

# *Visionary* Neurosurgery

IT IS THE MISSION of the Stanford University Department of Neurosurgery to deliver the highest quality, compassionate clinical care to our patients

.....

Ensure the rapid translation of pioneering research into widespread implementation of advanced clinical therapies for those suffering from neurological disease and injury

.....

To stay bold and steadfast in answering the most challenging neuroscience questions through innovation and discovery

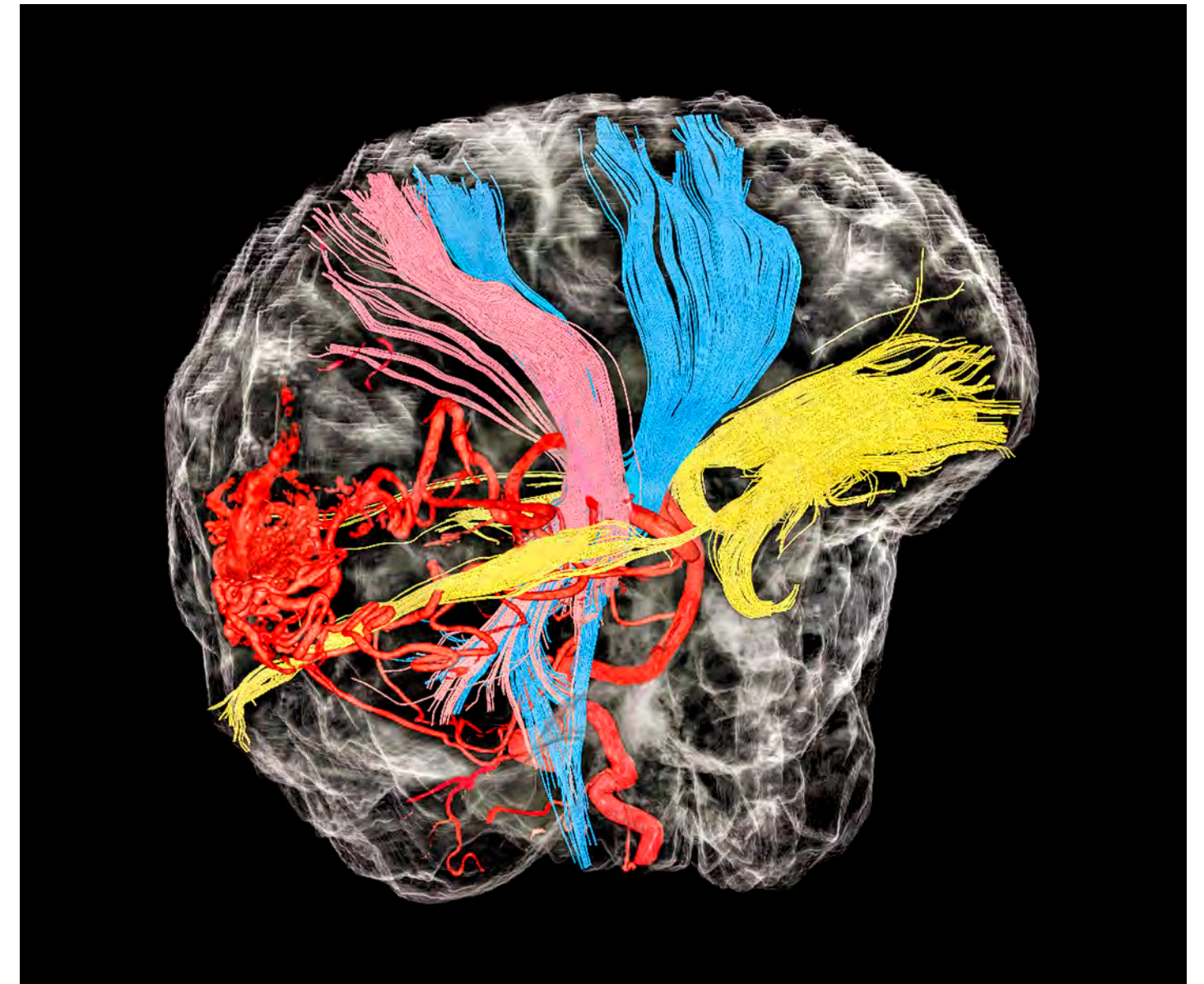
.....

To tackle even the most complex cases and rare diseases

.....

To develop the world's future leaders in neurosurgery and to support the wellbeing of our faculty, staff, and trainees

.....



*A Century of Innovation*

**CELEBRATING INNOVATIONS  
PAST AND PRESENT**

Over the last century, Stanford Neurosurgery has cultivated the world's most prominent neurosurgeons and scientists, as well as fostered a dynamic culture of innovation designed to continually drive prolific discovery, compassionate care, and exceptional education. We now look forward to not just sustain, but expand our legacy on behalf of patients throughout the next century and beyond.

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# Ultimately, the **future** is our focus



Friends,

I have been at Stanford for 46 years. Over the decades, the field of neurosurgery has witnessed remarkable advances. Many of the most significant began right here in our department.

It has been my honor to help lead the development of pioneering clinical, translational and fundamental scientific advances, along with our extraordinary faculty. We have been responsible for many of the breakthroughs in technology and technique that have set the standard for modern neurosurgical care around the world.

Among all the achievements of Stanford Neurosurgery, most rewarding is the gratitude we earn from our patients and their families. Seeing patients and their loved ones enjoy positive outcomes continually underscores the importance and impact of our efforts.

In the pages that follow, we highlight the exceptional work the Stanford Department of Neurosurgery is doing in our community and worldwide. We share an overview of our initiatives to optimize the health and wellness of our patients, and the professionals who deliver the care.

Ultimately, the future is our focus. It always has been in my tenure with Stanford. We build on our legacy of leadership by envisioning tomorrow. Thank you for sharing our vision.

GARY K. STEINBERG, MD, PHD

*Bernard and Ronni Lacroute-William Randolph Hearst  
Professor of Neurosurgery and the Neurosciences  
Chair, Department of Neurosurgery  
Founder and Co-Director, Stanford Stroke Center*



# Hindsight from 2020

A LOOK BACK AT STANFORD NEUROSURGERY

Edward Towne



An influx of thousands of surgeons and physicians arriving in California during the Gold Rush of the late 1840s and early 1850s, in combination with the development of surgical studies at the Cooper Medical College in San Francisco—which later became Stanford University's School of Medicine, laid the foundation for the neurological surgery program at Stanford. By the early 20th century many of the teachings of modern neurosurgery were brought by doctors, seeking to continue developing the field in their own right, to the West Coast.

A century later, the Stanford Department of Neurosurgery boasts a [large](#) faculty of outstanding surgeons, basic translational scientists, surgeon-scientists, and world-renowned experts in a variety of neurosurgical sub-specialties. Building on the legacy of those who helped develop neurosurgery in California and at Stanford, we continue to remain committed to pioneering and advancing the field through our key pillars of academic neurological surgery: leadership, clinical care, research, teaching, and diversity.

## EARLY NEUROLOGICAL SURGERY IN CALIFORNIA 1850S-EARLY 1900s

**Henry Gibbons (1808-1884)** Gibbons was considered one of the most prominent physicians on the West Coast in the mid to late 1800s, known for performing brain and spine operations on soldiers while serving in the Civil War. Gibbons' work was well recognized and he was invited to deliver lectures at Cooper Medical College.

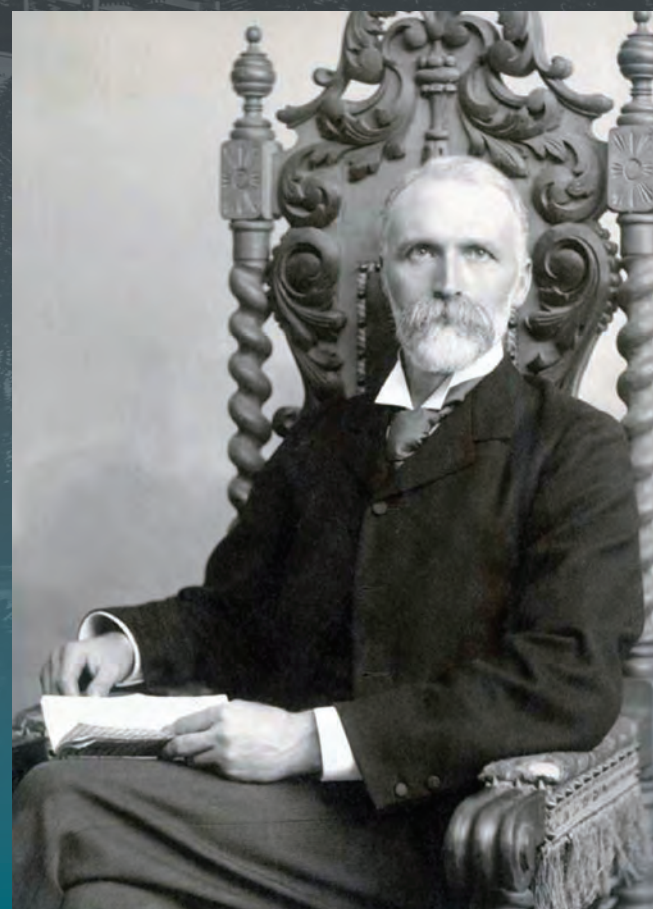
**Levi Cooper Lane (1828-1902)** Nephew of Elias Samuel Cooper (who opened the first medical school in the Western United States, which would later on become Stanford University School of Medicine). Lane was a surgeon and in 1908 published the first major textbook on head and neck surgery. He also instituted a new special course of lectures in 1895 to be delivered at the beginning of each term. For the inaugural course, Lane selected Dr. William Macewen.

**William Macewen (1848-1924)** Macewen was Regius Professor of Surgery in the University of Glasgow, Scotland. He visited Stanford to deliver a series of presentations on surgical anatomy in relation to neurological function that were based entirely on his original research. His lectures were considered models of excellence and were attended by students and faculty, as well as a large number of physicians from California, Nevada and Oregon who traveled long distances to see him speak about brain surgery.

William Macewan



William Macewan demonstrating Macewan's Triangle to Levi Cooper Lane and others at Stanford



## STANFORD'S FIRST NEUROSURGEONS 1920-1954

**Edward B. Towne (1883-1957)** One of three disciples of Dr. Henry Cushing (who inaugurated the modern field of neurosurgery in the early 20th century) to bring the discipline to California, Towne introduced Cushing's teachings directly to Stanford. A Harvard MD, after several years studying under Cushing, he was appointed Instructor in Surgery at Stanford, and was a visiting surgeon at Stanford University Hospital in San Francisco, the San Francisco City and County Hospital, and the now-defunct Southern Pacific Hospital. Towne was instrumental in establishing the need for scientific research and neurosurgical care that today continues to be the focus of the Stanford Neurosurgical program. During his tenure at Stanford, he published numerous papers in the field on areas such as meningiomas and spinal cord tumors.

