



**CNS**

**2019 ANNUAL  
MEETING**



**SAN FRANCISCO  
CALIFORNIA  
OCTOBER 19-23, 2019**

**SCIENTIFIC  
PROGRAM**



# Faster procedures. Efficient workflows. Accurate registrations.

The 7D Surgical System lets you harness the full potential of image guidance with the first and only **Machine-vision Image Guided Surgery (MvIGS)** platform—using only visible light to acquire thousands of virtual fiducials for nearly instantaneous cranial registrations in any position.

---

Discover a new kind of vision for  
cranial navigation at booth 831.

---

[7Dsurgical.com](http://7Dsurgical.com)

The 7D Surgical System Cranial Module has FDA 510(k) clearance for cranial navigation.  
The Cranial Navigation Module is also approved in Canada and Australia.  
©2019 7D Surgical. All rights reserved. MK-00029

**7D**  
SURGICAL



# 2019 ANNUAL MEETING



**SAN FRANCISCO  
CALIFORNIA  
OCTOBER 19-23, 2019**



2019 International Partner Society  
Japanese Congress of Neurological Surgeons



**The purpose** of the 2019 Annual Meeting of the Congress of Neurological Surgeons is to provide continuing medical education for practicing neurosurgeons, neurosurgical residents in training, and postgraduate neurosurgical fellows, as well as advanced practice providers including nurses, physician assistants, and clinical specialists.

|     |                                                                                                                                                                                                                                                                                                                                                            |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3   | <b>Welcome Letter</b>                                                                                                                                                                                                                                                                                                                                      |
| 4   | <b>Honored Guest</b>                                                                                                                                                                                                                                                                                                                                       |
| 5   | <b>Featured Speakers</b>                                                                                                                                                                                                                                                                                                                                   |
| 10  | <b>Schedule of Events</b>                                                                                                                                                                                                                                                                                                                                  |
| 18  | <b>Abstract Award Winners</b>                                                                                                                                                                                                                                                                                                                              |
| 19  | <b>CNS Xperience Lounge</b>                                                                                                                                                                                                                                                                                                                                |
| 20  | <b>Industry Interaction Highlights</b>                                                                                                                                                                                                                                                                                                                     |
| 23  | <b>Subspecialty Session Guide</b>                                                                                                                                                                                                                                                                                                                          |
| 28  | <b>Saturday</b><br>Symposia, Resident Reception, International Reception, Dinner Seminar                                                                                                                                                                                                                                                                   |
| 31  | <b>Sunday</b><br>Symposia, Resident SANS Challenge Preliminary Rounds, General Scientific Session I, Opening Reception                                                                                                                                                                                                                                     |
| 35  | <b>Monday</b><br>Guidelines Sessions, Sunrise Science and Late-breaking Abstract Sessions, General Scientific Session II, Exhibit Hall, Luncheon Seminars, Section Sessions, Operative Techniques and Case-based Discussion Sessions, International Symposia, Dinner Seminars                                                                              |
| 47  | <b>Tuesday</b><br>Guidelines Sessions, Sunrise Science and Late-breaking Abstract Sessions, General Scientific Session III, Exhibit Hall, Luncheon Seminars, NEUROSURGERY® Publications: Meet the Editors, Section Sessions, Operative Techniques and Case-based Discussion Sessions, Interactive Multimedia Research Presentation Session, Dinner Seminar |
| 54  | <b>Wednesday</b><br>Guidelines Sessions, Sunrise Science and Late-breaking Abstract Sessions, General Scientific Session III, Exhibit Hall, Luncheon Seminars, Abstract Sessions, Advanced Endoscopic and Exoscopic Neurosurgery Seminar                                                                                                                   |
| 60  | <b>Oral Abstract Presentations</b>                                                                                                                                                                                                                                                                                                                         |
| 92  | <b>Poster Presentations</b>                                                                                                                                                                                                                                                                                                                                |
| 110 | <b>CME Information</b>                                                                                                                                                                                                                                                                                                                                     |
| 112 | <b>General Information</b>                                                                                                                                                                                                                                                                                                                                 |
| 115 | <b>Exhibitors</b>                                                                                                                                                                                                                                                                                                                                          |
| 118 | <b>Products &amp; Services</b>                                                                                                                                                                                                                                                                                                                             |
| 124 | <b>Floor Plans</b>                                                                                                                                                                                                                                                                                                                                         |

## The CNS is pleased to provide complimentary WiFi!

Moscone West Convention Center:  
Network: CNS19

San Francisco Marriott Marquis:  
Network: CNS19  
Password: sanfran19



# ROBOTIC PRECISION. POWERED BY YOU.

## Stealth Autoguide™ Cranial Robotic Guidance Platform

### STEALTH™ + ROBOTICS

Stealth Autoguide™ cranial robotic guidance platform is engineered to provide stereotactic positioning and trajectory guidance. Continuous real-time monitoring, feedback, and robotically assisted movement allows you to quickly and accurately align to your surgical plans for cranial procedures.

Seamlessly integrating with your StealthStation™ system and Midas Rex™ MR7 drill technology, the innovative Stealth Autoguide™ improves your workflow efficiency with a minimal footprint in your OR.



#### Visualase™

Stealth Autoguide™ aligns the bone anchor to a planned trajectory. A flexible Visualase™ laser catheter is passed through the bone anchor to the target area.



#### Depth Electrodes

Stealth Autoguide™ assists in the placement of sEEG bolts to enable the placement of depth electrodes. Allowing you to place multiple sEEG bolts quickly and efficiently.



#### Biopsy

Stealth Autoguide™ easily and precisely aligns to your surgical plan to place the biopsy needle. This solution enables accurate location of lesion with direct depth stop calculation and confirmation of biopsy location with biopsy needle navigation.

### Medtronic Neurosurgery Enabling Technologies

826 Coal Creek Circle  
Louisville, CO 80027 USA  
Toll free: (877) 242-9504  
Telephone: (720) 890-3200  
Fax: (720) 890-3500

[medtronic.com](http://medtronic.com)  
[medtronic.com/StealthAutoguide](http://medtronic.com/StealthAutoguide)  
[medtronic.com/StealthStation](http://medtronic.com/StealthStation)  
[medtronic.com/Oarm](http://medtronic.com/Oarm)

Stealth Autoguide™ - Pending 510(k) clearance.

Caution: Federal Law (USA) restricts these devices for sale by or on the order of a physician. Refer to product instruction manual/package insert for instructions, warnings, precautions and contraindications.

Healthcare professionals must review the product technical manual prior to use for detailed disclosure. For information on Indications, Safety, and Warnings, call Medtronic at (877) 242-9504, or visit Medtronic's website at [www.medtronicneurosurgery.com](http://www.medtronicneurosurgery.com).

UC202002044 EN 07.2019

© 2019 Medtronic. All rights reserved. Medtronic, Medtronic logo and Further, Together are trademarks of Medtronic. All other brands are trademarks of a Medtronic company.

