is exploring how lateral plate fixation impacts rates of graft subsidence during lateral lumbar interbody fusion. He has several projects investigating the etiology of hardware and proximal junctional failure in both cervical deformity and adult lumbar deformity. Dr. Hudson also maintains an interest in vascular neurosurgical pathology, specifically cerebral aneurysms where he has an interest in pharmaceuticals which may affect their underlying formation and rupture.

Sakibul Huq, MD

PGY-4 Resident

Sakibul Huq, MD, joined the University of Pittsburgh Department of Neurological Surgery residency program in July 2021 after earning his MD from the Johns Hopkins University School of Medicine. He previously graduated from the University of North Carolina at Chapel Hill, where he studied biology and business administration on the fully funded Morehead-Cain Scholarship.

During medical school, Dr. Huq developed academic interests in neuro-oncology and skull base surgery. His translational research identified targeted therapies and drug repurposing strategies for brain tumors, and his clinical research introduced new applications of predictive analytics and frailty assessments to neurosurgical oncology. His work on these topics has resulted in numerous awards and over 40 peer-reviewed publications. Dr. Huq is also passionate about medical education and is an active mentor to students at various stages of training.

Sakibul Huq, MD

Dr. Huq is pursuing an enfolded skull base fellowship at UPMC under the direction of Paul Gardner, MD, and Georgios Zenonos, MD. He is a member of the Burroughs Wellcome Foundation Physician Scientist Incubator Program and is conducting translational research on skull base tumors. He is a grant recipient of The Beckwith Institute's Clinical Transformation Program, through which he is building a liquid biopsy research program under the mentorship of Costas Hadjipanayis, MD, PhD.

Dr. Huq also remains interested in neurosurgical organization and leadership. He previously served as the AANS Young Neurosurgeons Committee MISSION Fellow. Prior to medical school, he worked in management consulting with Huron Consulting Group, where he developed interests in healthcare quality, value and leadership.

Dr. Huq is a native of Pittsburgh. His hobbies outside neurosurgery include fitness, soccer, basketball, travel and music. He enjoys spending time with his fiancée, an Ob-Gyn resident at UPMC Magee-Womens, and their Australian shepherd Kobe.

Specialized Areas of Interest
Skull base neurosurgery, neuro-oncology, cerebrovascular neurosurgery, radiosurgery, general neurosurgery, quality improvement, high value care, medical education and socioeconomics.

Professional Organization Membership
American Association of Neurological Surgeons
AANS/CNS Section on Tumors
American Medical Association
Congress of Neurological Surgeons

Education & Training
MD, Johns Hopkins University School of Medicine, 2021
BS, University of North Carolina at Chapel Hill, 2014

Honors & Awards
Clinical Transformation Program Grant Recipient, The Beckwith Institute, 2024
Physician Scientist Incubator Program, Burroughs Wellcome Foundation, 2024
Walter Copeland Grant, Pittsburgh Foundation, 2023
Brian D. Silber Award, AANS, 2020
James Rutka Pediatric Brain Tumor Award, CNS, 2020
Harvey Cushing Medical Student Research Award, Johns Hopkins Medicine, 2020
Medical Student Summer Research Fellowship, AANS/NREF, 2020
MISSION Fellowship, AANS Young Neurosurgeons Committee, 2019
Medical Student Summer Fellowship, American Brain Tumor Association, 2019
Paul Ehrlich Research Award, Johns Hopkins Young Investigators Day, 2019
Carolyn L. Kuckein Student Research Fellowship, Alpha Omega Alpha, 2018
Henry Strong Denison Outstanding Student Research Award, Johns Hopkins Medicine, 2018
Tylenol Future Care Scholarship, 2016
Morehead-Cain Scholarship, University of North Carolina at Chapel Hill, 2014
Phi Beta Kappa, University of North Carolina at Chapel Hill, 2014
Highest Distinction, University of North Carolina at Chapel Hill, 2014

Rachel C. Jacobs, MD

PGY-5 Resident

Rachel C. Jacobs, MD, joined the University of Pittsburgh Department of Neurological Surgery residency program in July of 2020 after receiving her medical degree from the University of Pittsburgh School of Medicine. She obtained her undergraduate degree in neuroscience and behavioral biology from Emory University as a liberal arts scholarship recipient.

During her undergraduate education, she spent four years at Yerkes National Primate Research Center studying selective MRI-guided neurotoxic lesions and neuroanatomical procedures in rhesus macaques to assess brain reorganization following neonatal brain lesions. During medical school, she became heavily involved in the UPMC Center for Image-Guided Neurosurgery under the mentorship of L. Dade Lunsford, MD. Specifically, she worked on clinical studies regarding stereotactic radiosurgery outcomes for benign and malignant brain tumors, arteriovenous malformations and cavernous malformations. Her peer-reviewed work has been presented at regional and national neurosurgical conferences in oral and abstract form.

Dr. Jacobs enjoys boxing, spinning, and international travel in her free time. She is a native of Atlanta, Georgia.

Specialized Areas of Interest
Cerebrovascular and skull base neurosurgery.

Professional Organization Membership
American Association of Neurological Surgeons
American Medical Association
Congress of Neurological Surgeons

Education & Training
BS, Neuroscience/Behavioral Biology, Emory University, 2016
MD, University of Pittsburgh School of Medicine, 2020

Honors & Awards
Excellence in Neurosurgery Award, University of Pittsburgh Department of Neurological Surgery, 2022
Morris H. and Gertrude M. Harris Foundation Scholar for Jewish Medical Students, 2016-20
Liberal Arts Scholarship Recipient, Emory University, 2012-16

Publications: 2023-24
• Refereed Articles:
Gajjar AA, Le AHD, Jacobs RC, Mooney JH, Lavadi RS, Kumar RP, White MD, Elsayed GA, Agarwal N. Patient Perception of Spinal Cord Injury Through Social Media: An Analysis of 703 Instagram and 117 Twitter Posts. *J Craniovertebr Junction Spine* 14(3):288-29, 2023.

Agarwal P, Sharma N, Nayar G, Jacobs RC, Al-Bayati AA, Lunsford LD, McDowell MM, Greene S. Long-Term Outcomes of Deep Pediatric Arteriovenous Malformations. *J Neurosurg Pediatr* 33(1):22-28, 2023.

Bin-Alamer O, Plute T, Mallela AN, Jacobs R, Hadjipanayis CG, Hamilton DK, Maroon J, Lunsford LD, Friedlander RM, Abou-Al-Shaar H. Cross-Sectional Examination of Current and Future Trends and Attributes of The Presidents of the American Association of Neurological Surgeons and The Congress of Neurological Surgeons Societies. *World Neurosurg X* 23:100285.

Albin John, MD

PGY-2 Resident

Albin A. John, MD, MBA, joined the University of Pittsburgh Department of Neurological Surgery residency program in July 2023 after graduating from Texas Tech University Health Sciences Center. He received his undergraduate degree from Duke University.

Prior to residency, Dr. John performed clinical and translational research in various fields including neurology, orthopedics, plastic surgery, burn and neurosurgery. He has conducted clinical neurosurgical research on topics ranging from optogenetics to spinal hardware, operative techniques and advanced imaging for Chiari patients.

Dr. John was born and raised in Singapore. After immigrating to the United States, he spent his formative years in Houston, Texas. Outside of neurosurgery, he enjoys sports, cooking, salsa dancing, and spending time with family and friends.

Specialized Areas of Interest
Complex spine; spine oncology; hardware and medical devices; entrepreneurship.

Professional Organization Membership
American Association of Neurological Surgeons
Congress of Neurological Surgeons

Education & Training
BA, Neuroscience, Duke University, 2018
MBA, Rawls College of Business, 2020
MD, Texas Tech University Health Sciences Center, 2023

Honors & Awards
Alpha Omega Alpha, Zeta Texas Chapter, 2022
Phi Kappa Phi, Rawls College of Business, 2019
Distinction in Neuroscience, Duke University, 2018

Andrew Legarreta, MD

Chief Resident

Andrew D. Legarreta, MD, joined the University of Pittsburgh Department of Neurological Surgery residency program in July 2019, after earning his medical degree from Vanderbilt University School of Medicine. He completed his undergraduate studies at Duke University, where he earned a bachelor of arts in history.

During his time in medical school, Dr. Legarreta focused on the effects of sports-related concussions among high school athletes. His research specifically explored predictors of post-concussion syndrome and, separately, analyzed structural and functional neuroimaging findings in football players. His peer-reviewed studies have been presented in both oral and poster formats at regional and national neurosurgical conferences.

In his residency, Dr. Legarreta has concentrated on minimally invasive spine surgery, particularly in the context of deformity correction. His current research involves the application of machine learning techniques to various aspects of spine surgery.

In his leisure time, Dr. Legarreta enjoys playing guitar, traveling internationally and playing golf. He is originally from Buffalo, New York.

Andrew Legarreta, MD

Specialized Areas of Interest
Minimally invasive spine surgery; machine-learning; scoliosis and complex spinal deformity; sport-related concussion.

Professional Organization Membership
American Association of Neurological Surgeons
American Medical Association
Congress of Neurological Surgeons

Education & Training
BA, History, Duke University, 2014
MD, Vanderbilt University School of Medicine, 2019

Honors & Awards
Cornelius Vanderbilt Scholarship, Vanderbilt University School of Medicine, 2015-19

Publications: 2023-24
• Refereed Articles:
Belkhir JR, Pease M, McCarthy DJ, Legarretta A, Mittal AM, Crago EA, Gross BA, Lang MJ. Subarachnoid Hemorrhage Outcomes in an Endovascular Right of First Refusal Neurosurgical Environment. *World Neurosurg* 181:e524-e532, 2024.

Alan N, Zenkin S, Lavadi RS, Legarreta AD, Hudson JS, Fields DP, Agarwal N, Mamindla P, Ak M, Peddagangireddy V, Puccio L, Buell TJ, Hamilton DK, Kanter AS, Okonkwo DO, Zinn PO, Colen RR. Associating T1-Weighted and T2-Weighted Magnetic Resonance Imaging Radiomic Signatures With Preoperative Symptom Severity in Patients With Cervical Spondylotic Myelopathy. World *Neurosurg* 184:e137-e143, 2024.