**Frederick L. "Fritz" Reichert (1894-1969)** After 5 years of training at Johns Hopkins Hospital, under the tutelage of the eminent neurosurgeon Walter Dandy, Reichert was appointed Chief of Neurosurgery at Stanford University School of Medicine in San Francisco. For the next three decades, Reichert remained active in his laboratory where he investigated the regeneration of lymphatics and the development of collateral circulation. During his tenure he was also extensively involved in the practice and teaching of neurosurgery to residents and medical students.

**Frederick A. "Ted" Fender** One of Stanford's first neurosurgeons, Dr. Fender also served as president of the San Francisco Neurological Society from 1947-1948.



Fritz Reichert



**INFLUENTIAL FIGURES: 1954-1994**

**John W. Hanbery** Specializing in spine and pediatric neurosurgery, Hanbery's recruitment in 1954 was a turning point in Stanford Neurosurgery history. Devoted to teaching residents in the OR and bedside, it was through his determined efforts that the Stanford neurosurgery residency-training program was established in 1961. In 1964 Hanbery was appointed Head of the Stanford Division of Neurosurgery, where he remained until 1989. During his tenure as Head of Neurosurgery, Hanbery trained 26 residents and countless interns and medical students. His former residents felt so indebted to their mentor that they established the John W. Hanbery Society in 1974 in his honor. Many decades later the Society continues to meet every year, bringing together the program's alumni to review research and share professional and personal accomplishments.

**Gerald D. Silverberg** Upon Hanbery's retirement in 1989, Silverberg was appointed Acting Head of the Division of Neurosurgery and played an instrumental role in obtaining Departmental status for neurosurgery in 1990. Considered a superb clinician, master surgeon and gifted teacher, Silverberg's contributions to Stanford Neurosurgery were many; including introducing microscopic neurosurgery to Stanford, pioneering renaissance of total circulatory arrest for giant aneurysms, novel research on electrophysiology of cerebral arteries, and moving forward the study of CSF physiology and hydrocephalus.

**Richard H. Britt** Recruited to Stanford to help develop Neurosurgery's research programs, Britt was the first neurosurgical faculty member at Stanford to obtain NIH funding. Britt's clinical interests focused on spasticity, facial pain, brain abscess, and cerebellar stimulation.

**Frances K. Conley** A woman of firsts, Conley paved the way for many female neurosurgeons to come. Conley served as Chief of Neurosurgery at the Palo Alto Veterans Affairs Health System for more than 20 years, and as the Palo Alto VA's Chief of Staff until 2000. Considered an outstanding teacher and excellent physician, she was highly regarded for her skills as a spine surgeon, and her experimental research on immunology of brain tumors. Conley was the first woman to pursue a surgical internship at Stanford, the first female faculty member at Stanford in a surgical department, the first woman granted a tenured professorship in neurosurgery in the United States, and the first female winner of the Bay to Breakers 12K footrace.

**John R. Adler** Adler's invention of the Cyberknife revolutionized neurosurgical treatment of brain tumors. The frameless and minimally invasive robotic system targets radiation precisely to a tumor or vascular malformation without damaging nearby radiation-sensitive areas of the brain. Since its debut in 1994 the Cyberknife has been used to treat more than 9,000 patients at Stanford, and well over 100,000 patients worldwide.

**Lawrence M. Shuer** Between 1992-1995, Shuer served as Acting Chair of the Stanford Department of Neurosurgery. During his tenure, Shuer navigated the

department through turbulent times of faculty and financial turmoil, and successfully appealed an adverse action proposal from the Neurosurgical RRC to place the program on probation for lack of a permanent chair. A wonderful physician, surgeon, teacher, and role model, Shuer is involved with a broad range of surgeries, and also served as Stanford Hospital's Chief of Staff and Stanford School of Medicine's Associate Dean for Graduate Medical Affairs for over a decade.

**Gary K. Steinberg** In December 1995 Steinberg was appointed Chair of the Department and began an un-precedented expansion of clinical and basic research programs. Steinberg accelerated sub-specialty development with creation of programs such as neurosurgical oncology; pediatric neurosurgery; pain, epilepsy and movement disorders; complex spine and peripheral nerve surgery; traumatic brain and spinal injury, and a comprehensive cerebrovascular service. He expanded the faculty from 5 in 1995, to over 60 by 2020, including more than 20 basic scientists. During his 25-year tenure as Chair of the Department of Neurosurgery, Steinberg also founded and co-directs the Stanford Stroke Center, has established himself as the world's foremost expert moyamoya neurosurgeon, and continues to push boundaries in neurosurgery with discoveries such as use of stem cells for restoration of function after stroke.



Department Photo 1988

Clockwise: John Adler, John Hanbery, Richard Britt, Gary Steinberg, Gerald Silverberg, Frances Conley, Lawrence Shuer



# Innovations in Neurosurgery

1961

Founding of Stanford Neurosurgical Residency Program

1964

Founding of Stanford Division of Neurosurgery, John W. Hanbery Appointed Head of Division



1974



Founding of Hanbery Society (The Residency Program Alumni Association)

1989

Gerald D. Silverberg Appointed Acting Head of Division of Neurosurgery

1990

Stanford Neurosurgery Gains Departmental Status



1991

First Surgery Performed to Treat Moyamoya; Founding of Stanford Moyamoya Center



1992

Founding of Stanford Stroke Center

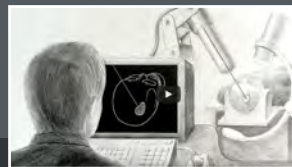


1994

Lawrence M. Shuer Appointed Acting Chair of Department

1994

Cyberknife Invented and Debuts at Stanford



1995

Gary K. Steinberg, MD, PhD, Appointed Department Chair

1996

Initiation of Pediatric Neurosurgery Program



1997

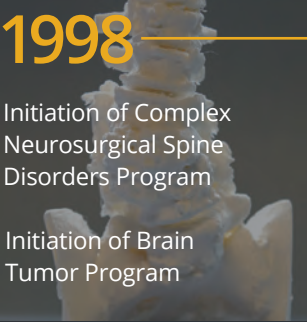
Founding of Neurosurgery Basic Science Division

1997-98

Merger of Stanford Hospital & Clinics/LPCH with UCSF/Mount Zion Medical Centers

1998

Initiation of Complex Neurosurgical Spine Disorders Program



Initiation of Brain Tumor Program

1999

Divorce of Stanford and UCSF

2003

Founding of Evidence-based Clinical Outcomes Division

2004

Initiation of Functional Neurosurgery Program



2008

Expansion to El Camino Hospital, Mountain View

2011

Expansion to St. Rose Dominican Hospital, Las Vegas  
Expansion to Dominican Hospital, Santa Cruz

2012

Reintegration of Santa Clara Valley Medical Center



2013

Stanford Neurosurgery Ranked #3 in Country For NIH Funding

Launch of Stanford Global Health Neurosurgery Program



2014



Stanford Neurosurgery Ranked #2 in Country for NIH Funding  
Established Stanford Concussion and Brain Performance Center

2016

Stanford Neurosciences Health Center Opens  
Initiation of Neurosurgical Peripheral Nerve Program

2017

Neurosurgery Virtual Reality and Simulation Center Opens

2018

New Lucile Packard Children's Hospital opens



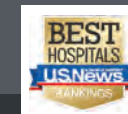
2019

Creation of Neurosurgery Diversity and Inclusion Committee  
Stanford Neurosurgery Again Ranked #2 in Country for NIH Funding



New Stanford Hospital Opens

Stanford is Ranked One of America's Top 10 Best Hospitals by US News & World Report



Stanford Neurosurgery and Neurology ranked #9 Nationally by US News & World Report





# Leaders in diagnosis and treatment

## ENDOWED CHAIRS

- 1997 Gary K. Steinberg, MD, PhD** Bernard and Ronni Lacroute-William Randolph Hearst Professor of Neurosurgery and the Neurosciences
- 2004 Michael S.B. Edwards, MD** Lucile Packard Children's Hospital Endowed Professor of Neurosurgery & Pediatric Neurosurgery
- 2007 Pak H. Chan, MD** The James R. Doty Professor in Neurosurgery and Neurosciences
- 2007 John R. Adler, MD** The Dorothy and Thye King Chan Professor in Neurosurgery
- 2008 Thomas Sudhof, MD, PhD** The Avram Goldstein Professor in the School of Medicine
- 2008 Steven D. Chang, MD** Robert C. and Jeannette Powell Neurosciences Professor
- 2008 Graham H. Creasey, MD** Paralyzed Veterans of America Professor of Spine Cord Injury Medicine
- 2013 E.J. Chichilnisky, MD, PhD** John R. Adler Professor
- 2013 Jaimie Henderson, MD** John and Jene Blume—Robert and Ruth Halperin Professor
- 2015 Ivan Soltesz, MD, PhD** James R. Doty Professor of Neurosurgery and Neurosciences
- 2017 Jon Park, MD** Saunders Family Professor
- 2018 Gerald Grant, MD** Endowed Professor in Pediatric Neurosurgery
- 2019 Jamshid Ghajar, MD, PhD** Moghadam Family Director of Brain Performance Center (endowed directorship)

## FACULTY



**Gary K. Steinberg, MD, PhD**  
Professor and Chair



**Lawrence M. Shuer, MD**  
Professor



**John R. Adler, MD**  
Professor, Emeritus



**Michael S.B. Edwards, MD**  
Professor, Emeritus



**Steven D. Chang, MD**  
Professor



**Graham H. Creasey, MD**  
Professor, Emeritus



**James R. Doty, MD**  
Clinical Professor



**Laurence Katznelson, MD**  
Professor



**Jaimie M. Henderson, MD**  
Professor



**Jamshid Ghajar, MD, PhD**  
Clinical Professor



**Michel Kliot, MD**  
Clinical Professor



**Odette A. Harris, MD, MPH**  
Professor



**Jon Park, MD, FRCSC**  
Professor



**John Ratliff, MD**  
Professor



**Gerald Grant, MD, FACS**  
Professor



**Juan C. Fernandez-Miranda, MD, FACS**  
Professor

Our team of internationally-recognized neurosurgeons are leaders in revascularization procedures for moyamoya, microsurgical techniques to cure intracranial malformations, skull base endoscopic endonasal tumor removal, novel stem cell therapy for stroke and spinal cord injury, radiosurgery, innovative application of focused ultrasound and brain-computer interface, concussion diagnosis and treatment, pituitary endocrinology, and use of robotics and virtual reality for pre- and intraoperative planning. We are driven by our dedication to excellent medical care and our compassion for the patients we treat and the families who care for them.