# Medtronic



## WELCOME MEMBERS:

Thank you for joining us for the 2019 Congress of Neurological Surgeons Annual Meeting. This year's meeting is taking controversy head on. Think you know the right thing to do for a patient with a low-grade glioma? How about advising an athlete about Chronic Traumatic Encephalopathy? Is a randomized controlled trial the most ethical way to decide whether or not a treatment is effective? In keeping with this year's meeting theme, "The Age of Reason for Neurosurgery," you'll be presented with the latest evidence on either side of these issues to help you determine the best way to help your patients.

The Scientific Program Committee, led by Alexander Khalessi, Nader Pouratian, and Brian Nahed, has put together an outstanding program with exciting speakers and relevant content. We are featuring specialty-specific, all-day symposia on Saturday and Sunday at a lower price. We're also introducing three International Symposia featuring neurosurgeons from around the world and providing more opportunities to present original science. For the first time, we included an abstract category on operative technique in order to highlight novel surgical strategies for treating neurological disease across all disciplines.

In addition to top-line neurosurgical content, we have special speakers who will provide you with a unique perspective on a variety of topics. There are also many social events for you to enjoy.

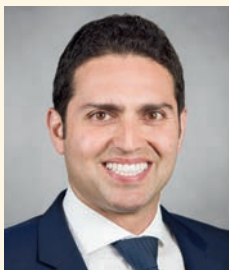
On behalf of the Congress of Neurological Surgeons' Executive Committee, the Scientific Program Committee, and the 2019 Honored Guest Raymond Sawaya, I welcome you to this year's CNS Annual Meeting in San Francisco, California.

Sincerely,

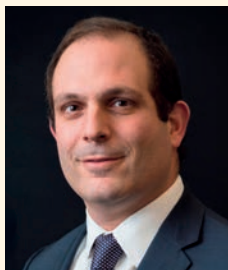
Ganesh Rao, MD  
CNS President



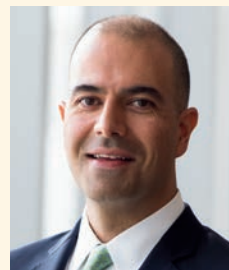
Ganesh Rao, MD  
CNS President



Alexander A.  
Khalessi, MD  
Annual Meeting Chair



Nader Pouratian,  
MD, PhD  
Scientific Program Chair



Brian V. Nahed, MD  
Vice-Scientific  
Program Chair



2019 ANNUAL MEETING



SAN FRANCISCO  
CALIFORNIA  
OCTOBER 19-23, 2019

## THE CNS WELCOMES YOU TO SAN FRANCISCO

The Moscone Center is in the trendy SoMa neighborhood of San Francisco. After coming into prominence as a high-tech hub in the 1990s, SoMa—short for South of Market—is one of the coolest neighborhoods in the city, packed with shops, museums, art galleries, and restaurants.



# HONORED GUEST

## Raymond Sawaya, MD

**Professor and Founding Chair of the Department of Neurosurgery, and the Anne C. Brooks & Anthony D. Bullock III Distinguished Chair in Neurosurgery at The University of Texas MD Anderson Cancer Center**



Raymond Sawaya, MD, was the founding chair of Neurosurgery at The University of Texas MD Anderson Cancer Center, as well as an advisor to the leaders of the Glioblastoma Multiforme (GBM) Moon Shot™. He also served as director of the Brain Tumor Center and is currently holder of the Anne C. Brooks & Anthony D. Bullock III Distinguished Chair in Neurosurgery. Dr. Sawaya was the chairman of the Department of Neurosurgery at Baylor College of Medicine from 2005 to 2015.

Dr. Sawaya earned his medical degree from St. Joseph University of Beirut, Lebanon, and completed a surgical internship at Beekman Downtown Hospital in New York City. Multiple residencies followed: in general surgery at Upstate Medical Center State University of New York, in pediatric neurosurgery at Children's Hospital Medical Center in Cincinnati, and in neurosurgery at the University of Cincinnati College of Medicine. In 1980, he accepted the position of chief resident in neurosurgery at Johns Hopkins Hospital and then held a fellowship at the National Institutes of Health (NIH) as a Fogarty International fellow. At NIH, he found his career focus: brain tumors and, in particular, glioblastomas. He was recruited back to the University of Cincinnati in 1982, where he spent eight years building that institution's brain tumor program.

Dr. Sawaya has influenced the field of neurosurgical oncology in several major ways. Ever since he was recruited in 1990 to establish a newly formed Department of Neurosurgery at MD Anderson, he has built the most comprehensive and best recognized neurosurgical oncology program in the country (Neurosurgery 56: 841-50, 2005). Dr. Sawaya was also residency program director at Baylor College of Medicine for several years during his term as chairman. He continues to contribute his expertise to one of the largest residency programs in the United States.

Dr. Sawaya is an internationally recognized leader in neurosurgery, with particular expertise in primary and metastatic brain tumors. His laboratory work helped identify molecular determinates of brain tumor invasiveness, and in particular, the role of serine proteases and their roles in glioma oncogenesis (over 60 publications). On the clinical side, he has helped identify brain metastases as a major threat to the well-being of cancer patients, and was the first to promote the treatment of patients with multiple brain metastases (J Neurosurg 79: 210-6, 1993; 368 citations). Dr. Sawaya is renowned for his great strides in enhancing the accessibility and safety of brain tumor surgery. This can best be demonstrated in his landmark paper on the importance of extent of resection on the survival of glioblastoma patients (J Neurosurg 95: 190-8, 2001; 1440 citations). He has also conducted the first prospective trial on the use of intraoperative MRI to maximize the extent of resection (Neurosurgery 64: 1073-81, 2009; 105 citations).

Dr. Sawaya has published more than 300 articles and book chapters and has served as both reviewer and editor for a number of peer-reviewed journals. He is the past president of the American Radium Society, the past president of the Houston Neurological Society and past chair of the American Association of Neurological Surgeons/Congress of Neurological Surgeons Section on Tumors. He is in demand as a lecturer across the nation and around the world and has received a number of awards in recognition of his expertise.

Dr. Sawaya is a "triple threat" who has excelled as a surgeon, researcher, and teacher and has been very successful as a leader and an advocate for the field. Dr. Sawaya considers his greatest achievement the building and maintaining of MD Anderson's comprehensive brain tumor program, which has allowed him to touch the lives of many patients.

### Look for Dr. Sawaya at the following sessions:

#### MONDAY, OCTOBER 21

##### General Scientific Session II

9:13–9:40 am

Honored Guest

Presentation: *Role of Resection for Glioblastoma: Can Technology Overcome Biology?*

##### M1

12:15–1:45 pm

Honored Guest Luncheon

Seminar: *Leadership Engagements*

*Advanced registration required.*

#### TUESDAY, OCTOBER 22

##### General Scientific Session III

8:51–9:13 am

Honored Guest

Presentation: *Evidence-based Medicine Through Development of Home-grown Databases*

#### WEDNESDAY, OCTOBER 23

##### General Scientific Session IV

8:50–9:12 am

Honored Guest

Presentation: *The Evolving Landscape and Management of Brain Metastases*

Meet Dr. Sawaya in the CNS Xperience Lounge inside the Exhibit Hall immediately following his General Scientific Session presentation.