Adida S, Legarreta AD, Hudson JS, McCarthy D, Andrews E, Shanahan R, Taori S, Lavadi RS, Buell TJ, Hamilton DK, Agarwal N, Gerszten PC. Machine Learning in Spine Surgery: A Narrative Review. *Neurosurgery*. 94(1):53-64, 2024.

Kumar RP, Adida S, Lavadi RS, Mitha R, Legarreta AD, Hudson JS, Shah M, Diebo B, Fields DP, Buell TJ, Hamilton DK, Daniels AH, Agarwal N. A guide to selecting upper thoracic versus lower thoracic uppermost instrumented vertebra in adult spinal deformity correction. *Eur Spine J* [Online ahead of print], 2024.

Gajjar AA, Kumar RP, Paliwoda ED, Kuo CC, Adida S, Legarreta AD, Deng H, Anand SK, Hamilton DK, Buell TJ, Agarwal N, Gerszten PC, Hudson JS. Usefulness and Accuracy of Artificial Intelligence Chatbot Responses to Patient Questions for Neurosurgical Procedures. *Neurosurgery* [Online ahead of print], 2024.

Bin-Alamer O, Abou-Al-Shaar H, Singh R, Mallela AN, Legarreta A, Bowden G, Mathieu D, Perlow HK, Palmer JD, Elhamdani S, Shepard M, Liang Y, Nabeel AM, Reda WA, Tawadros SR, Abdelkarim K, El-Shehaby AMN, Emad Eldin R, Elazzazi AH, Warnick RE, Gozal YM, Daly M, McShane B, Addis-Jackson M, Karthikeyan G, Smith S, Picozzi P, Franzini A, Kaisman-Elbaz T, Yang HC, Hess J, Templeton K, Zhang X, Wei Z, Pikis S, Mantziaris G, Simonova G, Liscak R, Peker S, Samanci Y, Chiang V, Kersh CR, Lee CC, Trifiletti DM, Niranjan A, Hadjipanayis CG, Lunsford LD, Sheehan JP. Local control and survival after stereotactic radiosurgery for colorectal cancer brain metastases: an international multicenter analysis. *J Neurosurg* 140(5):1233-1242, 2023.

Andrew Legarreta, MD

Shanahan RM, Hudson JS, Huq S, Legarreta A, Fields DP, Phillips HW, Kellogg RG. Infant Rudimentary Meningocele with Tethering of the Cervical Cord: A Case Report. *Asian J Neurosurg* 18(3):676-678, 2023.

Adida S, Legarreta A, Hudson JS, Kumar RP, Kass NM, Agarwal N, Gerszten PC, Andrews EG. Application of Machine Learning for Automatic Segmentation of Paraspinal Musculature. *World Neurosurg* 180:228-230, 2023.

Deng H, Puccio DJ, Anand SK, Yue JK, Hudson JS, Legarreta AD, Wei Z, Okonkwo DO, Puccio AM, Nwachuku EL. Power Drill Craniostomy for Bedside Intracranial Access in Traumatic Brain Injury Patients. *Diagnostics* (Basel) 13(14):2434, 2023.

Research Activities
Dr. Legarreta's research focuses on leveraging advanced technologies to enhance neurosurgical techniques and improve patient outcomes. His significant contributions include the application of machine learning to streamline and refine spine surgery processes, particularly by optimizing surgical planning. Additionally, he has been involved in the use of MRI radiomic signatures to better correlate preoperative imaging findings with symptom severity in patients with cervical spondylotic myelopathy. His work also extends to evaluating the effectiveness of stereotactic radiosurgery in treating brain metastases from colorectal and other gastrointestinal cancers, focusing on improving local control and survival rates. Furthermore, Dr. Legarreta explores the potential of artificial intelligence in enhancing patient communication, specifically through the deployment of AI-driven chatbots to field patient inquiries about neurosurgical procedures. This diverse array of research not only advances the field of neurosurgery but also promises to significantly impact patient care delivery.

Arka N. Mallela, MD

PGY-7 Resident

Arka N. Mallela, MD, joined the University of Pittsburgh Department of Neurological Surgery residency program in July 2018 after graduating from the University of Pennsylvania School of Medicine, earning his MD and MS in translational research. He received his undergraduate degrees from the Vagelos Scholars Program at the University of Pennsylvania, completing a BA in biophysics, biochemistry, and philosophy and an MS in biological chemistry.

Dr. Mallela's research lies at the intersection of neurophysiology, neuroimaging, network theory and deep learning. He is currently interested in utilizing these tools to study a variety of neurological diseases, including expressive language, fetal brain folding, epilepsy, and brain tumors. For his work, Dr. Mallela has received the 2023 CNS Stryker Tumor Award and was selected for the 2022 AES Fellows program. He was previously selected for the Burroughs Wellcome Foundation Physician Scientist Incubator Program as well as the Department of Neurological Surgery's inaugural NIH R25 scholar as part of the N3-PREP program. He is additionally funded via the NIH NRSA F32 grant and Loan Repayment Program to study the role of the supplementary motor area and associated areas in the generation of complex speech and motor movements using intracranial electrophysiology.

In his free time, Dr. Mallela enjoys hiking, gardening, and spending time with his family, wife, and friends.

Specialized Areas of Interest
Epilepsy surgery; neuro-oncology.

Arka N. Mallela, MD

Professional Organization Membership
American Association of Neurological Surgeons
American Epilepsy Society
Association for Clinical and Translational Sciences
Congress of Neurological Surgeons
Society for the Neurobiology of Language

Education & Training
BS, Biophysics, Biochemistry, Philosophy, University of Pennsylvania, 2013
MS, Biological Chemistry, University of Pennsylvania, 2013
MS, Translational Research, University of Pennsylvania, 2018
MD, University of Pennsylvania Perelman School of Medicine, 2018

Honors & Awards
N3-PREP Award, NIH R25 Program, 2024-25
First Place, Resident Presentation, Neurosurgical Society of Pittsburgh, 2024
Stryker CNS Tumor Award, AANS, 2023
American Epilepsy Society Fellow, 2022
NIH Loan Repayment Program, 2023-25
F32 Ruth L. Kirschstein Postdoctoral Individual National Research Service Award, 2022-25
Highest ABNS Score Award, UPMC Department of Neurosurgery, 2021
Physician Scientist Incubator Program, Burroughs Wellcome Foundation, 2021
Walter L. Copeland Grant, Copeland Foundation, 2020
American Brain Tumor Association Young Investigator Award, 2017
ITMAT Prize for Clinical/Translational Research, University of Pennsylvania, 2015
Vagelos Scholars Program in Molecular Life Sciences, University of Pennsylvania, 2009-2013

Publications: 2023-24
• Refereed Articles:
Ikegaya N, Aung T, Mallela A, Hect JL, Damiani A, Gonzalez- Martinez JA. Thalamic stereo-electroencephalography for neuromodulation target selection: Proof of concept and review of literature of pulvinar direct electrical stimulation. *Epilepsia* 65(6):e79-e86, 2024.

Sharma N, Mallela AN, Khan T, Canton SP, Kass NM, Steuer F, Jardini J, Biehl J, Andrews EG. Evolution of the meta-neurosurgeon: A systematic review of the current technical capabilities, limitations, and applications of augmented reality in neurosurgery. *Surg Neurol Int* 15:146, 2024.

Plute T, Bin-Alamer O, Mallela AN, Kallos JA, Hamilton DK, Pollack IF, Lunsford LD, Friedlander RM, Abou-Al-Shaar H. A comprehensive evaluation of career trajectories of the American Association of Neurological Surgeons William P. Van Wagenen fellows. *World Neurosurg X* 23:100365, 2024.

Bin-Alamer O, Plute T, Mallela AN, Jacobs R, Hadjipanayis CG, Hamilton DK, Maroon JC, Lunsford LD, Friedlander RM, Abou-Al-Shaar H. Cross-Sectional Examination of Current and Future Trends and Attributes of The Presidents of The American Association of Neurological Surgeons and The Congress of Neurological Surgeons Societies. *World Neurosurg X* 23:100285, 2024.

Aung T, Mallela A, Ho J, Tang W, Abou-Al-Shaar H, Gonzalez-Martinez J. Challenging cortical explorations in difficult-to-localize seizures: The rationale and usefulness of perisylvian paralimbic explorations with orthogonal SEEG depth electrodes. *Neurosurgery* 94(5):1061-1071, 2024.

Hect J, Mallela AN, Pupi M, Anthony A, Fogg D, Ho J, Slingerland A, Ikegaya N, Abou-Al-Shaar H, Aung T, Gonzalez-Martinez J. Safety of concomitant cortical and thalamic sEEG explorations in patients with drug resistant epilepsies. *Neurosurgery* [Online ahead of print], 2024.

Arka N. Mallela, MD

Bin-Alamer O, Qedair J, Abou-Al-Shaar H, Mallela AN, Alnefaie N, Abou Al-Shaar AR, Balasubramaniam K, McCarthy D, Fields DP, Agarwal N, Gerszten PC, Hamilton DK. Surgical intervention ≤ 24 hours versus > 24 hours after injury for the management of acute traumatic central cord syndrome: a systematic review and meta-analysis. *J Neurosurg Spine* 40(5):653-661, 2024.

Plute T, Abou-Al-Shaar H, Alarifi N, Patel A, Mallela AN, Baddour K, Zenonos GA, McCall AA, Gardner PA. Evaluation of clinical predictors of postoperative outcomes in tegmen defect patients with and without concurrent superior semicircular canal dehiscence and cerebrospinal fluid leak. *Am J Otolaryngol* 45(4):104317, 2024.

Albakhi I, Shafqat A, Bin-Alamer O, Mallela AN, Gersey ZC, Fernandes Cabral D, Sabbagh AJ, Hadjipanayis CG, Gonzalez-Martinez JA, Friedlander RM, Abou-Al-Shaar H. Complications and Visual Outcomes Following Surgical Resection of Pediatric Optic- pathway/Hypothalamic Gliomas: A Systematic Review and Meta-analysis. *Childs Nerv Syst* 40(7):2033-2042 2024.

Mallela AN, Iheagwara UK, Fogg D, Anthony A, Gersey ZC, Zhang X, Abou-Al-Shaar H, Anand S, Xu E, Zinn PO, Burton SA, Quinn A, Ozhasoglu C, Clump DA, Siddiqui Z, Amanukulor N. Preoperative stereotactic radiosurgery for cerebral metastases: safe, effective, and decreases steroid dependency. *J Neurosurg* [Online ahead of print], 2024.