## FY 2019 CLINIC VISITS

19,189

Stanford Health Care

5,240

Stanford Children's Health

2,200

Santa Clara Valley Medical Center

2,200

Veteran Affairs

**TOTAL: 28,829**





**Randal Peoples, MD, MS, FAANS**  
Clinical Professor



**Stephen L. Skirboll, MD**  
Associate Professor



**Robert L. Dodd, MD, PhD**  
Associate Professor



**Marco Lee, MD, PhD**  
Clinical Professor



**J. Harman Singh, MD**  
Clinical Associate Professor



**Gordon Li, MD**  
Associate Professor



**Ciara Harraher, MD, MPH**  
Clinical Associate Professor



**Melanie Hayden Gephart, MD, MAS**  
Associate Professor



**Atman Desai, MD**  
Clinical Associate Professor



**Suzanne Tharin, MD, PhD**  
Assistant Professor



**Casey Halpern, MD**  
Assistant Professor



**David Hong, MD**  
Clinical Assistant Professor



**Anand Veeravagu, MD**  
Assistant Professor



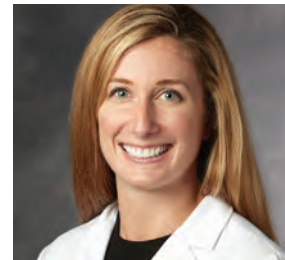
**Thomas J. Wilson, MD**  
Clinical Assistant Professor



**Kelly Mahaney, MD**  
Assistant Professor



**Tene A. Cage, MD**  
Clinical Assistant Professor



**Corinna Zygorakis, MD**  
Assistant Professor



**Joshua Levin, MD**  
Clinical Assistant Professor



**Mahendra T. Bhati, MD**  
Clinical Associate Professor



**Jayant Menon, MD**  
Clinical Assistant Professor



**J. Dawn Waters, MD**  
Clinical Assistant Professor



**Antonio Meola, MD, PhD**  
Clinical Assistant Professor



**Laura Prolo, MD**  
Assistant Professor

FY 2019 OPERATIVE CASES

3,166

Stanford Health  
Care

544

Stanford Children's  
Health

400

Santa Clara Valley  
Medical Center

170

Veteran Affairs

620

Outreach

TOTAL: 4,910



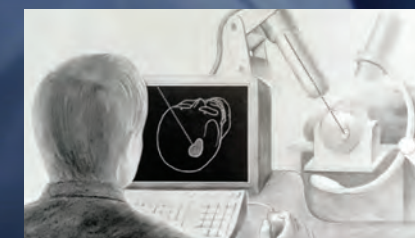
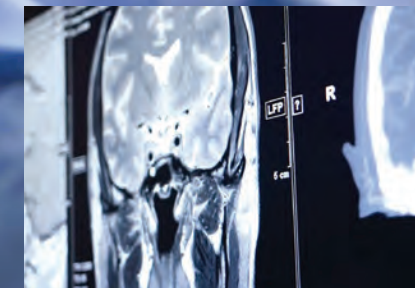
# Tackling the **most complex** **and rare** brain tumors

"It's very inspiring to work at a place like Stanford, where there's such incredible science ongoing every single day; that motivates [us] to continue to push the field forward."

—Melanie Hayden Gephart, MD, MAS

## Research Spotlight

Our current trials are focused on novel therapies to increase survival rates for patients with glioblastoma, and using enhanced visualization techniques intraoperatively to improve surgical outcomes. We are also developing metastasis-specific treatments that can efficiently enter the brain and kill the tumor, but are not toxic to normal brain cells. These treatments are developed from our laboratory studies using patient samples, tested in models that reliably recapitulate the human disease, and allow access to clinical trials for patients who are otherwise usually excluded.



Dr. Hayden Gephart performing a brain tumor resection at Stanford

At the Stanford Brain Tumor Center, our doctors are at the forefront of the latest brain tumor diagnosis, treatment and clinical trial options. We treat a wide variety of benign and malignant tumors of the brain and skull base in adults and children, including gliomas, craniopharyngiomas, meningiomas, chordomas, pituitary meningiomas, chordomas, pituitary adenomas, acoustic neuromas, metastatic adenomas, acoustic neuromas, metastatic tumors, and more. In addition to providing comprehensive disease management, we offer a variety of treatment options such as radiosurgery, neuro-interventional radiology, neurosurgical interventions, and radiation therapy.

### TUMOR BOARD

Our multi-disciplinary team meets weekly to decide which course of treatment would be best for the each individual patient.

### CYBERKNIFE

Globally-recognized for the invention of the Cyberknife, ours is the most experienced Cyberknife Center in the world; over 9,000 patients treated with Cyberknife at Stanford, and more than 100,000 worldwide. More patients treated with Cyberknife for spinal cord AVMs at Stanford than anywhere else in the world.

### NEUROGENETICS PROGRAM

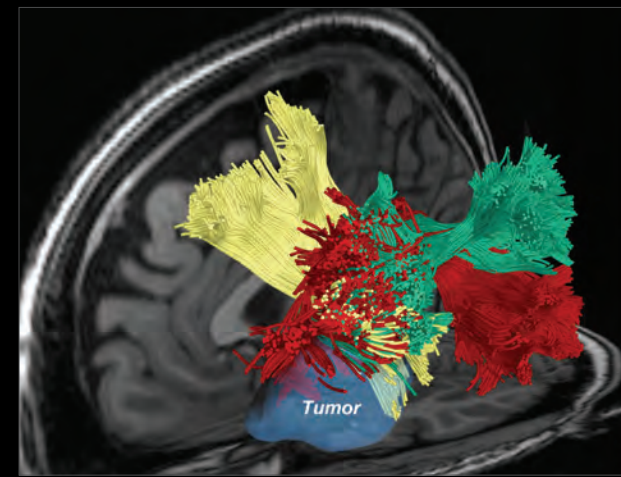
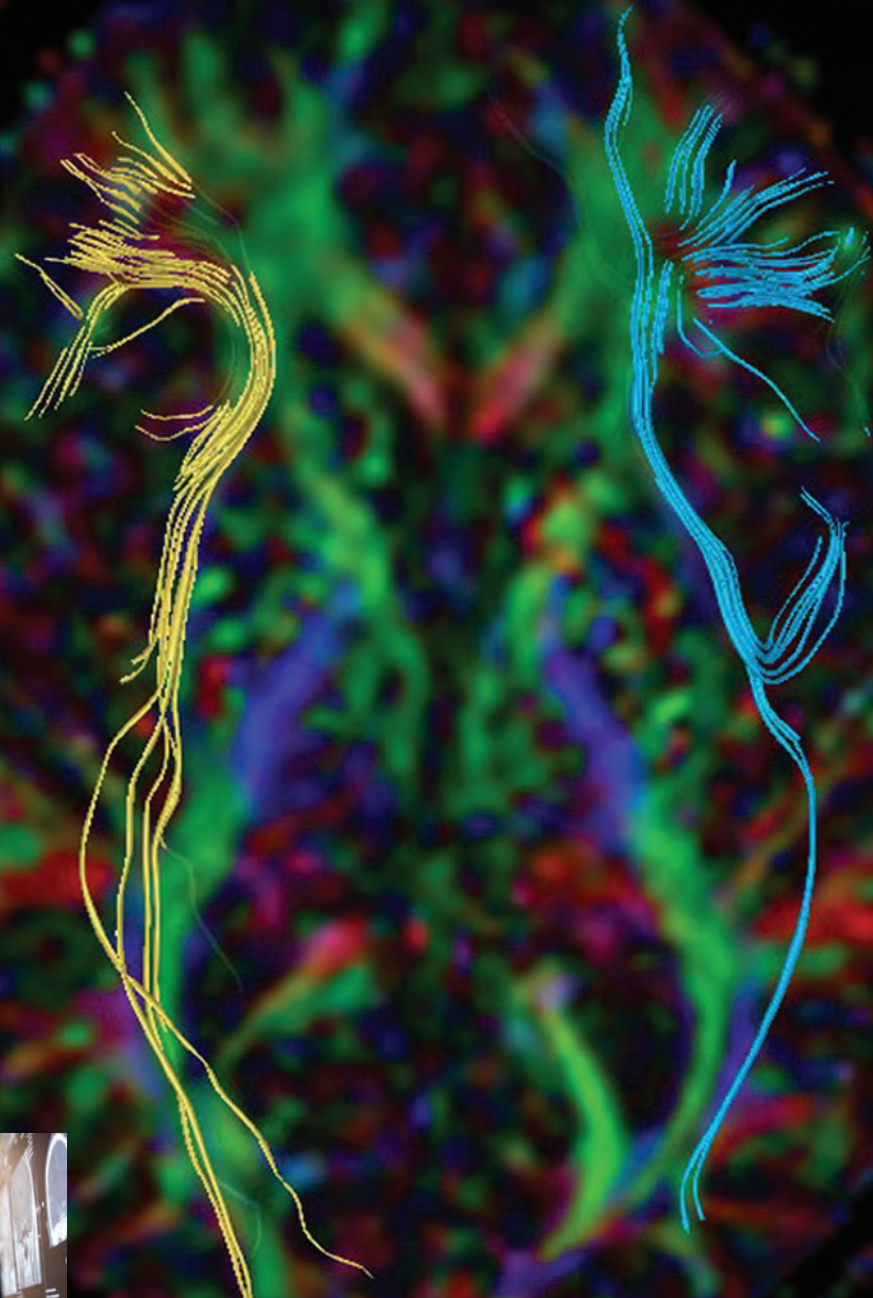
Launched in 2012, our Program is among a select group worldwide designed to treat the most difficult and complex cases of neurogenetic conditions, including Tuberous Sclerosis, Neurofibromatosis, Sturge-Weber Disease, Schwannomatosis, and more.

### BRAIN METASTASES CONSORTIUM

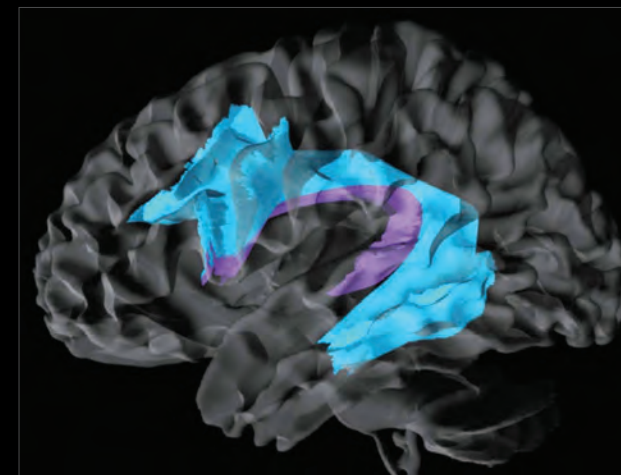
Launched in 2018 the consortium facilitates collaborative research between many exceptional researchers and clinicians across specialties at Stanford University, exponentially advancing our understanding of, and capacity to treat, metastatic brain tumors.