# FEATURED SPEAKERS

## Lucy Kalanithi, MD

A Conversation with Lucy Kalanithi

SUNDAY, OCTOBER 20

General Scientific Session I

5:56–6:30 pm

 *Lucy Kalanithi will be signing copies of “When Breath Becomes Air” immediately following the conclusion of her lecture in the 3rd floor foyer of Moscone West Convention Center.*

Lucy Kalanithi, MD, is the widow of the late Dr. Paul Kalanithi, author of The New York Times #1 bestselling memoir “When Breath Becomes Air” for which she wrote the epilogue. An internal medicine physician and faculty member at the Stanford School of Medicine in Palo Alto, California, Dr. Kalanithi completed her medical degree at Yale, where she was inducted into the Alpha Omega Alpha national medical honor society, her residency at the University of California-San Francisco, and a postdoctoral fellowship training in healthcare delivery innovation at Stanford’s Clinical Excellence Research Center. At the cross-section of her career as a medical professional and her personal experience standing alongside her husband during his life, diagnosis, treatment, and death, Dr. Kalanithi has special interests in healthcare value, meaning in medicine, patient-centered care, and end-of-life care. She has appeared on “PBS NewsHour,” “NPR Morning Edition,” and “Yahoo News with Katie Couric,” and been interviewed for People, NPR, and The New York Times. She lives in the San Francisco Bay Area with her daughter, Elizabeth Acadia.



## CNS MICHAEL L. J. APUZZO LECTURER ON CREATIVITY AND INNOVATION

## Shankar Vedantam

Hidden Brain

MONDAY, OCTOBER 21

General Scientific Session II

8:48–9:13 am

 *Shankar Vedantam will be signing copies of his book, “The Hidden Brain” in the CNS Xperience Lounge during the morning beverage break.*

Shankar Vedantam is the host of NPR’s “Hidden Brain” podcast and radio show. His goal is to help people think about the world in new and interesting ways. He is endlessly fascinated by research in fields ranging from psychology and history to sociology and economics.

Before joining NPR in 2011, Vedantam spent 10 years as a reporter at The Washington Post. From 2007 to 2009, he was also a columnist, and wrote the “Department of Human Behavior” column for the Post.

Vedantam is the author of the non-fiction book, “The Hidden Brain: How Our Unconscious Minds Elect Presidents, Control Markets, Wage Wars and Save Our Lives.” The book, published in 2010, describes how unconscious biases influence people.

In 2009–2010, Vedantam served as a fellow at the Nieman Foundation for Journalism at Harvard University.

“Hidden Brain” is among the most popular podcasts in the world, with over two million downloads per week. The “Hidden Brain” radio show is featured on more than 250 public radio stations across the United States.

Vedantam and “Hidden Brain” have been recognized with the Edward R. Murrow Award, and honors from the American Association for the Advancement of Science, the Webby Awards, and others.

Vedantam has served as a part-time lecturer at Harvard University and Columbia University. He has also served as a senior scholar at the Woodrow Wilson International Center in Washington.





# FEATURED SPEAKERS

WALTER E. DANDY ORATOR

**Doris Kearns Goodwin**

**Leadership in Turbulent Times**

**MONDAY, OCTOBER 21**

General Scientific Session II

11:23 am–12:10 pm

 *Doris Kearns Goodwin will be signing copies of her book, “Leadership: In Turbulent Times,” in the CNS Xperience Lounge immediately following the conclusion of this session.*

Doris Kearns Goodwin is a world-renowned presidential historian, public speaker, and Pulitzer Prize-winning New York Times #1 best-selling author. Her career as a presidential historian and author was inspired when, as a 24-year-old graduate student at Harvard, she was selected to join the White House Fellows, one of America’s most prestigious programs for leadership and public service. Goodwin worked with Lyndon Johnson in the White House and later assisted him in the writing of his memoirs. She then wrote “Lyndon Johnson and the American Dream,” which became a national bestseller and achieved critical acclaim.

Goodwin was awarded the Pulitzer Prize for “No Ordinary Time: Franklin and Eleanor Roosevelt—The Home Front in World War II.” Her sixth book, “The Bully Pulpit: Theodore Roosevelt, William Howard Taft, and the Golden Age of Journalism,” won the Carnegie Medal and is being developed into a film.

Goodwin’s “Team of Rivals: The Political Genius of Abraham Lincoln” served as the basis for Steven Spielberg’s hit film “Lincoln,” and was awarded the prestigious Lincoln Prize, the inaugural Book Prize for American History, and the Lincoln Leadership Prize.

Goodwin is frequently seen in documentaries including Ken Burns’ “The History of Baseball” and “The Roosevelts: An Intimate History,” on news and cable networks, and shows including “Meet the Press” and “The Late Show with Stephen Colbert.”

Goodwin graduated magna cum laude from Colby College. She earned a doctorate degree in Government from Harvard University, where she taught Government, including a course on the American Presidency.

Among her many honors and awards, Goodwin was awarded the Charles Frankel Prize, the Sarah Josepha Hale Medal, the New England Book Award, as well as the Carl Sandburg Literary Award.

Goodwin lives in Concord, Massachusetts. She was the first woman to enter the Boston Red Sox locker room in 1979, and is a devoted fan of the World Series-winning team.



**Carl Zimmer**

**A Journey to the Center of the Brain**

**TUESDAY, OCTOBER 22**

General Scientific Session III

9:13 am–9:40 am

 *Carl Zimmer will be signing copies of his book, “She Has Her Mother’s Laugh: The Powers, Perversions, and Potential of Heredity,” in the CNS Xperience Lounge during the morning beverage break.*

Carl Zimmer is the author of 13 books about science. His newest book is “She Has Her Mother’s Laugh: The Power, Perversions, and Potential of Heredity.” His column, “Matter,” appears each week in The New York Times.

Zimmer’s writing has earned a number of awards, including the 2016 Stephen Jay Gould Prize, awarded by the Society for the Study of Evolution to recognize individuals whose sustained efforts have advanced public understanding of evolutionary science. In 2017, he won an Online Journalism Award for his series of articles in which he explored his genome. “She Has Her Mother’s Laugh” was named a Notable Book of the Year by The New York Times Book Review. It was also selected for Publisher’s Weekly Best 10 Books of 2018 and the 2018 shortlist for Baillie-Gifford Prize for Nonfiction. The Guardian named it the best science book of 2018.

Zimmer created the podcast “What Is Life?” and is a familiar voice on other programs such as Radiolab. A professor adjunct at Yale University, he lives in Connecticut with his wife Grace and their children, Charlotte and Veronica. He is, to his knowledge, the only writer after whom a species of tapeworm has been named. *For more information on Carl Zimmer please visit [www.prhspeakers.com](http://www.prhspeakers.com).*



## Bret Stephens

U.S. Foreign Policy and the World

TUESDAY, OCTOBER 22

General Scientific Session III

11:41 am–12:10 pm

 *Bret Stephens will be signing copies of his book, “America in Retreat,” in the CNS Xperience Lounge immediately following the conclusion of this session.*

Bret Stephens became an op-ed columnist and associate editor for The New York Times in April 2017. Before that, he spent 11 years as the author of “Global View,” the foreign-affairs column of the Wall Street Journal, for which he was awarded the Pulitzer Prize for distinguished commentary in 2013. He also served eight years as the Journal’s deputy editorial-page editor, responsible for the newspaper’s global opinion section, as well as a member of the editorial board.