Albalkhi I, Shafqat A, Mallela AN, Anand S, Bin-Alamer O, Abou-Al-Shaar H. Fluorescence-guided Resection of Spinal Tumors: A Systematic Review and Meta-analysis. *Neurosurg Rev* 47(1):10, 2023.

Albalkhi I, Shafqat A, Bin-Alamer O, Mallela AN, Kuminkoski C, Labib MA, Lang MJ, Lawton MT, Morcos JJ, Couldwell WT, Abou-Al-Shaar, Long-term Functional Outcomes and Complications of Microsurgical Resection of Brainstem Cavernous Malformations: A Systematic Review and Meta-analysis. *Neurosurg Rev* 46(1):252, 2023.

Yoh N, Abou-Al-Shaar H, Bethamcharla R, Beiriger J, Mallela AN, Connolly ES, Sekula RF Jr. Minimally Invasive Surgical Evacuation for Spontaneous Cerebellar Hemorrhage: A Case Series and Systematic Review. *Neurosurg Rev* 46(1):208, 2023.

Bin-Alamer O, Abou-Al-Shaar H, Mallela AN, Legarreta A, Singh R, Lu VM, Bowden G. Local Control and Survival After Stereotactic Radiosurgery for Colorectal Cancer Brain Metastases: An International Multicenter Analysis. *J Neurosurg* 140(5):1233-1242, 2023.

Gersey ZC, Fogg D, Pease M, Mallela AN, Andrews E, Plute T, Pearce TM, Njoku-Austin C, Anthony A, Amankulor NM, Zinn PO. Outcomes and treatment algorithm in glioblastoma patients 80 years and older. *World Neurosurg* 178:e540-e548, 2023.

Research Activities

Dr. Mallela's research focuses broadly on bridging the gap between human behavior, in particular language, and structural and electrophysiological mechanisms to improve both our understanding of cognitive processes and to better treat patients with drug-resistant epilepsy, movement disorders, psychiatric disorders, and brain tumors. To address these key questions, this research marries intracranial electrophysiological exploration during stereo EEG, deep brain stimulation, and awake craniotomy with detailed neuropsychological testing, and advanced neuroimaging, At present, he is utilizing this approach to explore the role of the supplementary motor area in fluent expressive speech and motor production. Other work focuses on the role of functional brain mapping in the treatment of drug-resistant epilepsy and in virtual and augmented reality.

David J. McCarthy, MD

PGY-5 Resident

David McCarthy, MD, joined the University of Pittsburgh Department of Neurological Surgery residency program in July of 2020 after graduating from the University of Miami Miller School of Medicine. He earned a master's degree in clinical and translational research with a focus in statistics from the University of Miami and a bachelor of science degree in biochemistry from the University of Florida.

During medical school, Dr. McCarthy cultivated an interest in ischemic and hemorrhagic stroke treatment modalities and outcomes. In the laboratory, he investigated endothelial dysfunction in aneurysms and pharmaceutical stroke recovery enhancement. For aneurysms, he researched molecular inhibition of pathologic endothelial cell expression and enhanced endothelization following endovascular treatment modalities. In ischemic stroke, he utilized a murine photo-chemical cortical stroke model to assess the efficacy of various neuroprotective pharmaceutical agents. In clinical research, Dr. McCarthy authored and co-authored manuscripts that focused on optimizing neuroendovascular access, and post stroke thrombectomy critical care.

Dr. McCarthy's research interests include neurosurgical epidemiology and treatment trends, neuroendovascular devices, and the molecular physiology of cerebral aneurysms. He hopes to apply artificial intelligence and machine learning for computation flow dynamic assessment of cerebral aneurysms, comparing physiologic cell stress to genomic expression. Additionally, he hopes to contribute to neurosurgical literature with the improvement of current statistical methods.

Dr. McCarthy was raised in Tampa, Florida. In his free time, he enjoys creating art (resin, graphite), winter mountaineering, skiing, hiking, running, and weight lifting.

Specialized Areas of Interest
Cerebrovascular neurosurgery, neuro-oncology, pediatric neurosurgery, functional neurosurgery, and neurotrauma.

Professional Organization Membership
American Association of Neurological Surgeons
American Heart Association: Stroke Council
Congress of Neurological Surgeons

Education & Training
BS, Biochemistry, University of Florida, 2014
MS, University of Miami, 2018
MD, University of Miami Miller School of Medicine, 2020

Honors & Awards
Judson Scholarship Recipient, University of Miami Miller School of Medicine, 2014-2020
ISC Junior Investigator Travel Award, American Heart Association, 2019
Second Place Clinical Poster Award, Eastern Atlantic Student Research Forum, 2018
Cerebrovascular Disease and Stroke Fellowship Recipient, American Heart Association, 2017
Best Clinical Poster Presentation Winner, Eugene J. Sayfie Research Day, 2017
Medical Student Research Fellow, Neurosurgery Research and Education Foundation, 2017
Clinical and Translational Investigation Scholarship, University of Miami, 2017

Gautam M. Nayar, MD

PGY-7 Resident

Gautam M. Nayar, MD, joined the University of Pittsburgh Department of Neurological Surgery residency program in July of 2018.

After graduating from the University of Florida with a degree in computer science, Dr. Nayar completed his medical education at Duke University School of Medicine. As the Ruth K. Broad Foundation Neurosciences Fellow, he studied neuronal response and processing towards integration of sensory brain-computer interfaces in the laboratory of Miguel Nicolelis, MD, PhD. Dr. Nayar also cultivated an interest in spinal outcomes research focusing on minimally invasive approaches, radiation reduction protocol, and identification of pre-operative risk factors. Dr. Nayar's work on the clinical efficacy of ultra-low radiation imaging protocols was awarded the 2017 AANS Donald Quest Clinical Science Award.

Although raised in Pittsburgh, Dr. Nayar moved to Gainesville, Florida for high school and college. In his free time, he enjoys hiking, weight lifting, and spending time with his family.

Specialized Areas of Interest
Spine surgery.

Professional Organization Membership
American Association of Neurological Surgeons
Congress of Neurological Surgeons

Education & Training
BS, Computer Science, University of Florida, 2014
MD, Duke University, 2018

Honors & Awards
Donald Quest Clinical Science Award, AANS, 2017

Publications: 2023-24
• Refereed Articles:
Plute T, Nayar G, Weinberg J, Keister A, Abou-Al-Shaar H, Al-Bayati AR, Nogueira RG, Lang MJ, Nimjee S, Gross BA.. Assessment of the safety and efficacy of the Zoom 45 and 55 reperfusion catheters for medium and distal mechanical thrombectomies: A multi-institutional study. *J Stroke Cerebrovasc Dis* 33(6):107698, 2024.

Agarwal P, Sharma N, Nayar G, Jacobs RC, Al-Bayati A, Lunsford LD, McDowell MM, Greene S. Long-term outcomes of deep pediatric arteriovenous malformations. *J Neurosurg Pediatr* 33(1):22-28, 2024.

Algattas HN, Nayar GM, Snyderman CH, Stefko ST, Al-Bayati AR, Gardner PA. Endoscopic endo-nasal approach for salvage embolization of indirect carotid-cavernous fistula: 2-dimensional operative video. *Oper Neurosurg* (Hagerstown) 26(2):240, 2024.

Eric M. Nturibi, MD

PGY-2 Resident

Eric M. Nturibi, MD, joined the University of Pittsburgh Department of Neurological Surgery residency program in July of 2022 after earning an MD degree from the University of Pittsburgh School of Medicine. He received his undergraduate education at Franklin and Marshall College in Lancaster, Pennsylvania, graduating cum laude in 2015.

Prior to residency, Dr. Nturibi was involved in basic science research aimed at understanding the molecular mechanisms underpinning influenza infections in cellular and animal models. He was also involved in clinical and translational neurosurgical research in the fields of neurocritical care and pediatric neurosurgery.

Dr. Nturibi was born and raised in Nairobi, Kenya. Outside of the hospital, he enjoys sports—particularly soccer and athletics—grilling, spending time with his friends and exploring the wonderful city of Pittsburgh.

Specialized Areas of Interest
Neurotrauma; spine deformity surgery.

Hospital Privileges
Pittsburgh VA Hospital
UPMC Children's Hospital of Pittsburgh
UPMC Mercy
UPMC Presbyterian
UPMC Shadyside

Professional Organization Membership
American Medical Association
American Association of Neurological Surgery
Congress of Neurological Surgery
National Medical Association

Education & Training
BA, Biochemistry & Molecular Biology, Franklin and Marshall College, 2015
MD, University of Pittsburgh, 2022

Honors & Awards
The Theodore Kurze, MD, Senior Prize for Excellence in Neurological Surgery, UPMC Neurosurgery, 2022
Academic Achievement Award for Academic Merit and Community Service, Pittsburgh National Medical Association, 2018
Cum Laude, Franklin and Marshall College, 2015

Madi Remick, MD

PGY-1 Resident

Madison (Madi) Remick, MD, joined the University of Pittsburgh Department of Neurological Surgery as a PGY-1 resident on July 1, 2024 after earning her medical degree from the University of Pittsburgh. She received her bachelor of science in neuroscience from the University of Michigan after which she went on to receive a master of science in biomedical science from the University of Pittsburgh.

Madi Remick, MD

Dr. Remick's clinical and academic interests include functional neurosurgery, pediatric neurosurgery, and clinical outcomes research. Prior to medical school, Dr. Remick worked as the clinical research coordinator and lab manager of the Pediatric Brain Electrophysiology Laboratory at UPMC Children's Hospital of Pittsburgh. Prior to residency, she performed various clinical and translational research projects across various topics in neurosurgery with a specific focus on drug-resistant epilepsy under the mentorship of Taylor J. Abel, MD.

Born in Albany, New York, Dr. Remick spent her childhood in Cleveland, Ohio and Morgantown, West Virginia. Outside of work, she enjoys hiking, skiing, watching college football, and spending time with her friends, family, and partner Jim.

Specialized Areas of Interest
Functional neurosurgery; pediatric neurosurgery; skull base surgery; clinical outcomes research; medical education; women in surgery.