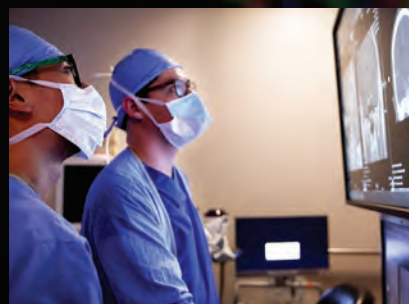
# Pioneering treatment approaches to complex tumor removal



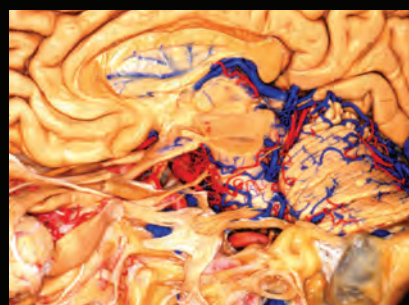
Pre-surgical tractography allows the surgeon to visualize how a tumor disrupts surrounding white matter structures



Visualizing white matter structures helps surgeons optimize a surgical approach



Using sophisticated imaging in the OR assists with intra-operative planning



New imaging technology is helping our surgeons gain a better understanding of brain anatomy



Surgeons review scans in a clinic at the Stanford Neurosciences Health Center

A group of super-specialized physicians trained and experienced in neurosurgery, oculoplastic surgery and ophthalmology, and otolaryngology/head and neck surgery, are using the latest technology and techniques—including endonasal, transcranial, and traditional methods—to determine the best approach for each individual patient.

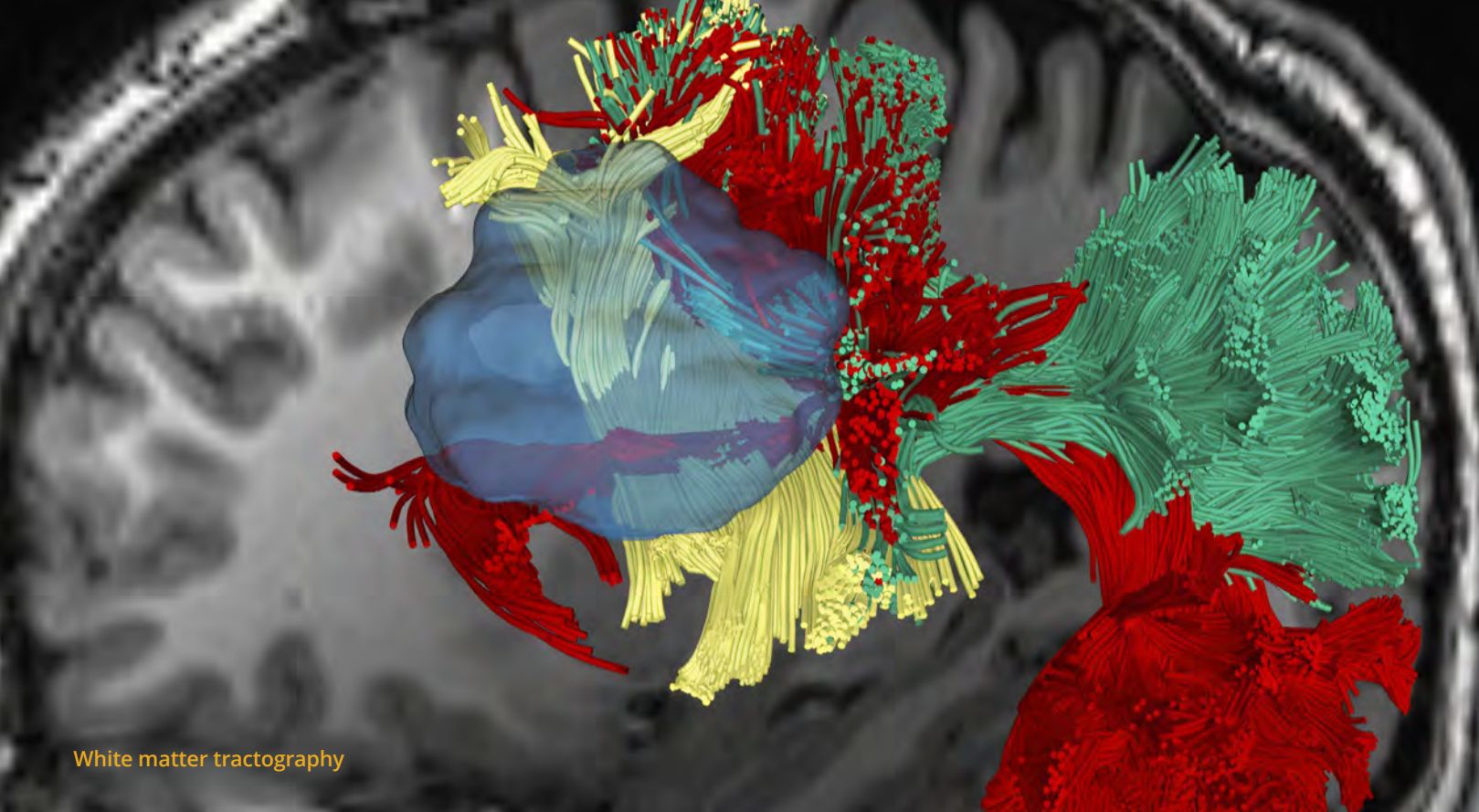


Dr. Juan Fernandez-Miranda and Dr. Zara Patel perform an endoscopic endonasal tumor removal surgery

“Operating on the brain is a huge privilege and a tremendous responsibility. We have made a commitment to our patients to be as knowledgeable about their anatomy, and as prepared as possible for each surgery.”

—Juan C. Fernandez Miranda, MD, FACS





White matter tractography

**REVOLUTIONIZING SKULL BASE SURGERY**

We are at the forefront of development and refinement of endoscopic endonasal surgical approaches, expanding into newer minimally-invasive routes into the brain and skull base, and making landmark contributions to the skull base community through continued education of residents, fellows and neurosurgeons worldwide.

**COMBINING ENHANCED VISUALIZATION WITH SURGICAL PLANNING**

We are demonstrating the importance of using High-Definition Fiber Tractography for presurgical planning and intraoperative navigation, pioneering combining anatomical and imaging studies to better delineate the trajectory, connectivity, asymmetry, and spatial relationships of the fiber tracts, and are using patient-specific tractography for our pediatric epilepsy patients.

## Research Spotlight

Dissection of the white matter fiber tracts provides a unique insight into the complex intrinsic architecture of the brain and compiles an essential knowledge for operating on intra-axial tumors. Our innovative studies are using data from the Human Connectome Project to further elucidate the complex anatomy of the white matter pathways in large scale populations. We have also been awarded an NIH grant to study the language pathways of stroke patients with aphasia undergoing intensive speech and language therapy; and are tracking white matter changes in neurodegenerative conditions such as ALS, Huntington’s disease and CTE, for development of a radiological neuroimaging biomarker to detect these diseases.

Dr. Laurence Katznelson reviews patient data in clinic

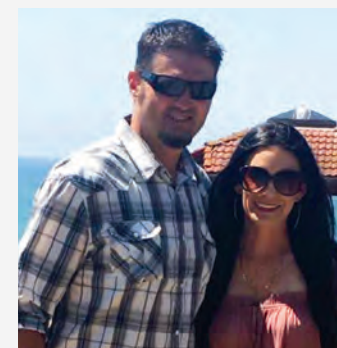


**PITUITARY DISORDERS**

We have established a preeminent center for pituitary disorders focused on developing new therapies, and applying the latest surgical techniques for pituitary tumor removal and resection. Our Center offers comprehensive streamlined care for the evaluation and treatment of pituitary tumors and other neuroendocrine disorders, and is committed to providing our patients precise diagnosis, safe and accurate surgery, and a compassionate team approach.

“These patients require multi-disciplinary approaches and we have found that when an ENT and neurosurgeon work together there are better patient outcomes; which is why we created the Stanford Pituitary Center.”

—Laurence Katznelson, MD



## Patient Feature

**Surviving A Difficult and Persistent Intracranial Tumor**

David Silva was diagnosed with a craniopharyngioma brain tumor—one of the most difficult and complex intracranial tumors to treat—when he was just 22 years old. Over the course of a decade Silva endured five brain surgeries at multiple hospitals, but the procedures were all unsuccessful and the tumor persisted. After successful removal of the tumor at Stanford, and more than a decade after his initial diagnosis, Silva’s pituitary is working well again, his vision has improved, he is no longer suffering from headaches, and he is worry-free with the knowledge the tumor is completely gone.



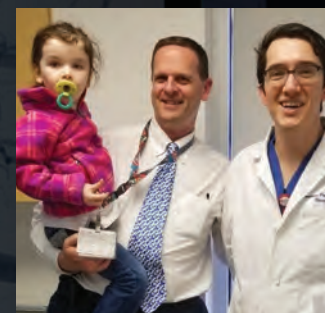
# At the forefront of minimally invasive treatments for infants, children, and adolescents



Brain surgery at Stanford to treat Chiari Malformation means Jeremiah can now be an active kid.

"He is living to best of his ability, I am now telling him to pace himself so that he doesn't overexert himself. I am so grateful to the Packard Children's team for being there for Jeremiah and our family."

—Heather Humann, Jeremiah's mom



Hadlee no longer suffers from multiple daily seizures caused by Tuberous Sclerosis Complex after two brain surgeries at Stanford.

"We came to Stanford, which has the most amazing teams of doctors, nurses, technologists and staff, who have found the perfect balance between medical and scientific knowledge, and trusting the families of their patients. They have done more for Hadlee than we ever thought possible, and all with a compassion like no other."

—Kaitlyn Steben, Hadlee's mom

"You have to love the kid more than you hate the disease. We want to preserve their quality of life, we just want them to be able to be a kid again."

—Gerald Grant, MD, FACS

Our pediatric neurosurgery team works with families to provide nurturing care for infants, children, and adolescents living with the full range of brain, spine, nerve and craniofacial disorders. To reduce recovery time and improve each child's quality of life after treatment, we work at the forefront of minimally invasive treatments, using innovative techniques, in one of the most advanced surgical facilities in the country.

- The only hospital in Northern California to offer the ROSA™ robotic surgical assistant for pediatric neurosurgery, which reduces anesthesia time, increases precision and improves safety
- The first pediatric hospital in the world to adopt Synaptive, a powerful new technology that helps brain surgeons conduct cranial surgery more quickly, safely and effectively
- Using virtual and augmented reality to maximize the each child's experience as well as to enhance education, training, and surgical planning





Devoted to advancing spine care and **pushing the frontiers** of peripheral nerve surgery



The Stanford Neurological Spinal Disorders team is made up of experts in the fields of spinal reconstruction, spinal deformity, spinal tumors, minimally invasive surgery, radiosurgery, pain management, and psychiatry; and is at the forefront of using innovative tools such as robotics and virtual reality to improve outcomes and achieve the best possible care for our patients.