Stephens began his career at The Wall Street Journal in 1998 as an editor in New York, and later wrote editorials and articles for the newspaper from Brussels. In January 2002, he was named editor-in-chief of The Jerusalem Post, a position he assumed at age 28. At the Post, he was responsible for the newspaper’s news, editorial, digital, and international editions, and also wrote a weekly column.

Stephens returned to the Journal in late 2004. He has reported stories from around the world, including Pakistan, Afghanistan, Iraq, Lebanon, Gaza, and interviewed dozens of world leaders. In June 2017 he became a regular political analyst for MSNBC.

Stephens has twice been chairman of Pulitzer Prize juries and is a national judge of the prestigious Livingston Awards. He holds two honorary doctorates. In 2014 he was awarded the Professional Achievement Prize by the University of Chicago, a distinction he shares with composer Philip Glass, astronomer Carl Sagan, and Nobel laureate Gary Becker.

In 2014 Penguin published his book “America in Retreat: The New Isolationism and the Coming Global Disorder.”

Stephens was born in New York and raised in Mexico City. He holds a BA with honors from the University of Chicago and an MSc from the London School of Economics. He lives with his wife Corinna, a classical music and opera critic for The New York Times, and their three children. The family divides its time between New York City and Hamburg, Germany.



## JOHN THOMPSON HISTORY OF MEDICINE LECTURE

### Rebecca Skloot

WEDNESDAY, OCTOBER 23

General Scientific Session IV

9:12–9:40 am

 *Rebecca Skloot will be signing copies of her book, “The Immortal Life of Henrietta Lacks,” in the CNS Xperience Lounge during the morning beverage break.*

Bestselling author Rebecca Skloot spent more than 10 years doggedly uncovering the truth about the life, death, and ultimate “immortality” of a poor Black tobacco farmer named Henrietta Lacks. Her phenomenal book, “The Immortal Life of Henrietta Lacks,” has sold nearly 3 million copies to date.

In “The Immortal Life,” Skloot tells the story of a young Black woman who died of cervical cancer in 1951—and left behind an inexplicably immortal line of cells known as HeLa. Henrietta’s cells—harvested without her knowledge or consent—contributed to scientific advancements as varied as the polio vaccine, treatments for cancers and viruses, in-vitro fertilization, and the impact of space travel on human cells.

Recognizable for its engaging, straightforward language, Skloot’s writing—both in “The Immortal Life” and her many feature articles for major publications—has charmed readers around the world. More than 250 communities, schools, and universities have chosen “The Immortal Life” for their common read programs.

“The Immortal Life” was selected as a best book of 2010 by over 60 media outlets. It spent more than four years on The New York Times bestseller list, was named one of Amazon’s 100 Books to Read in a Lifetime, and has been translated into more than 25 languages. Skloot was named One of Five Surprising Leaders of 2010 by The Washington Post. “The Immortal Life of Henrietta Lacks” was also made into an HBO film produced by Oprah Winfrey and Alan Ball.

Rebecca Skloot has a BS in biological sciences and an MFA in creative nonfiction. She has taught creative writing and science journalism at the University of Memphis, the University of Pittsburgh, and New York University. She is the founder and president of the Henrietta Lacks Foundation, which strives to provide financial assistance to needy individuals who have made important contributions to scientific research without their knowledge or consent. Skloot remains in close contact with the Lacks family.



# FEATURED SPEAKERS

## Aaron Carroll

Healthcare in the U.S.

WEDNESDAY, OCTOBER 23

General Scientific Session IV

11:31 am–12:10 pm

*Meet Aaron Carroll in the CNS Xperience Lounge immediately following the conclusion of this session.*

Aaron Carroll, MD, is a Professor of Pediatrics, Associate Dean for Research Mentoring, and the Director of the Center for Health Policy and Professionalism Research at the Indiana University School of Medicine. His research focuses on health care financing reform; the study of information technology to improve pediatric care; and areas of health policy including physician malpractice and the pharmaceutical industry/physician relationship. Dr. Carroll also serves as Regenstrief Institute's Vice President for Faculty Development where he leads Regenstrief's faculty development strategy and implementation efforts.

He was one of the first to study the use of mobile devices in actual care and has written numerous publications on the subject. Dr. Carroll has held millions of dollars in various government agency grants to explore the use of information technology in health care and is one of the leading pediatric informaticists in the U.S. He has also served in this capacity in committees for the American Academy of Pediatrics and is the co-founder of Medical Data Solutions, one of the first software companies to create programs for health professionals for mobile devices.

Dr. Carroll is the web and social media editor at JAMA Pediatrics, co-editor of The Incidental Economist and host of "Healthcare Triage," a YouTube channel that received the National Institute of Health Care Management Digital Media Award. He is a regular contributor to The New York Times' "The Upshot," as well as other media outlets, and he has appeared on "Good Morning America," the "CBS Evening News," "ABC News," and "The Colbert Report." Dr. Carroll's latest book, "Bad Food Bible," joins the three books he co-authored on medical myths.

Dr. Carroll earned a BA in chemistry from Amherst College, an MD from the University of Pennsylvania School of Medicine, and an MS in health services research from the University of Washington, where he was also a Robert Wood Johnson Clinical Scholar.



## The Congress of Neurological Surgeons Welcomes

## 2019 International Partner The Japanese Congress of Neurological Surgeons



**Yukihiro Sonoda**  
Japanese CNS President







Executive Committee, back right: Akash J. Patel, Clemens M. Schirmer, Ashok R. Asthagiri, Lola B. Chambless, Brian V. Nahed, Martina Stippler, Garni Barkhoudarian, Mohamad Bydon, Jennifer A. Sweet, and Daniel J. Hoh.

Front row: Regina Shupak, Nader Pouratian, Brian L. Hoh, Praveen V. Mummaneni, Steven N. Kalkanis, Ganesh Rao, Ashwini D. Sharan, Elad I. Levy, Alex A. Khalessi, Nicholas C. Bambakidis, and Maya A. Babu.



Congress of  
Neurological  
Surgeons

The CNS provides relevant learning experiences for today's practice challenges, with informative, world-class education. Discover more at [cns.org](http://cns.org).

## CNS Education Courses\*

Innovative live courses that move our specialty forward and foster collaboration and growth in our community.