Professional Organization Membership
Allegheny County Medical Society
American Association of Neurological Surgeons
Congress of Neurological Surgery
Pennsylvania Medical Society

Education & Training
MD, University of Pittsburgh, 2024
MS, Biomedical Science, University of Pittsburgh, 2019
BS, Neuroscience, University of Michigan, 2018

Honors & Awards
Theodore Kurze Senior Prize for Excellence in Neurological Surgery and Clinical Neuroscience, University of Pittsburgh, 2024
Bert & Sally O'Malley Awards for Outstanding Medical Student Research, University of Pittsburgh, 2024
Roth Research Fellowship Award, University of Pittsburgh, 2024

Publications: 2023-24
• Refereed Articles:
Abdallah HM, Gersey ZC, Plute T, Remick M, Abou-Al-Shaar H, Fazeli PK, Mahmud H, Lang MJ, Gardner PA, Zenonos GA, Gross BA. Toward optimized and cost-efficient protocols for inferior petrosal sinus sampling in the diagnosis of Cushing's Disease. *Neurosurgery* 94(3): 508-514, 2024.

Jessica Ryvlin, MD

PGY-1 Resident

Jessica Ryvlin, MD, will join the University of Pittsburgh Department of Neurological Surgery residency program in July 2024 after graduating from Albert Einstein College of Medicine with Distinction in Research. Prior to medical school, she graduated with honors in research from Cornell University with a degree in human biology, health, and society and a minor in health policy. For her undergraduate laboratory research focusing on congenital vascular development and hemodynamics, she received the American Heart Association Founders Affiliate Research Fellowship in 2016 and was a winner of the Federation of American Societies for Experimental Biology (FASEB) BioArt Competition.

Jessica Ryvlin, MD

As a medical student, Dr. Ryvlin spent several years as a clinical investigator in the Montefiore Medical Center Department of Neurosurgery Spine Research Group, going on to complete a year-long research fellowship dedicated to establishing and validating predictive tools for patients undergoing operative interventions for spinal metastases. She also consistently participated in global neurosurgery efforts in collaboration with the Virtue Foundation, traveling to Ulaanbaatar, Mongolia to provide clinical and operative support for education in complex spine and spinal oncology in resource-poor settings.

Dr. Ryvlin was born and raised in Minneapolis, Minnesota where she was a competitive tennis player in the United States Tennis Association (USTA) until moving to New York for her undergraduate and graduate degrees. Outside of neurosurgery, she enjoys alpine and back country skiing, climbing and bouldering, ultralight backpacking, board games, and traveling.

Specialized Areas of Interest
Spine; spinal oncology; complex spine; global neurosurgery; predictive analytics; machine learning & artificial intelligence; health disparities; medical education.

Professional Organization Membership
American Association of Neurological Surgeons
Congress of Neurological Surgeons

Education & Training
MD, Albert Einstein College of Medicine, 2024
BS, Cornell University, 2017

Honors & Awards
Distinction in Research Graduate, Albert Einstein College of Medicine, 2024
Alpha Omega Alpha Honor Society, 2023
Student Research Fellowship, Albert Einstein College of Medicine, 2020-22
Honors Research Program, Cornell University Division of Nutritional Sciences, 2017
Affiliate Research Fellowship, American Heart Association Founders, 2016
BioArt Competition Winner, Federation of American Societies for Experimental Biology, 2015

Publications: 2023-24
• Refereed Articles:
Ryvlin J, Kim SW, De la Garza Ramos R, Hamad M, Stock A, Owolo E, Fourman MS, Eleswarapu A, Gelfand Y, Murthy S, Yassari R. External Validation of an Online Wound Infection and Wound Reoperation Risk Calculator After Metastatic Spinal Tumor Surgery. *World Neurosurg* 185:e351-e356, 2024.

Fluss R, Ryvlin J, Lam S, Abdullah M, Altschul DJ. Deadliness of Traumatic Subdural Hematomas in the First Quarter of the Year: A Measurement by the American College of Surgeons-National Surgical Quality Improvement Program (ACS-NSQIP). *Cureus* 15(12):e50860, 2023.

Ryvlin J, Kim SW, Hamad MK, Fourman MS, Eleswarapu A, Murthy SG, Gelfand Y, De la Garza Ramos R, Yassari R. The prognostic role of neutrophil-to-lymphocyte ratio, platelet-to-lymphocyte ratio, and systemic immune-inflammation index on short- and long-term outcome following surgery for spinal metastases. *J Neurosurg Spine* 40(4):475-484, 2023.

Ryvlin J, Javed K, la Garza Ramos R, Hamad M, Essibayi MA, Gelfand Y, Murthy S, Yassari R. Is perioperative blood transfusion associated with postoperative thromboembolism or infection after metastatic spinal tumor surgery? *Clin Neurol Neurosurg* 235:108052, 2023.

Jessica Ryvlin, MD

De la Garza Ramos R, Ryvlin J, Hamad MK, Fourman MS, Eleswarapu A, Gelfand Y, Murthy SG, Shin JH, Yassari R. The prognostic nutritional index (PNI) is independently associated with 90-day and 12-month mortality after metastatic spinal tumor surgery. *Eur Spine J* 32(12):4328-4334, 2023.

De la Garza Ramos R, Ryvlin J, Hamad MK, Fourman MS, Gelfand Y, Murthy SG, Shin JH, Yassari R. Predictive value of six nutrition biomarkers in oncological spine surgery: a performance assessment for prediction of mortality and wound infection. *J Neurosurg Spine* 39(5):664-670, 2023.

Ryvlin J, Shin JH, Yassari R, De la Garza Ramos R. Editorial: Artificial intelligence and advanced technologies in neurological surgery. *Front Surg* 10:1251086, 2023.

Anthony Schulien, MD

PGY-4 Resident

Anthony J. Schulien, MD, joined the University of Pittsburgh Department of Neurological Surgery residency program in July 2021 after earning an MD degree from the University of Pittsburgh School of Medicine. Here, he completed the five-year Physician Scientist Training Program (PSTP), and was awarded The Theodore Kurze, MD, award for Excellence in Neurological Surgery and Clinical Neurosciences. Prior to medical school, he graduated magna cum laude from the University of Pittsburgh with a degree in neuroscience as well as a minor in chemistry.

During his training, Dr. Schulien has conducted longitudinal research on ischemic neuroprotective strategies at the Pittsburgh Institute for Neurodegenerative Diseases (PIND). His translational research has resulted in the development of a novel, blood brain barrier-permeable neuroprotective peptide that mitigates Kv2.1 potassium channel-mediated apoptotic neuronal death and improves neurologic functional outcomes following cerebral ischemia in a murine model. His work has resulted in publications in *Science Advances, Brain*, and the *Journal of Neuroscience*, among others. Dr. Schulien has presented this work broadly in both national and international forums. He has also performed clinical research in outcomes following skull base surgery with the department.

Before matriculation to medical school, Dr. Schulien found his passion for medicine as a volunteer EMT with the Loudoun County Volunteer Rescue Squad. Dr. Schulien was born and raised in Potomac Falls, Virginia. His hobbies include back country backpacking, snowboarding, and spending time with his family, friends, and dog.

Specialized Areas of Interest
Cerebrovascular neurosurgery; endovascular neurosurgery; skull base neurosurgery; neurotrauma; spine surgery; general neurosurgery.

Professional Organization Membership
American Association of Neurological Surgeons
American Medical Association
Congress of Neurological Surgeons
Society for Neuroscience

Professional Activities
Pitt Neurosurgery Residency Advisory Council (PNRAC)

Education & Training
BS, Neuroscience, University of Pittsburgh, 2015
MD, Physician Scientist Training Program, University of Pittsburgh, 2021

Anthony Schulien, MD

Honors & Awards

Top Presentation Award, Stuart Niles Rowe Research Day, University of Pittsburgh Department of Neurological Surgery, 2023

The Theodore Kurze, MD, Senior Prize for Excellence in Neurological Surgery, University of Pittsburgh Department of Neurological Surgery, 2021

Certificate of Merit for Excellence in the Longitudinal Research Project, University of Pittsburgh School of Medicine, 2021

Top Research Poster Award, Brain Day, University of Pittsburgh Brain Institute, 2018

Physician Scientist Training Program (PSTP) Trainee Scholarship, University of Pittsburgh School of Medicine, 2016

Neuroscience Research Excellence Award, University of Pittsburgh Department of Neuroscience, 2015

Summer Undergraduate Research Program (SURP) in Molecular Pharmacology Fellowship, Center for Neuroscience at the University of Pittsburgh (CNUP), 2014

The Chancellor's Undergraduate Research Fellowship, University of Pittsburgh Honors College, 2014

President's Volunteer Service Award, Loudoun County Volunteer Rescue Squad, 2013-2014

Nikhil Sharma, MD

PGY-1 Resident

Nikhil Sharma, MD, MS, joined the University of Pittsburgh Department of Neurological Surgery residency program in July 2024 after earning his MD from the University of Pittsburgh School of Medicine. He received his master's degree in biomedical science from Geisinger Commonwealth School of Medicine in 2019, and his bachelor's degree in business from Fairleigh Dickinson University in 2013.

Prior to medical school, Dr. Sharma was the inaugural recipient of the Charles Harrison Frazier Scholar Program at the University of Pennsylvania Department of Neurosurgery, where he worked on multiple projects ranging from multi-centered clinical trials to new device studies in the NICU and large database reviews. His work resulted in numerous publications and several awards at national conferences and continued the development of the scholar program.

As a medical student, Dr. Sharma was the neurosurgery mixed reality (MR) research fellow in the University of Pittsburgh Surreality Lab, under the mentorship of Edward G. Andrews, MD. His work on implementing mixed reality into the neurosurgical operating room led to numerous publications and more than $500,000 in grant awards, as well as partnerships with large medical device companies including Medivis.

Throughout his medical school journey, Dr. Sharma was awarded the Loren Roth Research Fellowship Award, the Pre-Doctoral Surreality Innovations and Research Fellowship Award, the Neurosurgery Charles Harrison Frazier Scholar Award, and the Dean's Summer Research Program Award. Dr. Sharma's other clinical research interests include skull base tumors and functional neurosurgery.

Dr. Sharma was born in Jaipur, India but spent most of his childhood in Bryn Mawr, Pennsylvania. Outside of neurosurgery, he enjoys playing golf, working out, traveling, playing chess, and spending time with family and friends.

Specialized Areas of Interest

Functional neurosurgery; neuro-oncology; artificial intelligence (AI) and mixed-reality (MR) in neurosurgery; medical education.