“We are a national pioneer in integrating prospective outcomes driven medical informative and database systems into the electronic health record. This allows us to identify pre- and post-operative treatment measures that influence patient outcomes, improve patient safety and maximize the efficacy of treatments.”

—Atman Desai, MD



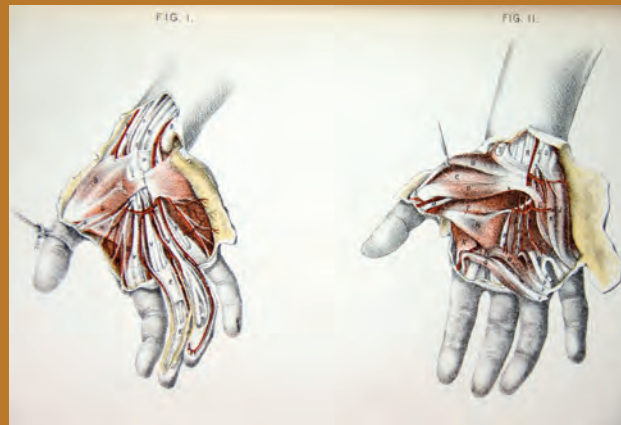
## Radiation-Free Surgery

Radiation exposure isn't just a concern for patients; surgeons and staff are exposed frequently when they're in the OR. Stanford neurosurgeon, Dr. Corinna Zygourakis, is the first neurospine surgeon in the Greater Bay Area to use 7D Surgical, a new image-guided surgical system that is radiation free!

## Research Spotlight

Our surgeons and scientists have brought the insights of big data modeling and precision health to spine surgery patients; developing and implementing a digital quality of life tracking system for pre- and post-operative patients used to predict adverse event occurrences, improve patient counseling and inform post-operative care in at risk patients.





**PERIPHERAL NERVE SURGERY**

From neuropathic disorders and traumatic nerve injuries, to nerve tumors and pain, we continue to push the frontiers of peripheral nerve surgery by pioneering new imaging and surgical techniques. By focusing our translational research on deriving methods for data-driven intraoperative decision making using intraoperative electrophysiology, advanced imaging techniques, and genetic expression information, we are expanding the limits of what is possible.

“We are never satisfied with the status quo and are driven to advance the field through research and teaching. Our common vision is to improve the lives of patients with peripheral nerve disorders, to offer treatment options that maximize recovery of function and minimize pain.”

—Thomas J. Wilson, MD



“We continue to lead in providing team-based, multidisciplinary care to patients with complex spine disorders. Our research efforts are focused on patient outcomes, preventing complications, understanding the biomechanics of spinal disorders, and pioneering innovative approaches to spinal disease, including minimally invasive and robotic surgery.”

—John Ratliff, MD, FACS

**REDUCING OPERATING TIMES, INCREASING SAFETY AND ACCURACY, AND IMPROVING OUTCOMES**

**MISS**

Pioneered at Stanford, Minimally-invasive Spine Surgery (MISS) takes advantage of recent advances in video endoscopy, intraoperative navigation, robotic assistance, and specially developed surgical instruments to offer treatments for a variety of procedures.

**Motion Preservation**

Cervical Arthroplasty, more commonly known as Artificial Disk, allows for a greater range of motion, reduces the burden on surrounding tissue and bones, improves long-term surgical outcomes and can significantly reduce the need for re-operation years down the road.



**ROBOTICS**

Using robotic systems allows us to combine very detailed preoperative imaging with an extraordinary amount of intraoperative accuracy, by taking 2-dimensional images and reconstructing an individual’s spine in 3-D. The integration of these tools means diagnostics and operations are quicker, less-invasive, safer, and more effective for our patients.



**Patient Feature**

**Shorter Hospital Stay and Faster Recovery with Minimally-Invasive Surgery**

Terenia survived a very serious car crash, but decades later her injuries began to create such debilitating symptoms she lost her ability to work as an artist and was in constant pain. Two surgeries to address the pain and weakness in Terenia’s arms, back and legs, using leading edge imaging, along with robotic and computer-assisted surgery to plan for, and complete shorter operations with less anesthesia, meant Terenia is back in her painting studio doing what she loves to do.



# Leading and expanding care and research for mild to severe head and spine trauma



Dr. Odette Harris meets with a trauma patient at the Stanford Hospital outdoor gardens.



"I like to think my story inspires other people with a traumatic brain injury to keep trying. It's hard work, but with hard work and a good attitude, TBI survivors can get better."

—Anthony Macchio-Young



## STANFORD BRAIN PERFORMANCE CENTER

Our Center is advancing the neuroscience of brain performance in development, injury, and aging, and helping to solve the major questions in brain health and injury. Our team of concussion experts:

- Were part of a national collaboration that identified and published the first-ever concussion sub-types guidelines
- Led the Centers for Disease Control's major new guidelines for diagnosing and managing head injuries in children
- Developed Eye-Sync, a new virtual reality technology helping sports medicine professionals determine when an athlete needs to be removed from play for concussion

"At Stanford, we developed a new classification system for concussion, all the PAC-12 are already using it, and it is expanding nationally. We are now going beyond concussion to brain performance, for improved science and clinical applications of attention, eye tracking, and injury management."

—Jamshid Ghajar, MD, PhD, FACS

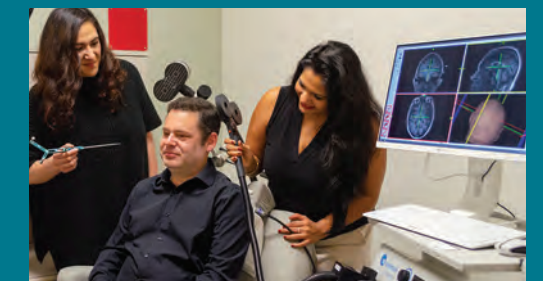
When an accident, fall or assault happens and someone has suffered a serious head or spine injury, it matters that Stanford's neurocritical care team includes expert neurosurgeons able to deal with even the most severe traumatic injuries. Whether caring for a patient with a brain or a spinal cord injury, our priority is to reduce swelling, stabilize, and minimize further damage; once a patient is through that period of survival our focus shifts to recovery and rehabilitation.

### Certified Level 1 Trauma Center

Stanford's Emergency Department offers patients access to treatment options that often mean the difference between life and death. The integration of trauma specialists, orthopedists, experts in ENT and plastic surgery, allows our patients to excel in their recovery.

### Caring for Veterans, Advancing Research

Our team cares for wounded veterans at the Palo Alto VA, where our neuroscientists are involved in leading and expanding research specifically focused on women with traumatic brain injury, using advanced neuroimaging and neuromodulation to diagnose and manage injuries, and on unique cutting-edge treatments for spinal cord regeneration.



Stanford researchers are working to improve outcomes for veterans with TBI using novel neuromodulation techniques.

## Patient Feature

### Survival and Recovery After Traumatic Brain Injury

Anthony Macchio-Young was in a bicycle accident and suffered a subdural hematoma that nearly ended his life. With an emergency craniotomy at Stanford and years' worth of specialized care Macchio-Young was able to re-learn how to write, walk, speak and eat. Macchio-Young now speaks to kids about the importance of wearing helmets, to physical therapy students about his recovery, and is taking part in brain injury research.



# An international referral center for treatment of complex cerebrovascular diseases



“Often times patients need more than one approach to cure their problem. When you combine the expertise and skill of our neurosurgeons, the world class talent of our ancillary group of physicians and staff, and our excellent facilities, that creates a very unique working environment and means superior care for our patients.”

— Robert Dodd, MD, PhD

Neurointerventionalist Dr. Robert Dodd reviews scans with a patient at a follow-up appointment



We are one of the largest quaternary referral centers internationally for highly specialized neurovascular surgeries, minimally invasive endovascular, and radiation/radiosurgery therapies.

- We use technological advances in neuroimaging, surgical navigation, intraoperative brain monitoring, and novel less invasive surgical techniques to accurately target and treat even the most complex cerebrovascular diseases

- New surgical centers in our adult and children’s hospitals bring together an unprecedented collection of advanced technologies and procedural bandwidth—our operating rooms, cardiac catheterization labs, angiography suites, endoscopy procedure rooms and imaging suites are all grouped together in one space



## NATIONALLY-RECOGNIZED STROKE CENTER

The Stanford Stroke Center is home to a large team of neurologists, neurosurgeons, neuroradiologists, nurse specialists, basic scientists, and clinical researchers. We have cared for tens of thousands of patients, trained dozens of stroke specialists in our fellowship programs, and are an international leader in the development of new stroke treatments through groundbreaking research.

- One of the first organizations in the US focused on comprehensive stroke diagnosis, treatment, research, and education
- The first Stroke Center in the US to meet The Joint Commission’s standards for Comprehensive Stroke Center Certification
- One of the highest enrolling sites nationally in acute stroke treatment trials, imaging-based stroke studies, and stroke prevention trials

## OUR NEUROVASCULAR TEAM HAS TREATED

3,800+

Aneurysms

4,300+

Vascular Malformations (AVMs, Cavernous Malformations, and AV Fistulas)





Every summer moyamoya patients and their families gather in Palo Alto for the Stanford Moyamoya Center Picnic



In recent clinical trials, patients have shown remarkable improvement in motor deficits using stem cell treatment for ischemic stroke.

“The dogma that the central nervous system cannot regenerate is simply not true; we just haven't figured out how to make it happen... yet. Restoration of even one spinal level of function could be the difference between total dependence and personal autonomy.”

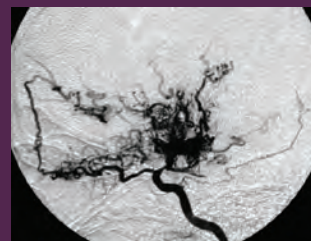
—Suzanne Tharin, MD, PhD

“When you get to come back, see them every year and observe that not only are they growing up, but they're growing up without strokes; and when you see young patients entering college, having children themselves, pursuing careers, that is incredibly fulfilling to be able to say you had a hand in helping that happen.”

—Teresa Bell Stephens, BSN, RN, CNRN

**WORLD'S LARGEST MOYAMOYA REFERRAL BASE**

Patients from all over the world are drawn to Stanford for re-vascularization bypass surgeries to treat moyamoya disease. The disease is still often overlooked by neurologists; in many cases patients remain undiagnosed or misdiagnosed until they've experienced serious cognitive decline from the multiple TIAs and ischemic strokes that are among the disease's signature symptoms.