 **CNS Tumor Complications**  
January 25–26, 2020 | Las Vegas, Nevada  
[cns.org/TCC](http://cns.org/TCC)

 **CNS Minimally Invasive Cranial Course**  
March 2020 | San Diego, California

 **CNS Spine Complications Course**  
February 7–9, 2020 | Park City, Utah  
[cns.org/SCC](http://cns.org/SCC)

 **CNS 2020 CNS Annual Meeting**  
September 12–16, 2020 | Miami, Florida  
"Vision for the Future"

 **CNS Oral Boards Review Course**  
February 22–23, 2020 | Houston, Texas

 **CNS Leadership Institute**  
May 2020 | Rosemont, Illinois

 **CNS SANS Written Boards Course**  
February 22–23, 2020 | Houston, Texas

 **CNS 2020 Skull Base Course**  
August 27–28 | 2020 Cleveland, OH

## Jointly Provided Courses

**Spine Summit 2020**  
March 5–8, 2020 | Las Vegas, Nevada  
[cns.org/spine](http://cns.org/spine)

**ASSFN Biennial Meeting**  
June 20–23, 2020 | Boston, Massachusetts  
[www.assfn.org/biennial.html](http://www.assfn.org/biennial.html)

**Pain Section 2020 Annual Meeting**  
March 5–7, 2020 | Las Vegas, Nevada  
[cns.org/pain](http://cns.org/pain)

**Tumor Section Satellite Symposium**  
September 11–12, 2020 | Miami, Florida

\* Schedule subject to change

# 2019 SCHEDULE OF EVENTS

All events will be held at Moscone West Convention Center unless otherwise indicated.

## Saturday, October 19

|                  |                                                                                                                                                                                     |                                                          |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| 7:00 am–6:00 pm  | CNS Oral Boards Review Course                                                                                                                                                       | Golden Gate C2-C3<br>San Francisco Marriott Marquis      |
| 7:00 am–4:30 pm  | Speaker Ready Room                                                                                                                                                                  | 3000                                                     |
| 7:00 am–4:30 pm  | Sergeant-at-Arms Office                                                                                                                                                             | 2022 Overlook                                            |
| 7:00 am–5:30 pm  | Registration and CNS Central                                                                                                                                                        | Level 1 Lobby                                            |
| 7:30–9:00 am     | CSNS/CNS Caucus                                                                                                                                                                     | Pacific I<br>San Francisco Marriott Marquis              |
| 8:00 am–4:15 pm  | SYM1: Spine Trauma and Spinal Cord Injury Symposium                                                                                                                                 | 3022                                                     |
| 8:00 am–4:15 pm  | SYM2: Functional Neurosurgery Update: Emerging Concepts                                                                                                                             | 2016                                                     |
| 8:00 am–4:15 pm  | SYM3: Maximizing Your Neurosurgical Employment Opportunities (Non-CME)                                                                                                              | 2011                                                     |
| 8:00 am–4:15 pm  | SYM4: Cerebrovascular Symposia: Stenting and Bypasses Bundle                                                                                                                        | 2001                                                     |
| 8:00 am–12:00 pm | SYM4A: New Era in Stenting                                                                                                                                                          |                                                          |
| 12:45–4:15 pm    | SYM4B: Bypass Techniques in Cerebrovascular Surgery                                                                                                                                 |                                                          |
| 8:00 am–4:15 pm  | SYM5: Advanced Topics in Spinal Operative Techniques Bundle                                                                                                                         | 2008                                                     |
| 8:00 am–12:00 pm | SYM5A: Advanced Minimally Invasive Spine Surgery—Operative Nuances, Indications, and Complication Avoidance                                                                         |                                                          |
| 12:45–4:15 pm    | SYM5B: Cervical Spine Case Management: When to Preserve Motion and When Not To—The Evidence in the Age of Reason                                                                    |                                                          |
| 8:00 am–4:15 pm  | SYM6: Brain Tumor Update Bundle                                                                                                                                                     | 2004                                                     |
| 8:00 am–12:00 pm | SYM6A: Brain Tumor Update: Advanced and Minimally Invasive Techniques for Resection of Malignant Brain Tumors (Breakout Session with NX Development from 10–10:30 am in Room 2006.) |                                                          |
| 12:45–4:15 pm    | SYM6B: Brain Tumor Update: Benign Brain Tumors                                                                                                                                      |                                                          |
| 8:00 am–12:00 pm | SYM7: Morbidity and Mortality                                                                                                                                                       | 2007                                                     |
| 9:15 am–12:00 pm | CSNS Plenary Session                                                                                                                                                                | Golden Gate B<br>San Francisco Marriott Marquis          |
| 12:00–1:00 pm    | CSNS Luncheon                                                                                                                                                                       | Golden Gate A<br>San Francisco Marriott Marquis          |
| 12:15–4:15 pm    | SYM8: Residency Program Update & Training the Trainers                                                                                                                              | 2007                                                     |
| 12:15–4:15 pm    | SYM9: Appropriate Coding, ICD, and CPT—2019 Update                                                                                                                                  | 2012                                                     |
| 1:00–3:00 pm     | CNS Education Committee Meeting                                                                                                                                                     | Yerba Buena Salons 1-2<br>San Francisco Marriott Marquis |
| 3:00–4:00 pm     | CNS Ad Hoc Committee on Wellness                                                                                                                                                    | Laurel<br>San Francisco Marriott Marquis                 |
| 3:00–4:00 pm     | CNS Nexus Committee Meeting                                                                                                                                                         | Yerba Buena Salons 1-2<br>San Francisco Marriott Marquis |
| 3:30–4:30 pm     | Joint Communications and Public Relations Meeting                                                                                                                                   | Pacific I<br>San Francisco Marriott Marquis              |
| 4:00–5:00 pm     | CNS Ad Hoc Data Science Committee Meeting                                                                                                                                           | Laurel<br>San Francisco Marriott Marquis                 |
| 4:00–5:00 pm     | CNS SANS Committee Meeting                                                                                                                                                          | Yerba Buena Salons 1-2<br>San Francisco Marriott Marquis |
| 4:15–5:45 pm     | CNS Resident Social and CSNS Young Neurosurgeons Reception                                                                                                                          | 2000                                                     |

|              |                                                                             |                                                                |
|--------------|-----------------------------------------------------------------------------|----------------------------------------------------------------|
| 4:30–5:30 pm | Neurosurgery PAC Board Meeting                                              | Pacific H<br>San Francisco Marriott Marquis                    |
| 5:30–7:00 pm | CNS International Reception                                                 | Yerba Buena Ballroom Salon 7<br>San Francisco Marriott Marquis |
| 6:30–8:30 pm | DIN1: How Do I Avoid Getting Penalized—ICD-10, CPTs, MACRA, ACOs, and APMs? | Boulevard<br>1 Mission Street, San Francisco                   |