Nikhil Sharma, MD

Professional Organization Membership
American Association of Neurological Surgeons
Congress of Neurological Surgeons
Society of Neurological Surgeons

Education & Training
BS, Business, Marketing, Fairleigh Dickinson University, 2013
MS, Biomedical Sciences, Geisinger Commonwealth School of Medicine, 2019
MD, University of Pittsburgh, 2024

Honors & Awards
Loren Roth Research Fellowship Award, University of Pittsburgh, 2022
Dean's Summer Research Program Award, University of Pittsburgh, 2021
Top Operative Technique Abstract, Functional Section, CNS Annual Meeting, 2021
Charles Harrison Frazier Neurosurgery Scholar, University of Pennsylvania Department of Neurosurgery, 2016-18

Publications: 2023-24
• Refereed Articles:
Kass NM, Irgebay Z, Cheng L, Moroni E, Dvoracek L, Andrews E, Canton S, Steuer F, Sharma N, Goldstein J. Mixed Reality in the Operating Room: An Initial Use in Frontal Sinus Setback in Gender Affirming Facial Surgery. *Plast Reconstr Surg Glob Open* 12(6):e5896, 2024.

Sharma N, Mallela AN, Khan T, Canton SP, Kass NM, Steuer F, Jardini J, Biehl J, Andrews EG. Evolution of the meta-neurosurgeon: A systematic review of the current technical capabilities, limitations, and applications of augmented reality in neurosurgery. *Surg Neurol Int* 15:146, 2024.

Frederico SC, Sharma N, Darling C, Zhang X, Kohanbash G. Myeloid cells as potential targets for immunotherapy in pediatric gliomas. *Front Pediatr* 12:1346493, 2024.

Sharma N, Head JR, Mallela AN, Shanahan RM, Abou-Al-Shaar H, Andrews EG. Single institution series describing External Ventricular Drain (EVD) placement and short- and long-term complications related to placement accuracy. *Surg Neurol Int* 15:67, 2024.

Canton SP, Njoku-Austin C, Steuer F, Dadi S, Sharma N, Kass NM, Fogg D, Clayton E, Cunningham O, Scott D, LaBaze D, Andrews EG, Hogan MV. Feasibility and usability of augmented reality technology in the orthopaedic operating room. *Curr Rev Musculoskelet Med* 17(5):117-128, 2024.

Agarwal P, Sharma N, Nayar G, Lunsford LD, McDowell MM, Greene S. Long-term outcomes of deep pediatric arteriovenous malformations. *J Neurosurg Pediatr* 33(1):22-28, 2023.

William Shuman, MD

PGY-3 Resident

William H. Shuman, MD, joined the University of Pittsburgh Department of Neurological Surgery residency program in July 2022 after graduating from the Icahn School of Medicine at Mount Sinai, earning his MD with distinction in research. He received his undergraduate degree from The Johns Hopkins University in 2016, completing a BA in biophysics and receiving the Detlev Bronk Award for Outstanding Scholarship in Biophysics.

During medical school, Dr. Shuman conducted clinical neurosurgical research focusing on patient outcomes primarily in spine surgery and skull base surgery, and he has presented his work

William Shuman, MD

at multiple national research conferences. He is interested in using his research experience to optimize postoperative outcomes for neurosurgical patients.

Dr. Shuman was born and raised in Detroit, Michigan. In his free time, he enjoys playing guitar, listening to blues rock and folk music, weight lifting and running, hiking, playing golf, pick-up basketball, bowling, cooking, and spending time with his family and friends.

Specialized Areas of Interest
Skull base surgery; spine surgery; pediatric neurosurgery; neurotrauma.

Professional Organization Membership
American Association of Neurological Surgeons
Congress of Neurological Surgeons

Education & Training
BA, Biophysics, The Johns Hopkins University, 2016
MD, Icahn School of Medicine at Mount Sinai, 2022

Honors & Awards
Distinction in Research, Icahn School of Medicine at Mount Sinai, 2022
Healthcare Delivery and Outcomes Presentation Award, AANS/CNS Spine Summit, 2019
Detlev Bronk Award in Biophysics, The Johns Hopkins University, 2016
Phi Beta Kappa, 2016

Oliver Y. Tang, MD

PGY-2 Resident

Oliver Y. Tang, MD, joined the University of Pittsburgh Department of Neurological Surgery residency program in July 2023 after earning his medical degree from the Warren Alpert Medical School of Brown University. Prior to medical school, he graduated magna cum laude from Brown University in 2019 with a bachelor of science in neuroscience with honors, studied in the Selective Program in Liberal Medical Education, and was one of four students in his undergraduate class to receive the Harvey A. Baker Fellowship.

Dr. Tang's clinical and academic interests include translational neuro-oncology, image-guided neurosurgery, health policy and social determinants of health, artificial intelligence and big data in clinical medicine, medical education, and global neurosurgery. He has published over 75 peer-reviewed publications in these fields. He has also received funding from the Neurosurgery Research & Education Foundation and the National Institutes of Health to study topics including CAR T therapy for glioblastoma and traumatic brain injury outcomes in Rwanda. During medical school, he was inducted into the Alpha Omega Alpha honor society and was also recognized with the Stanley Aronson Prize for excellence in the clinical neurosciences.

Dr. Tang was born in New York, but spent most of his childhood in New Jersey. Outside of neurosurgery, he enjoys swimming, musical theater, movie going, mystery and science fiction, video and board games, and spending time with family and friends.

Specialized Areas of Interest
Neuro-oncology; image-guided neurosurgery; pediatric neurosurgery; health policy; big data and artificial intelligence; medical education; global neurosurgery.

Oliver Y. Tang, MD

Professional Organization Membership
American Association of Neurological Surgeons
Congress of Neurological Surgeons
Society of Neuro-Oncology

Education & Training
MD, The Warren Alpert Medical School of Brown University, 2023
BS, Program in Liberal Medical Education, Brown University, 2019

Honors & Awards
CNS Foundation DEI Abstract Award, Congress of Neurological Surgeons, 2022, 2023
Neurosurgery "Editor's Choice" Article, Congress of Neurological Surgeons, 2021, 2023
The Stanley Aronson Prize, The Warren Alpert Medical School of Brown University, 2023
Alpha Omega Alpha, The Warren Alpert Medical School of Brown University, 2022
Framework in Global Health Program Scholarship, Brown University, 2021
Neurosurgery Research and Education Fund Medical Student Summer Research Fellowship, Neurosurgery Research and Education Fund, 2020
Best Clinical Research Award for Socioeconomic/CSNS Podium Presentation, Congress of Neurological Surgeons, 2019
Best Computational Health Systems Abstract Award at Computational Neuroscience Outcomes Center Symposium, Brigham & Women's Hospital, 2019
Third Place Socioeconomic E-Poster Award, American Association of Neurological Surgeons, 2019
Harvey A. Baker Fellowship, Brown University, 2019
The Milton Hamolsky Prize, Brown University, 2019

Publications: 2023-24
• Refereed Articles:
Bagley SJ, Binder ZA, Desai AS, Nasrallah MP, Maloney E, Brem S, Lustig R, Kurtz G, Alonso-Basanta M, Mohan S, Hwang W, Tang O, Logun M, Bhattacharyya M, Markovitz K, Delman D, Marshall A, Alanio C, Beatty GL, Brogdon JL, Hexner E, O'Rourke DM. Repeated peripheral infusions of anti-EGFRvIII CAR T cells in combination with pembrolizumab remodel the tumor microenvironment in de novo glioblastoma. *Nature Cancer* 5(3):517-531, 2024.

Ali R, Connolly ID, Tang OY, Mirza FN, Johnston B, Abdulrazeq HA, Lim R, Galamaga PF, Libby TJ, Sodha NR, Groff MW, Gokaslan ZL, Telfeian AE, Shin JH, Asaad WF, Zou J, Doberstein CE. Bridging the Literacy Gap for Surgical Consents: An AI-Human Expert Collaborative Approach. *npj Digital Medicine* 7(1):63 2024.

Ali R, Tang OY, Connolly ID, Abdulrazeq HA, Mirza FN, Lim RK, Johnston BR, Groff MW, Williamson T, Svokos K, Libby TJ, Shin JH, Gokaslan ZL, Doberstein CE, Zou J, Asaad WF. The Face of a Surgeon: An Analysis of Demographic Representation in Three Leading Artificial Intelligence Text-to-Image Generators. *JAMA Surgery* 159(1):87-95, 2024.

Mirza FN, Tang OY, Connolly ID, Abdulrazeq HA, Lim RK, Roye GD, Priebe C, Chandler C, Libby TJ, Groff MW, Shin JH, Telfeian AE, Doberstein CE, Asaad WF, Gokaslan ZL, Zou J, Ali R. Using ChatGPT to Facilitate Truly Informed Medical Consent. *New England Journal of Medicine AI* 1(2), 2024.

Ali R, Tang OY, Connolly I, Fridley JS, Shin JH, Zadnik Sullivan PL, Cielo D, Oyelese AA, Doberstein CE, Telfeian AE, Gokaslan ZL, Asaad WF. Performance of ChatGPT, GPT-4, and Google Bard on a Neurosurgery Oral Boards Preparation Question Bank. *Neurosurgery* 93(5):1090-1098, 2023.

Gina Watanabe, MD

PGY-1 Resident

Gina Watanabe, MD, joined the University of Pittsburgh Department of Neurological Surgery residency program in July 2024 after earning her medical degree from the University of Hawaii John A. Burns School of Medicine, where she was elected into the Alpha Omega Alpha Honor Society. She attended the University of Hawaii on a prestigious Regents scholarship and completed a bachelor of science degree in molecular cell biology in 2020.

Dr. Watanabe's clinical and academic interests span many areas of neurosurgery including neuro-oncology, neurotrauma, minimally invasive and complex spine, cerebrovascular, patient outcomes, technology in neurosurgery, and neurosurgery education.

Dr. Watanabe was born and raised on the island of Oahu. Outside of neurosurgery, she enjoys playing the guitar, tennis, and spending time with family and friends.

Specialized Areas of Interest

Spine, neuro-oncology, cerebrovascular, clinical outcomes, patient education, technology and innovation.