**30**

Years of Expertise in Moyamoya Treatment

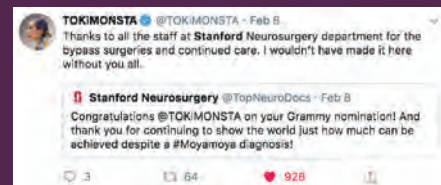
**1850**

Over 1,850 Bypass Surgeries

**1,200**

Over 1,200 Patients Treated from 49 States and 19 Countries.

Celebrities affected by moyamoya disease are taking to social media to help spread awareness in hopes of helping others get the right diagnosis and treatment.



**LEGACY OF LEADERSHIP IN STEM CELL THERAPY**

We are leading the country in pioneering clinical trials for direct intracerebral stem cell transplantation for patients with stroke, spinal cord injury and traumatic brain injury.

**STROKE**

- We are studying the use of human neural and bone marrow derived stem cells in the treatment of motor deficits following ischemic stroke, as well as exploring pre-clinical mechanisms, pharmacology, and toxicology questions associated with these cells
- Significant pre-clinical improved outcomes, such as motor function improvements and attenuation of post-stroke inflammation, are encouraging the translation of this product into clinical trials for chronic stroke victims
- Stanford Neurosurgery was the major site participating in the first North American clinical trial investigating intraparenchymal stem cell transplantation therapy, for patients with persistent disability following ischemic stroke

**SPINAL CORD INJURY**

- We are studying the efficacy of human neural stem cells and induced pluripotent stem cell (IPS) lines to improve functional outcomes in cervical spinal cord injury
- Our spinal cord injury and repair effort interacts closely with the Stanford Institute for Stem Cell Biology and Regenerative Medicine and our neuroscientists at the VA Palo Alto Health Care System and the Santa Clara Valley Medical Center

**NEUROLOGICAL INJURY, DISEASE, AND CANCER**

- The Stanford Stem Cell Transplantation Program has been making important advances in research and pre-clinical treatments for two decades. Its overarching goal is to investigate promising cellular transplantation therapies for neurological injury, disease, and cancer
- Drugs, proteins, and other novel molecules are also explored to enhance the efficacy and survival of transplanted stem cells



# Developing novel neuromodulatory techniques **for chronic disease**



Our Functional Neurosurgery Program focuses on a variety of treatments for movement-related disorders, pain, and epilepsy. Many of the therapies available through the Program utilize the stereotactic neurosurgical techniques developed at Stanford. We are at forefront of developing neurotechnology that will transform our notion of what is possible for people with chronic neurological disease.

## **AT THE FOREFRONT OF MINIMALLY-INVASIVE THERAPIES**

We are one of the first centers in the world to acquire the High-Intensity Focused Ultrasound MR Scanner to treat Essential Tremor; allowing for immediate, significant, and durable reduction of tremor without opening the skull.

## **NATIONAL LEADERS IN EPILEPSY TREATMENT**

Our Level IV Epilepsy Center is one of the nation's leading centers for clinical care of people with seizure disorders and for basic science research on mechanisms of epilepsy. We are revolutionizing treatment for drug-resistant epilepsy, and testing the efficacy and safety of novel treatments such as MRI-guided laser ablation.

## **Did You Know?**

In 2020 we conducted the first responsive deep brain stimulation surgery for obesity in the world.





Alex Baker



David Tran with his care team at Stanford.

## Patient Feature

Tremors and chronic pain caused by Parkinson's Disease forced Alex Baker to retire early, and threatened to take away his life-long passion, surfing. After Deep Brain Stimulation at Stanford, Baker reduced his medications by more than half, his gait and handwriting returned to normal, and when he does have tremors they are minor and temporary.

### EXPANDING THE POSSIBILITIES OF DEEP BRAIN STIMULATION

Our world-renowned experts in image-guided surgery offer new or improved treatments for Parkinson's disease, dystonias, pain, and epilepsy. We use leading-edge techniques developed at Stanford, including a frameless approach in our copper-shielded ORs, to perform Deep Brain Stimulation (DBS). Our latest trials expand the use of DBS as a beneficial therapy for those with addictive behaviors such as severe alcoholism and binge eating.



### PIONEERING COMPUTER BRAIN INTERFACE

Part of Brain Gate, our novel program using Brain Computer Interface arrays implanted into the cortex of paralyzed patients is making national headlines and offering new hope for those who have been unable to communicate due to diseases such as ALS or injury. Preliminary results show patients are able to navigate through commonly used tablet programs, including email, chat, music-streaming and video-sharing apps, or surfing the web, simply by thinking.

## Patient Feature

David Tran suffered for many years from debilitating pain in his face caused by Trigeminal Neuralgia (TN), a type of chronic facial pain condition, making even basic daily tasks like brushing teeth or eating unbearable. Microvascular decompression surgery at Stanford eliminated the pain and gave Tran his life back.

### EXPERTS IN MICROSURGICAL AND RADIOSURGERY TREATMENT FOR PAIN

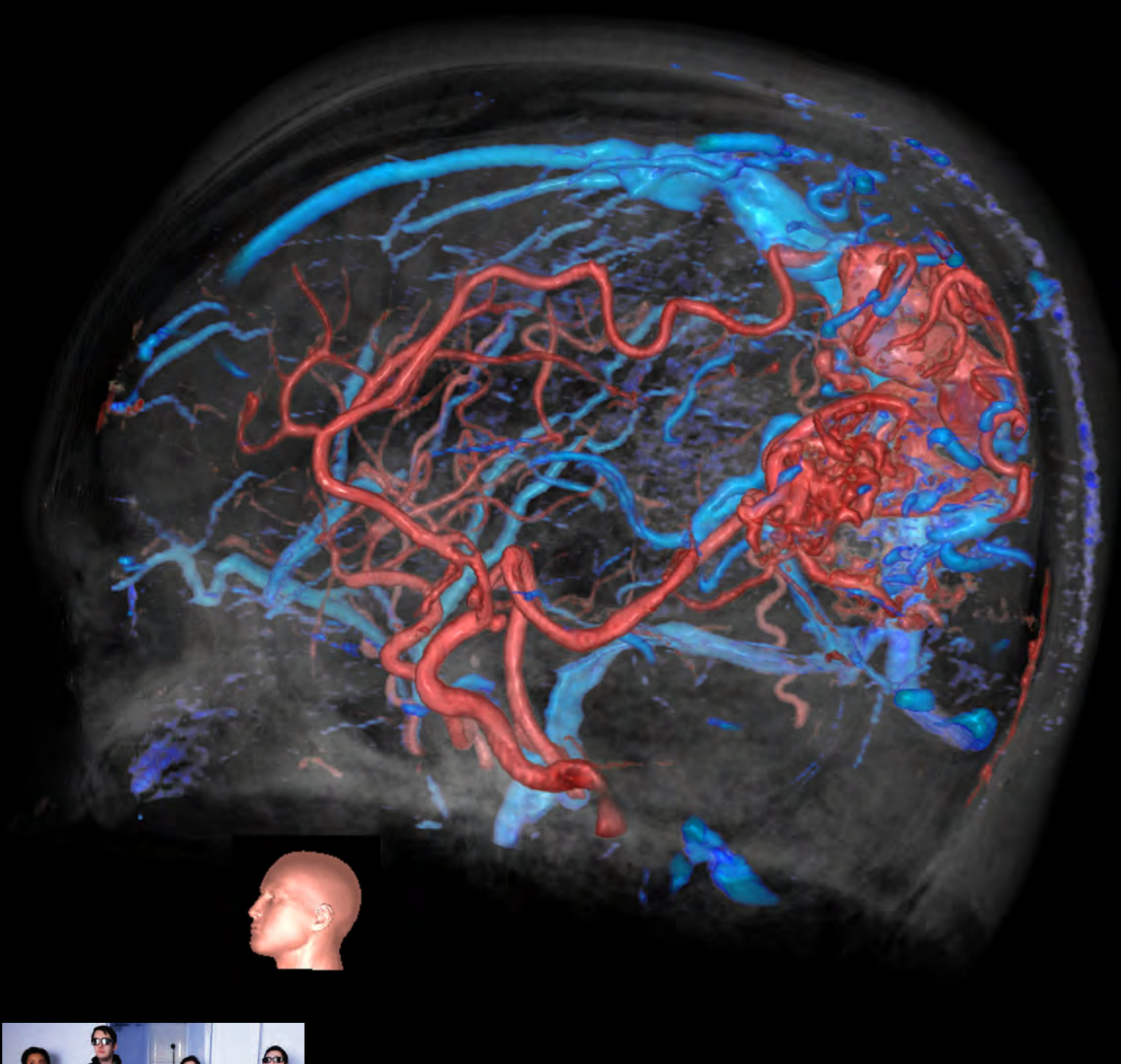
We treat a variety of pain conditions affecting the nervous system, including neuralgias, causalgia, neuropathic pain, failed back syndrome, reflex sympathetic dystrophy, and chronic pain. Our experts are developing novel neuromodulatory techniques and working closely with pain specialists to bring us one step closer to finding long-term, safe, and minimally-invasive solutions for those suffering from chronic pain.

"If anyone has this condition, please do not be discouraged. Instead persevere and find medical treatment. I was able to find Stanford and able to find a cure for my pain. I am thankful to have my life back."

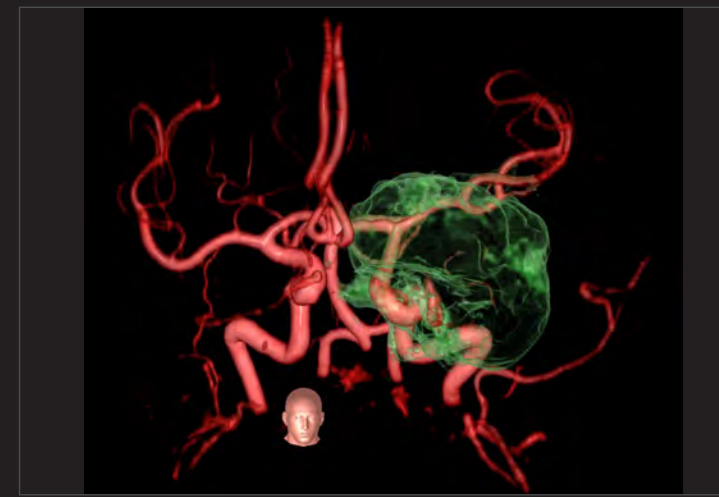
—David Tran, Trigeminal Neuralgia patient



# Expanding precision virtual reality as a patient education and surgical planning tool



We also use 3-D printing to better understand individuals' injuries, tumors, deformities, disorders, aneurysms, and AVMs.



To create 3-D images of a patient's anatomy, scientists fuse two-dimensional images from MRI and CT scans using advanced computer programs.