### Sunday, October 20

|                  |                                                                                                                                                   |                                                            |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
| 7:00–8:30 am     | CNS Leadership Institute Meeting                                                                                                                  | Yerba Buena Salon 8<br>San Francisco Marriott Marquis      |
| 7:00–11:00 am    | CNS Oral Boards Review Course Spine Breakout                                                                                                      | Golden Gate C2<br>San Francisco Marriott Marquis           |
| 7:00–11:00 am    | CNS Oral Boards Review Course Core Topics Breakout                                                                                                | Golden Gate C1<br>San Francisco Marriott Marquis           |
| 7:00–11:00 am    | CNS Oral Boards Review Course Specialty Breakout                                                                                                  | Golden Gate C3<br>San Francisco Marriott Marquis           |
| 7:00 am–6:30 pm  | Speaker Ready Room                                                                                                                                | 3000                                                       |
| 7:00 am–4:30 pm  | Sergeant-at-Arms Office                                                                                                                           | 2022 Overlook                                              |
| 7:00 am–7:30 pm  | Registration and CNS Central                                                                                                                      | Level 1 Lobby                                              |
| 8:00 am–4:15 pm  | Association of Neurosurgical Physician Assistants (ANSPA) Fall 2019 CME Meeting Presented in Collaboration with Congress of Neurological Surgeons | 3014                                                       |
| 8:00 am–4:15 pm  | SYM10: Acute Stroke Care: Guidelines Review and Future Directions (Breakout Session with Penumbra from 2:00–2:30 pm in Room 3016.)                | 3018                                                       |
| 8:00 am–4:15 pm  | SYM11: Neurotrauma Update (Breakout Session with Natus Neurology from 9:00–9:30 am in Room 3024.)                                                 | 3022                                                       |
| 8:00 am–4:15 pm  | SYM12: A Comprehensive and Evidence-based Guidelines Review for the Treatment of Intracranial Aneurysms                                           | 2016                                                       |
| 8:00 am–4:15 pm  | SYM13: Spine Biomechanics and Deformity Symposium Bundle                                                                                          | 2011                                                       |
| 8:00 am–12:00 pm | SYM13A: Spinal Biomechanics for the Practicing Neurosurgeon: What I Need to Know for My Practice                                                  |                                                            |
| 12:45–4:15 pm    | SYM13B: Thoracolumbar Spinal Deformity for the Non-deformity Spine Surgeon                                                                        |                                                            |
| 8:00 am–4:15 pm  | SYM14: Advanced Functional Mapping and 3D Anatomy for the Neurosurgeon Bundle                                                                     | 2004                                                       |
| 8:00 am–12:00 pm | SYM14A: Surgical Management of Eloquent Area Tumors: Functional Mapping and/or Navigation                                                         |                                                            |
| 12:45–4:15 pm    | SYM14B: 3D Surgical Neuroanatomy                                                                                                                  |                                                            |
| 8:00 am–4:15 pm  | SYM15: Emerging Technologies in Neurosurgery Bundle                                                                                               | 2008                                                       |
| 8:00 am–12:00 pm | SYM15A: Intraoperative Technological Adjuncts: Indications and Techniques for Laser Therapy, Robotics, and Exoscopes                              |                                                            |
| 12:45–4:15 pm    | SYM15B: Virtual and Augmented Reality: Science and Clinical Applications                                                                          |                                                            |
| 8:00 am–4:15 pm  | SYM16: Pain and Peripheral Nerve Symposium Bundle                                                                                                 | 3003                                                       |
| 8:00 am–12:00 pm | SYM16A: Non-spinal Targets for Pain: Nerve, DRG, and Brain                                                                                        |                                                            |
| 12:45–4:15 pm    | SYM16B: Peripheral Nerve Surgery: Techniques and Exposure                                                                                         |                                                            |
| 8:00 am–4:15 pm  | SYM17: Quality Summit Bundle                                                                                                                      | 2014                                                       |
| 8:00 am–12:00 pm | SYM17A: QI: Implementation and Results                                                                                                            |                                                            |
| 12:45–4:15 pm    | SYM17B: Using Big Data to Help Neurosurgeons and Their Patients                                                                                   |                                                            |
| 8:00 am–12:00 pm | SYM18: Morbidity and Mortality                                                                                                                    | 2007                                                       |
| 8:30 am–12:00 pm | SNS Summit                                                                                                                                        | Yerba Buena Salons 11-12<br>San Francisco Marriott Marquis |

|                   |                                                                                                                              |                                                           |
|-------------------|------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| 9:00–10:00 am     | CNS Resident Committee Meeting                                                                                               | Yerba Buena Salons 3-4<br>San Francisco Marriott Marquis  |
| 9:00–10:00 am     | Joint Guidelines Committee Meeting                                                                                           | Yerba Buena Salons 1-2<br>San Francisco Marriott Marquis  |
| 10:00–10:30 am    | CNS Quarterly Editorial Board Meeting                                                                                        | Yerba Buena Salon 5<br>San Francisco Marriott Marquis     |
| 10:00–10:45 am    | ThinkFirst Executive Committee Meeting                                                                                       | Yerba Buena Salon 14-15<br>San Francisco Marriott Marquis |
| 10:30–11:30 am    | CNS Guidelines Committee Meeting                                                                                             | Yerba Buena Salons 1-2<br>San Francisco Marriott Marquis  |
| 10:45 am–12:15 pm | ThinkFirst Board of Directors Meeting                                                                                        | Yerba Buena Salon 14-15<br>San Francisco Marriott Marquis |
| 11:00 am–12:00 pm | Joint Section on Disorders of the Spine and Peripheral Nerve<br>Scientific Program Committee Meeting                         | Golden Gate B<br>San Francisco Marriott Marquis           |
| 11:00 am–1:00 pm  | Joint Section on Women in Neurosurgery Executive Committee<br>Meeting                                                        | Yerba Buena Salon 10<br>San Francisco Marriott Marquis    |
| 11:00 am–1:00 pm  | Neurosurgery Quality Council                                                                                                 | Yerba Buena Salon 6<br>San Francisco Marriott Marquis     |
| 11:30 am–1:00 pm  | Joint Section on Tumors Executive Committee Meeting                                                                          | Golden Gate A<br>San Francisco Marriott Marquis           |
| 12:30–2:00 pm     | ThinkFirst Reception                                                                                                         | Yerba Buena Salon 14-15<br>San Francisco Marriott Marquis |
| 12:30–3:00 pm     | Joint Section on Disorders of the Spine and Peripheral Nerve<br>Executive Committee Meeting                                  | Golden Gate B<br>San Francisco Marriott Marquis           |
| 12:30–4:30 pm     | American Society for Stereotactic and Functional Neurosurgery<br>Executive Committee Meeting                                 | Yerba Buena Salon 13<br>San Francisco Marriott Marquis    |
| 12:45–4:15 pm     | SYM19: My Worst Spinal Complication: Lessons Learned                                                                         | 2022                                                      |
| 12:45–4:15 pm     | SYM20: Modern Approaches to SRS                                                                                              | 2007                                                      |
| 1:00–3:00 pm      | Resident SANS Challenge Preliminary Round                                                                                    | 2018                                                      |
| 2:00–4:00 pm      | Joint Section on Cerebrovascular Surgery Executive<br>Committee Meeting                                                      | Golden Gate A<br>San Francisco Marriott Marquis           |
| 2:30–4:30 pm      | Joint Section on Pain Executive Committee Meeting                                                                            | Yerba Buena Salon 10<br>San Francisco Marriott Marquis    |
| 4:30–6:30 pm      | <b>GENERAL SCIENTIFIC SESSION I</b><br>Presiding Officer: Ganesh Rao<br>Moderators: Lola B. Chambless, Alexander A. Khalessi | Ballroom                                                  |
| 5:03–5:47 pm      | CONTROVERSY: Chronic Traumatic Encephalopathy                                                                                |                                                           |
| 5:59–6:30 pm      | FEATURED SPEAKER<br>A Conversation with Lucy Kalanithi<br>Lucy Kalanithi                                                     |                                                           |
| 6:30–8:30 pm      | Opening Reception                                                                                                            | Level 2 Lobby                                             |