Professional Organization Membership

American Association of Neurological Surgeons
Congress of Neurological Surgeons

Education & Training

BS, Molecular Cell Biology, University of Hawaii at Manoa, 2020
MD, University of Hawaii John A. Burns School of Medicine, 2024

Honors & Awards

Dr. Frank and Mary McDowell Award for Excellence in Surgery, John A. Burns School of Medicine, 2024
Dr. Albert C.K. Chun-Hoon Service Award, John A. Burns School of Medicine, 2024
Po'okela Noi'i Research Award, John A. Burns School of Medicine, 2024
Alpha Omega Alpha, Hawaii Chapter, 2024
Matsumoto Scholarship in Honor of Dr. Windsor Cutting, John Burns School of Medicine, 2020
Honors Thesis Prize, University of Hawaii at Manoa, 2020
Associated Students of the University of Hawaii Research Award, University of Hawaii at Manoa, 2019
Regents Scholar, University of Hawaii at Manoa, 2016

Publications: 2023-24

• Refereed Articles:

Watanabe G, Wong JM, Estes B, Khan MF, Ogasawara C, Umana GE, Martin AR, Bloch O, Palmisciano P. Diffuse Midline H3K27-Altered Gliomas in the Spinal Cord: A Systematic Review. *J Neurooncol* 166(3):379-394, 2024.

Watanabe G, Conching A, Fry L, Putzler D, Khan MF, Haider MA, Haider AS, Ferini G, Rodriguez-Beato FY, Sharma M, Umana GE, Palmisciano P. Intraventricular Glioma in Pediatric Patients: A Systematic Review of Demographics, Clinical Characteristics, and Outcomes. *World Neurosurg* [Epub ahead of print], 2024.

Gina Watanabe, MD

Watanabe G, Young K, Rauber E, Khan MF, Suzuki R, Riestenberg R, Umana GE, Palmisciano P. A systematic review of extraneural meningioma metastasis: timing, evolution and outlook. *J Neurooncol* [Epub ahead of print], 2024.

James Yoon, MD

PGY-3 Resident

James Yoon, MD, joined the University of Pittsburgh Department of Neurological Surgery residency program in July 2022 after earning his medical degree from Yale School of Medicine. Prior to medical school, he graduated manga cum laude from Brown University in 2017 with a Bachelor of Science in neuroscience with honors.

Dr. Yoon's research focuses on value-based healthcare aimed at improving patient experiences through policy reforms, delivery system innovation, and outcomes research that informs safe, evidence-based clinical practices. During medical school, Dr. Yoon completed a health law and policy fellowship at the Solomon Center at Yale Law School. He is also active in organized neurosurgery and was elected to serve on the Young Neurosurgeons Committee in 2020 and co-president of the Cushing Society at Yale School of Medicine in 2021.

In recognition of his work, Dr. Yoon was recognized as one of "30 Under 30" trailblazers in North America healthcare by *Forbes Magazine* in 2022.

Dr. Yoon was born in South Korea. Outside of neurosurgery, he enjoys fencing, cooking Korean food, playing the viola, hiking, traveling, and spending time with his family and friends.

Specialized Areas of Interest
Cerebrovascular neurosurgery; skull base neurosurgery; neuro-oncology; value-based health-care, clinical outcomes research; socioeconomics in neurosurgery; organized neurosurgery; medical education.

Professional Organization Membership
American Association of Neurological Surgeons
American Medical Association
Congress of Neurological Surgeons
Young Neurosurgeon's Committee of AANS

Education & Training
BS, Neuroscience, Brown University, 2017
MD, Yale School of Medicine, 2022

Honors & Awards
'30 Under 30' in Healthcare, *Forbes Magazine*, 2022
Editor's Choice Manuscript, *Neurosurgery*, 2021
National Institutes of Health (NIH) - National Heart, Lung, and Blood Institute Research Fellowship, 2019
Yale School of Medicine Student Travel Award, 2018, 2019, 2022
Sigma Xi Honor Society, 2017
Magna cum laude, Brown University, 2017
Karen T. Romer Undergraduate Teaching and Research Award, Brown University, 2016
Presidential Linking Internships and Knowledge Award, Brown University, 2015
Entrepreneurship Program Synapse Fellowship, Brown University, 2015
Sheridan Center Certificate in Research Mentorship, Brown University 2015
Texas Governor's Award, 2013

James Yoon, MD

Publications: 2023-24

• Refereed Articles:

Yoon JS, Ng PR, Hoffman SE, Gupta S, Mooney MA. Price Transparency for Cervical Spinal Fusion Among High-Performing Spine Centers in the United States. *Neurosurgery* [Online ahead of print], 2024.

Research Activities

Dr. Yoon continues his research in value-based healthcare with a recent publication examining the early experiences of the nationwide price transparency mandate by CMS and its implementation with cervical spinal surgery in the United States.

2024 Graduating Residents

Congratulations to David Fernandes Cabral, MD, Justiss Kallos, MD, Zachary Gersey, MD, and Roberta Sefcik, MD, on their successful completion of the University of Pittsburgh's seven-year neurological surgery residency program. Following graduation, Dr. Fernandes Cabral joined the Department of Neurological Surgery faculty at UPMC Mercy; Dr. Gersey headed to the University of Miami to begin an advanced brain tumor fellowship; Dr. Kallos is serving a fellowship at Memorial Sloan Kettering Hospital in New York; and Dr. Sefcik accepted a position as assistant professor at the Medical University of South Carolina.

Research

The goal of the Department of Neurological Surgery at the University of Pittsburgh is to improve the care and treatment of patients with neurological disease. This goal is being achieved partly though the implementation and administration of state-of-the-art basic and translational research. Our department—with more than 60 faculty members and investigators—endeavors to be at the forefront of medical research. Numerous advances have already been achieved—research translated into practice.

Annually, the department has been highly ranked in total research funding, a direct result of the success and quality of our research and development. In the 2024 fiscal year, our faculty and residents were involved in almost 200 research projects totaling more than $13.2 million in expenditures. Additional charitable donations to the department totaled more than $1.6 million.

Ongoing research includes the disciplines of molecular biology, neurophysiology, neurochemistry, neuroanatomy, neuroradiology and other neuroscience arenas. Specific questions addressed include research into the acute and chronic care following neurotrauma, neural recovery and plasticity, the neurobiologic and therapeutic response in neuro-oncology, the underlying mechanisms and treatment of epilepsy and movement disorders, cell death and radiation injury, and cerebrovascular physiology and modeling. The department provides an outstanding research environment for fellows, residents, and students seeking training in neurosurgical research.

Intramural research support for junior faculty and residents is available through the Walter L. Copeland Fund. The Copeland Fund was established at The Pittsburgh Foundation in 1961, with instructions that the entire annual proceeds support cranial research in the Department of Neurosurgery at the University of Pittsburgh. The fund has provided substantial seed money, often leading to millions of dollars in federal grants for the Department of Neurological Surgery. In fy 2024, researchers from our department were awarded $142,000 from the Copeland Fund.

The Walter L. Copeland Laboratory

The Walter L. Copeland Laboratory serves as a central facility for research and development within the Department of Neurological Surgery. Located on the ninth floor of Scaife Hall, the laboratory was dedicated on November 29, 2001 by L. Dade Lunsford, MD. The laboratory houses several research disciplines which provide resources for a wide range of neurosurgery faculty, residents, visiting fellows and students. Neurotrauma, brain imaging, and neuroanatomical research are the primary initiatives being conducted in the laboratory. A significant amount of this work is funded by The Walter L. Copeland Fund of The Pittsburgh Foundation, a fund that has provided resources for research at the University of Pittsburgh since 1961.

The Neurotrauma Clinical Trials Center (NCTC)—under the direction of David O. Okonkwo, MD, PhD and co-director, Ava M. Puccio, RN, PhD—is located within the Copeland Laboratory. The NCTC team conducts innovative clinical research with a focus on biomarkers as well as the evaluation of neurotherapeutics for traumatic brain and spinal cord injury. In addition, annual resident training is performed every July for hands-on cadaver training of multi-modality intracranial monitoring insertions (i.e. external ventricular drain placement, and intracranial pressure and brain oxygenation/temperature monitoring). Instruction of lumbar puncture and Mayfield positioning for operating room stabilization is performed with simulation.

The Surgical Neuroanatomy Laboratory—under the direction of Paul Gardner, MD— specializes in training residents and fellows on advanced anatomy and neurosurgical skull-base approaches. The lab places a specific focus on the development, and subsequent training, of new methods of intraoperative cranial navigation and endoscopic techniques. The lab also hosts yearly

international visiting research fellows, where neurosurgeons from around the world participate in ground-breaking research regarding innovative neurosurgical methodology. Kyle Affolter is the coordinator for these efforts.

The Fiber Tractography Lab, under the direction of Fang-Cheng (Frank) Yeh, MD, PhD, is focused on the application of HDFT for presurgical planning and intraoperative navigation to facilitate brain function preservation and improve resection rates in patients with complex brain lesions. The laboratory's work is also centered on studying the structure and connectivity of the fiber tracts forming the "normal" human brain and their structural alteration in patients with brain tumors, vascular lesions, stroke, and neurodegenerative diseases.

Neurotrauma Research

The Brain Trauma Research Center (BTRC) at the University of Pittsburgh is a multidisciplinary research program aimed at improving outcome following severe traumatic brain injury. Research conducted both at our center and at other brain injury research programs clearly demonstrates the potential for improving outcomes using therapies designed to treat biochemical derangements that occur following impact to the brain. In order to identify the most critical of these sequelae of brain injury and to find newer therapies that are effective in treating them, the BTRC has established several basic science head injury laboratories and clinical research projects.

C. Edward Dixon, PhD, leads the Department of Neurological Surgery's efforts in preclinical traumatic brain injury research. The research focuses on basic and translational efforts to study mechanisms of cognitive deficits after TBI and to evaluate novel interventions. Shaun Carlson, PhD, leads efforts on synaptic dysfunction mechanisms of TBI. The Department of Neurological Surgery has pioneered efforts in the study of presynaptic mechanisms of cognitive deficits after TBI. Preclinical TBI research is supported by the National Institutes of Health, Veterans Administration, and the Department of Defense.

David O. Okonkwo, MD, PhD, leads the department's clinical research efforts as director of the Neurotrauma Clinical Trials Center (NCTC). The NCTC performs wide-ranging studies, including clinical trials funded by federal agencies and industry to study new therapies, novel brain monitoring devices, advanced neuroimaging, and biomarkers. The center also houses the National TBI Biospecimens Repository. This repository, under the direction of Ava Puccio, RN, PhD, is the largest centralized collection of biological samples from traumatic brain injury patients in the United States. The NCTC and the National TBI Biospecimens Repository have pioneered efforts in basic and clinical science which have substantially influenced clinical practice, including:

1. Evaluating the clinical utility of point-of-care assessment platforms for blood biomarkers of TBI;
2. Applying machine learning techniques to computed tomography scans to predict outcomes for severe TBI patients;
3. Establish the sensitivity and clinical utility of magnetoencephalography to image brain injury; and,
4. Assess the viability of hypothermia as a treatment of severe head injury.