With VR headsets, surgeons can "fly" through the brain—getting a close-up look at the brain tissue and vessels, even practicing clipping of an aneurysm with a simulated aneurysm clip, all without opening the skull.

Stanford opened its Neurosurgical Simulation and Virtual Reality Center in 2016, the first institution in the greater Pacific Northwest to use patient-specific 3-D virtual reality (VR) technology across the neurosurgery clinics, operating rooms, and classrooms. We are also the first functional neurosurgery and spine clinics in the world to use patient-specific, 360-degree virtual reality for direct patient engagement. Over 1,200 Stanford neurosurgery patients have benefited from Surgical Theater 360 VR at some point during their care.

## BEFORE AND DURING SURGERY

By immersing themselves in three-dimensional views of their patients' anatomy, our surgeons can practice and map out the exact path they will take during the surgery, ahead of time. The VR system helps surgeons in the operating room, guiding them in a three-dimensional space and correlating the three-dimensional images with the real-time microscopic surgical view.

## TEACHING AND TRAINING

The system allows instructors to highlight different components of the brain from different angles, such as arteries to show a vascular malformation, bones to show spine or skull deformities, or tissue to show a tumor. Students explore complex cases in VR and progress, as avatars, through the steps for removing a tumor or repairing an aneurysm.

## PATIENT EDUCATION

For patients, a mobile unit, complete with VR headset, is rolled into a clinic or hospital room. Being able to visualize the problem in three dimensions can help reassure patients, and is especially useful for young patients or those who don't understand English well.

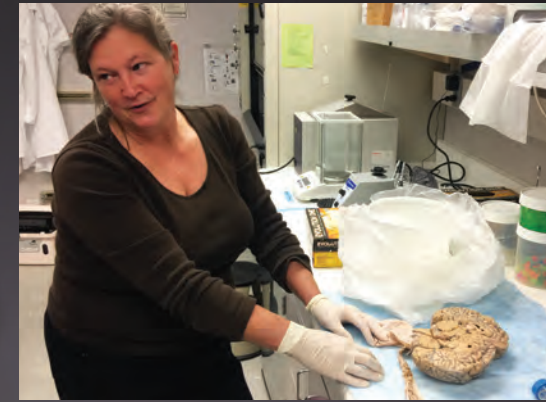


Residents and faculty prepare for surgery using VR and then continue their hands-on training at Stanford's Neurosurgical Anatomy Lab where they explore complex neurosurgical procedures on cadaveric specimens.



# At the forefront of discovery

From anti-cancer therapies and stem cell transplantation therapies for spinal cord injury to the elucidation of retinal neural circuitry and gene-environment interactions in fetal development, our research scientists are making rapid progress tackling some of the most complex neurological disease questions in the neurodegenerative and neuroregenerative fields today.



Lorelei Shoemaker, PhD, is working on enhancing our understanding of arteriovenous malformations.



Sara Bolin, PhD, is studying the role of Casein Kinase 2 and metastatic spread of childhood brain tumors.

The Department of Neurosurgery is a world leader in the fast-paced environment of innovative research translation. The rich intellectual environment at Stanford, paired with our accessibility to the most advanced technology, is unmatched and ensures the rapid translation of pioneering laboratory research into life-saving clinical therapies for our patients.

## LEADING NATIONALLY IN RESEARCH

30+

Active  
Laboratories

10

10 Top 100 NIH-  
Funded PIs in  
Neurosurgery

#2

In NIH Funding  
Nationally in  
Neurosurgery

#3

In Research at  
Medical Schools by  
US News  
& World Report



Tanya Weekrakkody, PhD, is working to better understand how inflammation modifies cortical activity.



# Research visionaries

While research themes vary from lab to lab, we are all focused on studying aspects of neurologic and psychiatric disease and injury that can be investigated at the bench, with clear implications for practices in the clinic and operating room. The results of these studies and the discoveries in our labs translate into new, innovative, and minimally-invasive therapies for patients, not offered anywhere else in the world.



**Ivan Soltesz, PhD**

*James R. Doty Professor of  
Neurosurgery and Neurosciences*

*"I can imagine that in 20 years or so we'll have full-scale models of mouse and human brains at single-cell resolution."*

The Soltesz lab utilizes various molecular, genetic, electrophysiological, imaging, and behavioral tools to decipher how interneurons modulate the flow of information through the hippocampus and how their dysfunction in neurological disorders such as epilepsy contribute to neurocognitive decline.



**Lu Chen, PhD**

*Professor of Neurosurgery and of  
Psychiatry and Behavioral Sciences*

*"We would very much like to understand the link between defective homeostatic plasticity and impaired cognitive function."*

The Chen lab's long-term research goal is to understand the cellular and molecular mechanisms that underlie synapse function during behavior in the developing and mature brain, and how synapse function is altered during mental retardation.



**E.J. Chichilnisky, PhD**

*John R. Adler Professor  
of Neurosurgery and of  
Ophthalmology and, by Courtesy,  
of Electrical Engineering*

*"Understanding retinal circuitry and how to interface to it effectively will be relevant for developing other interfaces to the brain—for treating disease, and for augmenting human capabilities."*

The Chichilnisky lab focuses on a combination of basic and applied research to develop an artificial retina -- an electronic implant that can reproduce the electrical signals that the retina normally transmits to the brain in order to restore vision to people blinded by retinal degeneration.





**Theo D. Palmer, PhD**

*Professor of Neurosurgery*

*"Finding synergy between genes and environment, and trying to model which interactions are important, that's the fun part of what we do."*

The Palmer lab's ongoing research hopes to identify additional combinations of mild genetic and environmental risks that have synergistically negative effects on brain development; with the ultimate goal of developing diagnostic tools that identify these risks and can educate physicians and mothers about potential ways to reduce risk and prevent neurodevelopmental disorders.



**Peter Tass, MD, PhD**

*Professor of Neurosurgery*

*"From the very beginning, it was my goal to use self-organization principles for therapeutic purposes, to develop subtle interventions that induce significant therapeutic effects."*

The Tass lab is engaged in ground breaking research designed to impact the course of diseases like Parkinson's, stroke and tinnitus, with the possibility of influencing numerous other diseases. Current research projects include using invasive and non-invasive neuromodulation to disrupt the neural networks that give rise to many of the symptom clusters associated with these diseases.



**Albert J. Wong, MD**

*Professor of Neurosurgery*

The goal of the Wong lab is to define targets for cancer therapeutics and then translating these findings into important clinical tools. The major type of cancer that we study is glioblastoma multiforme, the most common and devastating of the human brain tumors, but our work also has relevance in lung, breast, ovarian and prostate cancers. We have discovered and characterized novel and mutant/splice variant proteins, have generated an effective peptide vaccine for GBM therapy, and have developed a bi-specific antibody reagent with even greater potential for treatment of patients with EGFRvIII positive GBM.



**Thomas Sudhof, MD**

*Avram Goldstein Professor of Molecular & Cellular Physiology and of Neurosurgery, and Professor, by courtesy of Neurology and Psychiatry*

*"This 'solid descriptive science,' like neuroanatomy or biochemistry, [are] disciplines that cannot claim to immediately understand functions or provide cures, but which form the basis for everything we do."*

The Südhof's laboratory studies how synapses form in the brain, how their properties are specified, and how they accomplish the rapid and precise signaling that forms the basis for all information processing by the brain.



**Robert Sapolsky, PhD**

*John A. and Cynthia Fry Gunn Professor of Biology and of Neurology, and of Neurosurgery*

*"Stress causes very few diseases. What stress does is it makes it harder for your body to withstand the traditional causes of diseases."*

The Sapolsky lab has worked in three general areas: a) the ability of stress and stress hormones to damage the nervous system and accelerate aspects of brain aging; b) the design of gene therapy strategies to protect neurons from both the adverse effects of stress, and from necrotic insults; c) the ability of the protozoan parasite *Toxoplasma gondii* to enter the nervous system and alter a variety of aspects of brain function and behavior.



**Julia Kaltschmidt, PhD**

*Associate Professor of Neurosurgery*

The Kaltschmidt lab's goal is to understand the molecular basis of neuronal circuit formation, with particular interest in spinal circuits underlying locomotor function, spinal circuitry of sexual function, and neuronal circuitry of the gut.



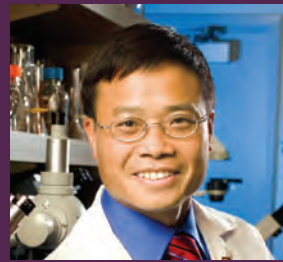


*"We have demonstrated in a number of models of Alzheimer's Disease that restoring certain functionality in the brain results in a profound effect in this disease."*

**Mehrdad Shamloo, PhD**

*Professor (Research) of Neurosurgery and, by Courtesy, of Neurology*

The ultimate goal of the Shamloo laboratory and research is to rapidly advance our understanding of normal brain function at the molecular, cellular, circuit, behavioral and functional levels, and to elucidate the pathological process underlying malfunction of the nervous system following injury and neurologic disorders such as stroke, Alzheimer's disease and autism.



*"Our aim is to, not only provide insights for treating brain injury, but also for attenuating immunodepression."*

**Heng Zhao, PhD**

*Professor (Research) of Neurosurgery*

The Zhao lab mainly studies—and was the first to demonstrate—the protective effect of post-conditioning against stroke. Additional research focuses on the protective effect of preconditioning and mild hypothermia, in hopes of discovering mechanisms that these treatments have in common, or will lead to treatment for stroke and increase a patient's chance for recovery.



*"We aim to develop new treatments which will one day help improve the quality of life for patients with spinal cord injuries."*

**Giles Plant, PhD**

*Associate Professor of Neurosurgery*

The Plant laboratory is dedicated to improving the quality of life for those living with spinal cord injuries. The lab's research focuses on repair of the injured spine cord using human induced pluripotent stem cells (HiPSCs), mesenchymal stem cells and glial cell transplantation with the long-term goals of developing neuroprotective and regenerative translational protocols for human clinical treatments.



*"The premise of our lab is that the brain is complex, and its complexity has required that it evolve mechanisms to keep things well controlled. Our lab is searching for those mechanisms."*

**John Huguenard, PhD**

*Professor of Neurology, of Neurosurgery, and, by Courtesy, of Molecular and Cellular Physiology*

The Huguenard laboratory is interested in identifying structural points within brain circuitry from which epileptic seizures initiate or propagate, determining the microcircuit (cellular and synaptic) mechanisms that promote such seizures, and developing real time interventions that prevent seizure occurrence or spread.