### Monday, October 21

|                 |                                                                                   |                                                    |
|-----------------|-----------------------------------------------------------------------------------|----------------------------------------------------|
| 6:00–7:00 am    | Joint Drugs & Devices Committee Meeting                                           | Pacific J<br>San Francisco Marriott Marquis        |
| 6:30 am–6:30 pm | Speaker Ready Room                                                                | 3000                                               |
| 6:30 am–6:30 pm | Registration and CNS Central                                                      | Level 1 Lobby                                      |
| 8:00–10:30 am   | Spouse Hospitality                                                                | 2nd Floor Atrium<br>San Francisco Marriott Marquis |
| 7:00–8:30 am    | Sunrise Science and Late-breaking Abstract Session (Tumor)                        | 3014                                               |
| 7:00–8:30 am    | Sunrise Science and Late-breaking Abstract Session<br>(Cerebrovascular)           | 2014                                               |
| 7:00–8:30 am    | Guidelines for the Management of Metastatic Disease to the<br>Spine: The Evidence | 2016                                               |



|                   |                                                                                                                                                                                                                                            |                                                          |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| 7:00–8:30 am      | Guidelines for DBS for Parkinson's Disease and Neuroablation for Pain                                                                                                                                                                      | 3020                                                     |
| 7:00–8:30 am      | Neurotrauma Debates                                                                                                                                                                                                                        | 3022                                                     |
| 8:40 am–12:10 pm  | <b>GENERAL SCIENTIFIC SESSION II</b><br>Presiding Officer: Steven N. Kalkanis<br>Moderators: Nader Pouratian, Martina Stippler                                                                                                             | Ballroom                                                 |
| 8:51–9:13 am      | FEATURED SPEAKER<br>Hidden Brain<br>Shankar Vedantam                                                                                                                                                                                       |                                                          |
| 9:18–9:40 am      | HONORED GUEST PRESENTATION<br>Role of Resection for Glioblastoma: Can Technology Overcome Biology?<br>Raymond Sawaya                                                                                                                       |                                                          |
| 10:48–10:55 am    | JAPANESE CNS PRESIDENTIAL ADDRESS<br>Yukihiko Sonoda                                                                                                                                                                                       |                                                          |
| 10:55–11:00 am    | 2019 CNS RESIDENT AWARD PRESENTATION<br>Ambulation on POD#0 is Associated with Decreased Adverse Events After Elective Lumbar Spine Surgery: Analysis of the Michigan Spine Surgery Improvement Collaborative (MSSIC)<br>Hesham M. Zakaria |                                                          |
| 11:03–11:23 am    | PRESIDENTIAL ADDRESS<br>The Age of Reason for Neurosurgery<br>Ganesh Rao                                                                                                                                                                   |                                                          |
| 11:26 am–12:10 pm | WALTER E. DANDY ORATION<br>Leadership in Turbulent Times<br>Doris Kearns Goodwin                                                                                                                                                           |                                                          |
| 9:30 am–4:00 pm   | Exhibit Hall Open – Visit the CNS Xperience Lounge!                                                                                                                                                                                        | Exhibit Hall                                             |
| 9:40–10:40 am     | Morning Beverage Break – Visit the Exhibit Hall and enjoy a complimentary cup of coffee!                                                                                                                                                   | Exhibit Hall                                             |
| 10:00–10:30 am    | Live Tumor Surgery in 3D using Synaptive's Robotic Digital Microscope (Presented by Synaptive)                                                                                                                                             | CNS Xperience Lounge<br>Exhibit Hall                     |
| 10:30 am–2:30 pm  | Sergeant-at-Arms Office                                                                                                                                                                                                                    | 2022 Overlook                                            |
| 12:15–1:45 pm     | M1: Honored Guest Luncheon: Leadership Engagements                                                                                                                                                                                         | 2001                                                     |
| 12:15–1:45 pm     | M2: So You've Been Sued... Medical Practice 2019 Update                                                                                                                                                                                    | 2012                                                     |
| 12:15–1:45 pm     | M3: Is Intracerebral Hemorrhage a Surgical Disease?                                                                                                                                                                                        | 2003                                                     |
| 12:15–1:45 pm     | M4: Cervical Spondylotic Myelopathy—Anterior Versus Posterior                                                                                                                                                                              | 2005                                                     |
| 12:15–1:45 pm     | M5: Spinal Tumor Surgery: Case-based Management                                                                                                                                                                                            | 2007                                                     |
| 12:15–1:45 pm     | M6: Peripheral Nerve Entrapment Syndromes: Diagnosis and Management                                                                                                                                                                        | 2008                                                     |
| 12:15–1:45 pm     | M7: Neurocritical Care: A Multidisciplinary Collaboration                                                                                                                                                                                  | 2009                                                     |
| 12:15–1:45 pm     | M8: Pediatric Concussion                                                                                                                                                                                                                   | 2000                                                     |
| 12:15–1:45 pm     | M9: Acoustic Neuromas: Current Management Strategies                                                                                                                                                                                       | 2010                                                     |
| 12:15–1:45 pm     | M10: Harnessing the Immune System to Treat Brain Tumors                                                                                                                                                                                    | 2011                                                     |
| 12:15–1:45 pm     | Non-CME Sponsored Luncheon Session: Stealth Autoguide™ Robotic Navigation   Robotic Precision   Powered by You<br>Development and Clinical Experience by Dr. Stefan Wolfsberger                                                            | 2002                                                     |
| 12:15–1:45 pm     | Non-CME Sponsored Luncheon Session: See Addendum for details                                                                                                                                                                               | 2004                                                     |
| 12:15–1:45 pm     | Non-CME Sponsored Luncheon Session: See Addendum for details                                                                                                                                                                               | 2006                                                     |
| 12:15–1:45 pm     | Joint Section on Neurotrauma & Critical Care Executive Committee Meeting                                                                                                                                                                   | Yerba Buena Salons 5-6<br>San Francisco Marriott Marquis |
| 1:45–2:45 pm      | Afternoon Beverage Break – Visit the Exhibit Hall!                                                                                                                                                                                         | Exhibit Hall                                             |
| 1:45–2:45 pm      | Special Session: The FDA: Investigational Device Exemptions, Regulatory Process, and Moving Medical Devices to Patients (Non-CME)                                                                                                          | 3001                                                     |