The NCTC continues to play a pivotal role in large collaborative efforts, such as Transforming Research and Clinical Knowledge in TBI (TRACK-TBI), a multi-center study funded by the National Institute of Neurological Disorders at the NIH. The department is a key contributor to the next generation of TRACK-TBI studies, which seeks to improve the treatment and long-term outcomes of patients with TBI.

The NCTC is also actively enrolling research participants to examine the potential effects of repeated head impacts and/or TBIs on long-term neurological health. The goal of this research is to identify clinical, advanced imaging, and blood biomarker correlates for mild cognitive impairment.

Brain Tumor Research

Innovative and cutting-edge brain tumor research conducted at the University of Pittsburgh Department of Neurological Surgery occurs across multiple campuses at the University of Pittsburgh including the John Rangos Research Center at UPMC Children's Hospital of Pittsburgh, the University of Pittsburgh School of Medicine, and the UPMC Hillman Cancer Center.

Brain tumor research at the University of Pittsburgh is one of the largest clinical and most productive basic/translational brain tumor programs in the country, encompassing research across the adult and pediatric brain tumor science spectrum and supported heavily in funding from the National Institutes of Health and other generous foundations. University brain tumor research is collaborative with researchers and clinicians from diverse fields, including neurosurgery, radiation oncology, neuro-oncology, neuropathology, and neuroradiology, working together to tackle the complex challenges associated with brain tumors. This multidisciplinary collaboration fosters a comprehensive understanding of brain tumor biology, enables faster translation of discoveries into clinical practice, and ultimately improves patient care with clinical trials.

Brain Tumor Research Advances

Significant contributions to brain tumor research have occurred at the University of Pittsburgh, with numerous ground breaking discoveries and innovations. Researchers have pioneered novel techniques for intraoperative brain tumor visualization for fluorescence-guided surgery (FGS). In addition, brain tumor imaging has been developed at the University of Pittsburgh, such as advanced MRI and PET imaging, which allow for better visualization and characterization of tumors. These imaging tools aid in precise tumor diagnosis, treatment planning, and monitoring of treatment response.

Brain tumors are inherently immunosuppressive. Previous work in our brain tumor program identified new vaccine strategies for the treatment of gliomas. Researchers in our group developed glioma-associated antigen peptide vaccines to boost tumor-specific immune responses. Phase I clinical trials of these vaccines demonstrate robust induction of antigen-specific immune responses and some clinical activity in both adult and pediatric patients with glioma. Recent studies have identified patterns of gene expression in peripheral blood mononuclear cells that are associated with response and resistance to peptide-based vaccination in pediatric low-grade gliomas.

Another strategy in brain tumor research is to inhibit the pathways that promote tumor growth or to stimulate those that promote tumor cell killing. The poor response of malignant gliomas to conventional therapies, such as cytotoxic chemotherapy or radiotherapy, reflects resistance of these tumors to undergoing apoptosis in response to DNA damage or mitogen depletion. Through a large-scale screening study, we have identified several exploitable targets, which when inhibited induce tumor cytotoxicity. We have been examining pharmacological agents to inhibit these targets, alone and in combination with agents that induce apoptotic signaling in these tumors.

The Brain Tumor Biology and Therapy Laboratory, led by Sameer Agnihotri, PhD, has identified novel and clinically actionable pathways in diffuse midline gliomas (DMG), pediatric gliomas, and glioblastoma multiforme (GBM) with publications in *JCI Insight, Molecular Oncology,* and *Developmental Cell.* Dr. Agnihotri was one of a handful of international researchers awarded a

Distinguished Scientist Award and Grant from the Sontag Foundation for study of pediatric brain tumors. He also received an Idea Development Award from the Department of Defense and a V-Foundation grant to support brain tumor research.

The Brain Tumor Evolution Therapy Lab, led by Baoli Hu, PhD, has focused on developing a new class of drugs for targeting the immune-suppressive microenvironment in glioblastoma and understanding molecular mechanisms of medulloblastoma metastatic dissemination. An important publication in *Nature Cell Biology* was published last year. This work in the lab has been supported by NIH/National Cancer Institute (NCI) R01 and NINDS R21 grants. In 2024, another R01 was awarded for medulloblastoma research and Dr. Hu's lab was also awarded an RK Mellon Institute grant.

The Brain Tumor Metabolism and Functional Genomics lab, led by Antony MichaelRaj, PhD, was involved in multiple high impact journal publications in *Science* and *Nature Communications*. Dr. MichaelRaj was the recipient of a research grant by the Matthew Larson Foundation for studying pediatric ependymomas, and has had multiple high impact publications including *Cell*, *Nature Communications* and *Cell Reports*.

The Pediatric Neurosurgery ImmunoOncology lab, led by Gary Kohanbash, PhD, advanced research across multiple focus areas including preclinical testing of immunotherapies, big data generation and analysis, and radiochemistry. The lab has published two primary research articles including a manuscript in *Cancer Research Communications* demonstrating the potential for a new PET imaging agent to be used for monitoring immunotherapy responses. The lab has also obtained NIH R01 and R21 grant funding from the NCI and NINDS, respectively and received a grant from the Ian's Friends Foundation to develop a novel swine model of DIPG.

Brain Tumor Translational Advances

The Department of Neurological Surgery brain research efforts have been at the forefront of developing innovative treatment strategies for brain tumors. Researchers have conducted extensive investigations into targeted therapies, immunotherapies, and gene therapies that hold great promise for improving patient outcomes. Their work has led to the development of clinical trials testing novel treatments, providing hope for patients who have limited options.

An important new clinical trial, which will be the first in the U.S. for newly diagnosed GBM patients, will be intraoperative photodynamic therapy (PDT). Patients will initially undergo a maximal resection of their GBM tumor with the use of 5-ALA fluorescence-guided surgery (FGS). After completion of tumor removal during surgery, intraoperative 5-ALA PDT will then be performed. Patients will then go onto their standard of care treatment options after their tumor removal and PDT. Enrollment of the first GBM patients began in 2024, with Jan Drappatz, MD, associate director of neuro-oncology at UPMC, serving as the principal investigator.

In 2022, the University of Pittsburgh Department of Neurological Surgery became an integral part of the Glioblastoma Therapeutics Network, a collaborative effort by the National Cancer Institute (NCI). This program, led at UPMC by Kalil Abdullah, MD, and his Translational NeuroOncology Lab is designed to stimulate scientific and clinical teams from select institutions across the country to develop promising drugs in the laboratory and then design clinical trials that can be performed at multiple sites. As a component of this NIH-funded effort, researchers are currently evaluating new drugs that may be used to treat the most difficult brain cancer, glioblastoma. One of these drugs targets IDH-mutant gliomas, which are more common in younger adults. In addition to laboratory work, clinical trials are being planned for both new drugs.

A new form of treatment—magnetic hyperthermia therapy (MHT)—for GBM is now under development at the UPMC Hillman Cancer Center in the Brain Tumor Nanotechnology Laboratory, directed by Costas Hadjipanayis, MD, PhD. MHT relies on the intratumoral delivery of magnetic iron-oxide nanoparticles (MIONPs) for the generation of local hyperthermia after application of an alternating magnetic field (AMF). MHT is currently being studied in preclinical brain tumor models in combination with adjuvant therapies (chemoradiation). A trial has been launched for studying MHT for treatment of canines with spontaneous gliomas with Johns Hopkins University. Treatment planning is also under development with Penn State University. A new collaboration with Blue Pearl Pet Hospital in Pittsburgh is being established for further study of MHT in canine brain tumor patients prior to launching a clinical trial for human brain tumor patients.

Clinical Care Advances

As one of the highest volume tumor centers in the country, care of our neurooncology patients is facilitated by an emphasis on cutting-edge technology and clinical advances. Currently, clinical care of patients with skull base tumors, primary brain tumors and metastatic brain tumors related to systemic cancer represent a major focus for our department's activities. During the last 42 years, the UPMC Center for Image-Guided Neurosurgery has provided care to more than 20,000 patients using minimally invasive options to biopsy, resect, or provide adjuvant therapies. One of the most important adjuvant strategies to control brain tumor progression is optimization of radiation delivery techniques. Using technologies such as Gamma Knife® radiosurgery at UPMC Presbyterian (over 18,000 patients have been treated and over 1,400 articles, books, or chapters have been published) and linear accelerator radiation technologies at UPMC Shadyside, methods to enhance the efficacy and safety of radiation delivery have been pioneered.

Since 1975 the department has been noted as a source of innovation in brain tumor diagnosis and management. In 1981 the first dedicated CT scanner was installed in a unique operating room at UPMC Presbyterian to facilitate minimally invasive surgical techniques. Now updated this facility also serves as a site to explore less invasive strategies for tumor removal such as the endoscopic endonasal approaches, endoport resection using guiding technologies coupled with endoscopic removal, and transorbital approaches. Working hand in hand with our skull base program, innovative combined strategies for tumor biopsy or removal followed by adjuvant radiosurgery, chemotherapy, or immunotherapy has offered new advances in patient care resulting in ever longer high-quality outcomes. Recently, the UPMC Hillman Cancer Center obtained the AIRO/BrainLab system, allowing for intraoperative CT scanning to allow navigated instrumentation during oncologic spinal reconstruction, and high-fidelity intraoperative frameless registration for patients with brain tumors. This substantial investment is a foundational commitment to advancing state-of-the-art brain neurosurgical oncology care.

Laser Interstitial Thermal Therapy (LITT) has been an area of emphasis at UPMC. Both the UPMC Hillman Cancer Center and UPMC Presbyterian utilize this technology for patients with brain tumors and radiation necrosis across our region and worldwide. One of the primary advantages of LITT is its minimally invasive nature, as it involves the use of a thin laser probe inserted directly into the target tissue. This allows for precise and localized treatment, reducing the risk of damage to surrounding healthy tissues. LITT is particularly beneficial for brain tumors and lesions, as it provides an alternative to open surgery, thereby minimizing the risk of complications, reducing hospital stays, and promoting quicker recovery times. Moreover, LITT is performed under real-time MRI guidance, enabling the neurosurgical team to monitor and adjust the treatment as necessary, ensuring optimal outcomes. Additionally, LITT is associated with lower morbidity rates and improved quality of life for patients, as it preserves neurological function and avoids the need for traditional open craniotomy procedures. As of 2024, UPMC has performed more laser ablations for brain tumors than any center in Pennsylvania.