*"Our goal is to develop powerful new technologies that allow us to decode the brain's complicated circuitry and discover therapies for neurological diseases like epilepsy, Parkinson's and Alzheimer's."*

**Jin Hyung Lee, PhD**

*Associate Professor of Neurology, of Neurosurgery, and of Bioengineering, and, by Courtesy, of Electrical Engineering*

The Lee lab uses interdisciplinary approaches from biology and engineering to analyze, debug, and manipulate systems-level brain circuits - with the goal of understanding the connectivity and function of these large-scale networks to develop new therapies for neurological diseases.



*"I'm working to better understand...and develop ways to prevent, or try to reverse, patients' cognitive decline after a stroke."*

**Marion S. Buckwalter, MD, PhD**

*Professor of Neurology and Neurosurgery*

The Buckwalter lab's goal is to understand how inflammatory responses contribute to brain damage after stroke and how they influence recovery. In particular, we are interested in inflammatory signaling of glial cells in both the central nervous system and the periphery in models of stroke and infection.





**Xinnan Wang, MD, PhD**

Associate Professor of Neurosurgery

*"We've identified a molecular marker that could allow doctors to diagnose Parkinson's accurately, early and in a clinically practical way."*

The goal of the research at the Xinnan Wang lab is to understand the regulatory mechanisms controlling mitochondrial dynamics and function and the mechanisms by which even subtle perturbations of these processes may contribute to neurodegenerative disorders.



**Jun Ding, PhD**

Associate Professor of Neurosurgery and, by Courtesy of Neurology

The long-term scientific goal of the Ding lab is to construct functional circuit diagrams and establish causal relationships between activity in specific groups of neurons, circuit function, animal motor behavior and motor learning, and, thereby, to decipher how the basal ganglia process information and guide motor behavior.



**Summer Han, PhD**

Assistant Professor (Research) of Neurosurgery and of Medicine (Biomedical Informatics)

*"I have developed various statistical methods to analyze high-dimensional data to identify genetic and environmental risk factors and their interactions for complex disease."*

The Han Lab focuses its research on understanding the genetic and environmental etiology of complex disease and developing and evaluating efficient screening strategies based on etiological understanding. Areas of research interests include statistical genetics, molecular epidemiology, cancer screening, health policy modeling, and risk prediction modeling.



**J. Bradley Zuchero, PhD**

Assistant Professor of Neurosurgery

*"We've created a genetic toolkit that enables researchers to perturb any cell's cytoskeleton — the cell skeleton that gives cells shape, lets them move, and, when misregulated in cancer, makes tumor cells invade nearby tissues."*

The Zuchero lab aims to uncover the cellular mechanisms by which glia sculpt and regulate the nervous system, with particular interest in understanding how glia form the insulating myelin sheath, and why regeneration of lost myelin fails in diseases like multiple sclerosis and after stroke.



**Paul Nuyujukian, MD, PhD**

Assistant Professor of Bioengineering and of Neurosurgery and, by Courtesy, of Electrical Engineering

*"To see a participant move a cursor just by thinking about it actually happen is unbelievable. It was hard to not display emotion on the spot."*

The Brain Interfacing lab is interested in the applicability of brain-machine interfaces as a platform technology for a variety of brain-related medical conditions, particularly stroke and epilepsy. This research spans both pre-clinical models and human clinical studies.



**Claudia K. Petritsch, PhD**

Associate Professor (Research) of Neurosurgery

The Petritsch lab uses pharmacological, molecular, and in vivo and ex vivo techniques, to uncover the mechanism for cell fate decisions in oligodendrocyte precursor cells, in the healthy and diseased brain.



# Producing **the world's future leaders** in neurosurgery



Our training program benefits from the teaching of 30 full-time clinical and 19 research faculty members across five hospitals – SHC, LPCH, VAPAHCS, SCVMC, and Kaiser. We emphasize both proficiency in clinical techniques and patient care, and the development of a deep commitment to research, to produce the world's future leaders in neurosurgery.

#### Program Highlights:

- 7-year training program (PGY I-VII)
- 3 residents per class (21 total)
- Applicants for the 2019 entering class: 358
- Consistently match within top 5, 2019 match was the top 3

**100%**

Of our Residents Passed the Written Board Exam at First Attempt for the 6th Consecutive Year

**92%**

Of our Graduates Enter Academic Careers—the Highest in the Country

**3**

Of our Residency Program Alumni are William P. Van Wagenen Fellows (Odette Harris, Samuel Cheshier, Kai Miller)

**482**

Our Residents Produce a Total of 482 Publications, an Average of 22 Publications Each



Residents and faculty taking time to enjoy activities outside the hospital setting.



## CARING FOR OUR DOCTORS

We believe physician burnout is a problem that needs to be addressed and that ensuring physician wellness is key to fostering a leading neurosurgical program. Our faculty champion efforts to reduce stress and anxiety and provide individualized mentorship to each resident. We also offer group exercise and team building activities in an effort to improve the physical and mental health of our faculty and residents.



### Did You Know?

Stanford Medicine established the Stanford WellMD Center in 2015 to advance the well-being of physicians and was the first academic medical center in the U.S. to hire a chief wellness officer.



"The road is a little bit bumpier for women in neurosurgery, but I think that a lot of it can be overcome by changing the culture."

—Ciara Harraher, MD



Stanford's female neurosurgeons participate in the national New Yorker Cover #ILookLikeASurgeon Challenge in May 2017.



Odette Harris, MD, MPH and Maheen M. Adamson, PhD with student volunteers from one of several Stanford Neurosurgery programs aimed at expanding access to neurosciences for underrepresented minority high-schoolers.

### FOCUS ON DIVERSITY

Over the last couple of decades our department has made a concerted effort to mentor, train, and hire a diverse population of surgeons, scientists, and residents. With 33% women and other underrepresented minority faculty clinicians and researchers, our department is one of the nation's leaders in faculty diversity. While we're proud of that percentage, we recognize we are still a long way from parity, and continue to actively encourage, recruit, and promote female and other underrepresented minority neurosurgeons and scientists.

33%

Women or underrepresented minority faculty

29%

Women or underrepresented minority residents

### FEATURED PROGRAMS

- SNaP Program: An initiative focused on supporting the well-being among women in the Department
- Team Building Gatherings: Hosted by the Vice Chair of Diversity multiple times per year, these events bring together female faculty, residents and fellows
- Neuroscience Journal Club: Monthly meetings for high-schoolers to read and discuss scientific literature with Stanford faculty
- Harris Internship: A summer program for teens focused on scholarly activities in neuroscience as they relate to gender and/or health care disparities
- Castilleja Project: A year-long initiative for girls aimed at enhancing the pipeline of females in medicine and science
- Boys and Girls Club: A summer initiative for BGCP members aimed at developing the pipeline of underrepresented minorities in medicine and science



# Comprehensive care locally and globally



## THE NEW STANFORD HOSPITAL

The new adult hospital includes 600 beds, a new Level-1 Trauma Center and Emergency Department, state-of-the-art diagnostic and treatment rooms including 20 operating rooms, eight interventional/radiology image-guided rooms, 3 MRIs, 3 CTs and an interventional MRI.

- Consistently ranked among the nation's best hospitals by U.S. News & World Report, including in the top 10 for Neurology & Neurosurgery

- Ranked among the top 100 hospitals by Vizient, including Quality Leadership and Ambulatory Care Quality and Accountability Award
- Magnet-designated by the American Nurses Credentialing Center
- Designated a "Senior Friendly" hospital by NICHE
- Designated a "Most Wired" hospital by Hospitals Magazine
- One of the first hospitals in the country to receive HIMSS Stage 7 Hospital distinction



We are fortunate to have excellent facilities and the most technologically advanced equipment in the world to help us treat neurological diseases for both adult and pediatric patients. Our hospitals offer the only Level 1 Trauma Center between San Francisco and San Jose, and a Joint Commission-certified comprehensive Stroke Center. Our one-of-a-kind dedicated outpatient Neuroscience Health Center brings all our specialized care teams together in one place, in an ultra-modern facility designed to support patients throughout their entire journey of care.

In 2018 Stanford Children's Health opened its newly-expanded facility. The hospital includes a surgical center featuring the most advanced surgical, interventional and hybrid technologies available anywhere, and the only neuro-hybrid suite of its kind dedicated to pediatric patients in Northern California.

## THE NEWLY-EXPANDED CHILDREN'S HOSPITAL

- Consistently ranks in all 10 pediatric specialties by U.S. News & World Report
- One of only a few Northern California pediatric facilities to offer state-of-the-art 3-Tesla MRI, and one of the only children's hospitals using this functional neuroimaging and brain mapping to determine surgical candidacy and guide surgical approach
- Includes 6 new surgical suites
- Includes 3.5 acres of gardens and green space
- LEED Platinum certification, 1 of only 2 hospitals in the world to earn the highest designation for sustainability
- Magnet-designated by the American Nurses Credentialing Center
- Offers comprehensive care at over 60 locations across the Bay Area





Dr. David Hong trains local physicians at Okryu Children's Hospital in North Korea.



Dr. Juan C. Fernandez-Miranda is working with neurosurgeons in China to improve skull base surgery techniques.



Stanford neurosurgeons visit Uganda annually to collaborate with Ugandan surgeons and conduct research.



**GLOBAL NEUROSURGERY**  
It's important to us to share our knowledge and expertise in areas where neurosurgeons are few and where access to neurosurgical treatment is lacking. The current international distribution of neurosurgeons is entirely unbalanced, with the majority residing in North America and Europe. This means many people around the world still do not have access to even the most basic neurological therapies and surgeries. Our programs allow our medical students, nurses, residents, and surgeons to travel to different parts of the world several times each year, to provide clinical care, and to conduct research. Through our Stanford Global Health Neurosurgery Program, we are expanding our reach and providing care to patients in Uganda, China, Jamaica, and North Korea.



Stanford neurosurgery faculty, residents, medical students, and nurses all participate in our global neurosurgery program.

Stanford neurosurgeons remove a tumor alongside Ugandan neurosurgeons in an operating room in Kampala Hospital.





The John A. Blume Foundation Initiative for the Study of Parkinson's Disease, the Jene F. Blume Parkinson's Caregiver Program, and the John and Jene Blume-Robert and Ruth Halperin Professorship provides critical support to Stanford Neurosurgery that allows our scientists to pursue the most promising leads for helping individuals and their families, who suffer from this debilitating disease both here and around the world. The Foundation has supported these initiatives for over a decade and we are deeply grateful to our philanthropic partners who help us achieve our mission of eradicating this disease, which mean so much to so many.

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PHILANTHROPY PLAYS A CRITICAL ROLE IN ADVANCING CLINICAL RESEARCH. OUR TEAM OF PHYSICIAN-SCIENTISTS RELY HEAVILY ON THE GENEROSITY OF PATIENTS, FRIENDS AND FAMILY TO HELP SUPPORT AND ACCELERATE OUR RESEARCH WORK.

To learn more about ways you can get involved or directly support our research work, please visit <https://stan.md/gift>

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