In 2024, a new academic-industrial partnership was launched by the UPMC Department of Neurological Surgery, the University of Pennsylvania and Synaptive Medical. This initiative entitled "Diffusion MRI-Guided Pre-Operative Planning for Supra-Total Resection of High-Grade Gliomas" will be led by Ragini Varma, PhD, professor of radiology at the University of Pennsylvania, and Dr. Hadjipanayis in partnership with Wes Hodges, founder of Synaptive Medical, to provide an enhanced preoperative planning tool for brain tumor surgery that will facilitate extended safe resection of glioblastoma tumors that are not evident with conventional imaging. The tool will be created by integrating diffusion MRI-based methods to visualize white matter pathways in edematous and infiltrated regions of the brain into a commercial neuro planning and navigational software with Synaptive Medical Inc. that will be used by clinical partners at UPMC, the University of Pennsylvania, the University of Nebraska, and the Ochsner Clinic Foundation for evaluation of clinical utility and patient safety. The extended resection facilitated by the enhanced tool is expected to lead to better patient outcomes.

Focused ultrasound will now be available at UPMC for treatment of patients in 2024. Research efforts are underway to establish important clinical trials utilizing focused ultrasound for treatment of brain tumors by opening of the blood brain barrier and sonodynamic therapy in combination with 5-ALA administration.

Innovative imaging techniques are being developed and applied to better understand brain tumors and their structural relationship with surrounding white matter tracts. High-Definition Fiber Tractography (HDFT) provides a superior presurgical evaluation of the fiber tracts for patients with complex brain lesions, allowing us to reconstruct fiber tracts and design a less invasive trajectory into the target lesion. The department is investigating its potential for not only presurgical planning and intraoperative navigation but also for neurostructural damage assessment, estimation of postsurgical neural pathway damage and recovery, and tracking of postsurgical changes, neuroplasticity, and responses to rehabilitation therapy. The ability to obtain fiber-tracking preoperatively has now been expanded to the UPMC Hillman Cancer Center at UPMC Shadyside, allowing a multimodal approach to tumor resection. The goal is to facilitate brain function preservation and recovery in patients undergoing complex brain tumor surgery.

For brain tumor patients, presurgical brain mapping is performed using magnetoencephalography (MEG), a cutting-edge technology and the most advanced method of functional brain imaging. MEG recordings provide a direct measurement of brain functions allowing brain surgeons to view critical functional areas of brain to determine the best way for removing brain tumors, while preserving brain function and improving recovery.

Magnetoencephalography (MEG) Research

Research is an important aspect of the UPMC Brain Mapping Center (BMC) which houses the TRIUX neo MEG system. Ajay Niranjan, MD, MBA, is director of the BMC, while Avniel Singh Ghuman, PhD, associate professor of neurological surgery, and Brian Coffman, PhD, assistant professor with the University of Pittsburgh Department of Psychiatry, are co-directors of research. The aim of magnetoencephalography (MEG) research is to facilitate, develop, and advance clinical and basic neuroscience research using MEG. To this end, Dr. Coffman is helping to develop new research applications for MEG in collaboration with researchers throughout the community and providing guidance to researchers considering the application of MEG to their research program.

MEG is the most powerful functional neuroimaging technique for noninvasively recording magnetic fields generated by electrophysiological brain activity, providing millisecond temporal resolution at a spatial resolution far exceeding other neurophysiological imaging methods.

MEG is currently being used to study the healthy brain—both in adults and during development—to understand the neural basis of cognitive processes, including reading, vision, audition, motor control, semantic memory, executive functioning, emotional processing, and working memory. Furthermore, research groups at the University of Pittsburgh and Carnegie Mellon University are also using MEG to investigate neurophysiological dysfunction in a host of pathologies, including TBI, schizophrenia, spinal cord injury, HIV-AIDS, epilepsy, autism spectrum disorders, Alzheimer's disease and Parkinson's disease. MEG currently supports both presurgical clinical services and several major (R01 or equivalent) NIH grants. MEG research at the UPMC Brain Mapping Center continues to increase the impact on scientific understanding of the brain, with 7-10 publications and more than 100 citations every year for the last four years.

National TBI Biospecimens Repository
A national repository of biological samples from patients who have sustained traumatic brain injuries (TBIs) has been established in the Department of Neurological Surgery at the University of Pittsburgh. This biorepository supports the Transforming Research and Clinical Knowledge in Traumatic Brain Injury (TRACK-TBI) study, a multi-center initiative funded by the National Institutes of Health (NIH) that has been revolutionizing clinical care for brain-injured patients. A central goal of the TRACK-TBI biorepository is to identify blood-based biomarkers that can assist hospital-based clinicians in diagnosing TBIs and allow industry partners in the laboratory to identify new, effective treatments. Three thousand participants who have sustained a TBI have been recruited into the TRACK-TBI study, and a large, high-quality database of clinical, imaging, biomarker, and outcome data has been generated.

In collaboration with the TRACK-TBI coordinating center at the University of California San Francisco—led by Geoff Manley, MD—and 17 U.S. partner sites, David Okonkwo, MD, PhD, and Ava Puccio, RN, PhD, at the University of Pittsburgh received a large supplemental award from the U.S. Department of Defense (DoD) to establish the TRACK-TBI biorepository. Following laboratory renovations and certification in February 2016, the Department of Neurological Surgery at the University of Pittsburgh became the official new home of the TRACK-TBI biospecimens repository. Current collaborative research with industry and the DoD include a FDA-pivotal trial examining acute blood-based biomarker studies in an effort to diagnosis positive intracranial computed tomography findings.

The TRACK-TBI biorepository is the largest centralized collection of biological samples from TBI patients in the US. For a complex disorder like TBI, which has global incidence but lacks definitive clinical classification for diagnosis and therapy, multicenter collaboration is key for progress in research. Only with large numbers of patients and samples will researchers be able to address the many variations of TBIs. Similar to other disease processes, such as cardiovascular disease and cancer, diagnoses must be matched with a biomarker of injury and genetic markers for treatment directives.

Additional NIH and DoD studies have recognized the expertise of the biorepository and are utilizing the biorepository efforts for their storage needs.

Faculty Research Laboratories

The University of Pittsburgh Department of Neurological Surgery operates a number of specialized research laboratories, each focusing on a unique area. These laboratories include:

Brain Tumor Biology and Therapy Laboratory
The Brain Tumor Biology and Therapy Laboratory, under the direction of Sameer Agnihotri, PhD, studies pediatric and adult high-grade gliomas (HGG) and diffuse intrinsic pontine gliomas (DIPG).

Brain Tumor Evolution & Therapy Laboratory
The Laboratory of Brain Tumor Evolution & Therapy, under the direction of Baoli Hu, PhD, studies the genetic and epigenetic events contributing to the evolution of brain tumors.

Brain Tumor Nanotechnology Laboratory
UPMC Hillman Cancer Center lab directed by Costas G. Hadjipanayis, MD, PhD, involved in the testing of nanoparticle constructs for the targeted imaging and therapy of patient-based brain tumor models.

Clinical Neurophysiology Laboratory
The Clinical Neurophysiology Laboratory, led by Parthasarathy Thirumala, MD, MS, studies the diagnostic value of intraoperative neuromonitoring (IONM) during surgery to detect perioperative neurological disorders.

Cognitive Neurodynamics Laboratory
The Laboratory of Cognitive Neurodynamics, under the direction of Avniel Ghuman, PhD, studies how our brain turns what falls upon our eyes into the rich meaningful experience that we perceive in the world around us.

Cortical Systems Laboratory
Neuroscience lab, under the direction of Jorge Gonzalez-Martinez, MD, PhD, studying brain electrophysiology and behavior in patients undergoing epilepsy and movement disorder surgery.

Fiber Tractography Laboratory
The Fiber Tractography Lab—under the direction of Frank Yeh, PhD—is focused on the application of High-Definition Fiber Tractography for presurgical planning and intraoperative navigation to facilitate brain function preservation.

Molecular Tumor Personalized Precision Laboratory
The Molecular Tumor Biology and Personalized Precision Therapy Lab, directed by Pascal Zinn, MD, PhD, focuses on personalized patient-centered care for brain and spinal tumors

Neuroapoptosis Laboratory
The Neuroapoptosis Laboratory, under the direction of Robert Friedlander, MD, studies the basic mechanisms of apoptosis, as mediated by the caspase apoptotic family in neurologic diseases.

Pediatric Neurosurgery ImmunoOncology Laboratory
The Pediatric Neurosurgery ImmunoOncology Laboratory (PNIO), led by Gary Kohanbash, PhD, seeks to develop novel immuno-oncology approaches to treat deadly pediatric central nervous system tumors.

Spinal Cord Stimulation Laboratory
The Spinal Cord Stimulation Laboratory, under the direction of Marco Capogrosso, PhD, studies the interactions between electrical stimulation and the dynamics of spinal circuits.

Spine Computational Outcomes Learning Institute (SCOLI)
SCOLI, co-directed by Nitin Agarwal, MD, and D. Kojo Hamilton, MD, is dedicated to advancing neurosurgical patient care using cutting-edge clinical and translational science.

Surgical Neuroanatomy Laboratory
The Surgical Neuroanatomy Lab (SNL), led by Paul Gardner, MD, has a dual educational and research role aiming to improve surgical techniques and outcomes by mastering knowledge of relevant surgical neuroanatomy.

Surreality Laboratory
The Surreality Lab, under the direction of Edward Andrews, MD, features cutting-edge research and development in spatial computing, artificial intelligence/machine learning and robotics.

Translational Neuro Oncology Laboratory
The Laboratory for Translational Neuro Oncology, led by Kalil Abdullah, MD, develops novel preclinical models of glioma and identifies drug targets for early-phase clinical trials in patients with malignant brain tumors.

For more detailed information on these research labs, please visit the Faculty Research Laboratories page on our department website at neurosurgery.pitt.edu/research/labs.

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