|              |                                                                                                                                           |                                                       |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| 1:45–2:45 pm | Special Session: ABNS Case Log Course                                                                                                     | 3003                                                  |
| 2:45–4:15 pm | Council of State Neurosurgical Societies<br>Achieving High Quality                                                                        | 3016                                                  |
| 2:45–4:15 pm | Section on Cerebrovascular Surgery<br>Artificial Intelligence in Cerebrovascular Neurosurgery                                             | 2014                                                  |
| 2:45–4:15 pm | Section on Disorders of the Spine and Peripheral Nerves<br>Spine Section Update                                                           | 2016                                                  |
| 2:45–4:15 pm | Section on Neurotrauma and Critical Care                                                                                                  | 3022                                                  |
| 2:45–4:15 pm | Section on Pain<br>Complex Facial Pain: When to Use What                                                                                  | 3024                                                  |
| 2:45–4:15 pm | Section on Pediatric Neurological Surgery<br>Pediatric Brain Tumors: Advancements in Molecular Diagnosis<br>and Update on Clinical Trials | 3018                                                  |
| 2:45–4:15 pm | Section on Peripheral Nerves<br>Peripheral Nerve Task Force                                                                               | 2018                                                  |
| 2:45–4:15 pm | Section on Stereotactic and Functional Neurosurgery<br>The Future of Preoperative Functional Mapping                                      | 3020                                                  |
| 2:45–4:15 pm | Section on Tumors<br>Complications in Tumor Surgery: Navigating the Unexpected                                                            | 3014                                                  |
| 4:15–5:45 pm | Operative Techniques and Case-based Discussion Session<br>CSNS: How to Build a Spine Center                                               | 3016                                                  |
| 4:15–5:45 pm | Challenging Skull Based Tumors: Operative Techniques and<br>Case-based Discussions                                                        | 3014                                                  |
| 4:15–5:45 pm | Treating Cerebral Vascular Malformations: Operative Techniques<br>and Case-based Discussions                                              | 2014                                                  |
| 4:15–5:45 pm | Spinal Deformity and MIS Surgery: Operative Techniques and<br>Case-based Discussions                                                      | 2016                                                  |
| 4:15–5:45 pm | Challenging Cases in ICP Management: Operative Techniques<br>and Case-based Discussions                                                   | 3022                                                  |
| 4:15–5:45 pm | The Case Against Spinal Cord Stimulation: Operative Techniques<br>and Case-based Discussion                                               | 3024                                                  |
| 4:15–5:45 pm | Recurrent Disease in Pediatric Brain Tumors Patients: Case-<br>based Discussions and Operative Techniques                                 | 3018                                                  |
| 4:15–5:45 pm | Challenging Cases in Epilepsy Surgery: Operative Techniques<br>and Case-based Discussions                                                 | 3020                                                  |
| 4:15–5:45 pm | Peripheral Nerve: Operative Techniques and Case-based<br>Discussions                                                                      | 2018                                                  |
| 5:45–7:15 pm | The International Masters Symposium on Brain Tumor Surgery                                                                                | 3001                                                  |
| 5:45–7:15 pm | The International Cerebrovascular Symposium                                                                                               | 3003                                                  |
| 5:45–7:15 pm | The International Functional Neurosurgery Symposium                                                                                       | 3002                                                  |
| 6:30–8:15 pm | Joint Military Committee                                                                                                                  | Pacific I<br>San Francisco Marriott Marquis           |
| 6:30–7:30 pm | BNI Reception                                                                                                                             | Nob Hill D<br>San Francisco Marriott Marquis          |
| 6:30–7:30 pm | USC Neurosurgery Reception                                                                                                                | Yerba Buena Salon 4<br>San Francisco Marriott Marquis |
| 7:30–9:30 pm | DIN2: Multi-modality AVM Treatment in the Past, Present, and<br>Future                                                                    | Prospect<br>300 Spear Street, San Francisco           |
| 7:30–9:30 pm | DIN3: Navigation and Robotics: Fad or Future?                                                                                             | Morton's<br>400 Post Street, San Francisco            |

## Tuesday, October 22

|                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                    |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| 6:30 am–6:30 pm                   | Registration and CNS Central                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Level 1 Lobby                                      |
| 6:30 am–5:30 pm                   | Speaker Ready Room                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3000                                               |
| 7:00–8:30 am                      | Sunrise Science and Late-breaking Abstract Session (Spine)                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2016                                               |
| 7:00–8:30 am                      | Sunrise Science and Late-breaking Abstract Session (Socioeconomic)                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3016                                               |
| 7:00–8:30 am                      | Guidelines on Management on Brain Metastases Update                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 3014                                               |
| 7:00–8:30 am                      | The Voice of Reason in Brain Death: From Bedside to the News                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3022                                               |
| 8:00–10:30 am                     | Spouse Hospitality                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2nd Floor Atrium<br>San Francisco Marriott Marquis |
| San Francisco<br>Marriott Marquis | <b>GENERAL SCIENTIFIC SESSION III</b><br>Presiding Officer: Brian L. Hoh<br>Moderators: Ashok R. Asthagiri, Jennifer A. Sweet<br><b>HONORED GUEST PRESENTATION</b><br>Evidence-based Medicine Through Development of Home-grown Databases<br>Raymond Sawaya<br><b>FEATURED SPEAKER</b><br>A Journey to the Center of the Brain<br>Carl Zimmer<br>Controversy: Clinical Trials, Ethics, and Stem Cells: Are RCTs Necessary to Validate a Novel Therapy?<br><b>FEATURED SPEAKER</b><br>U.S. Foreign Policy and the World<br>Bret Stephens | Ballroom                                           |
| 9:30 am–3:00 pm                   | Exhibit Hall Open – Visit the CNS Xperience Lounge!                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Exhibit Hall                                       |
| 9:40–10:40 am                     | Morning Beverage Break – Visit the Exhibit Hall and enjoy a complimentary cup of coffee!                                                                                                                                                                                                                                                                                                                                                                                                                                                | Exhibit Hall                                       |
| 10:00–10:30 am                    | Live Surgery in the Exhibit Hall (Presented by Cerenovus)                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | CNS Xperience Lounge<br>Exhibit Hall               |
| 10:30 am–2:30 pm                  | Sergeant-at-Arms Office                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2022 Overlook                                      |
| 12:15–1:45 pm                     | T11: Perioperative Pain Management: Opioids, Non-opioids, and Neurosurgery Advocacy                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2001                                               |
| 12:15–1:45 pm                     | T12: Carotid Artery Disease: Symptomatic/Asymptomatic/Stent/CEA                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2003                                               |
| 12:15–1:45 pm                     | T13: Peak Performance: Optimizing the Spine Surgical Patient from Pre-op to Post-op                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2005                                               |
| 12:15–1:45 pm                     | T14: Controversies in Spinal Deformity Surgery                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2007                                               |
| 12:15–1:45 pm                     | T15: Is There an Outcome Worse than Death? Outcomes, Palliative Care, and Ethical Considerations in Neurosurgical Care                                                                                                                                                                                                                                                                                                                                                                                                                  | 2008                                               |
| 12:15–1:45 pm                     | T16: Patient Specific Goal-directed Therapy in TBI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2009                                               |
| 12:15–1:45 pm                     | T17: Clinical Trials in Movement Disorder Surgery                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2010                                               |
| 12:15–1:45 pm                     | T18: Management of Pituitary Adenomas and Parasellar Pathology                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2012                                               |
| 12:15–1:45 pm                     | T19: Malignant Gliomas: Advances in Surgery and Adjuvant Therapy                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2011                                               |
| 12:15–1:45 pm                     | T20: Beating Press Ganey                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 2000                                               |
| 12:15–1:45 pm                     | Non-CME Sponsored Luncheon Session: OLIF360SM Single-Position Surgery: OLIF and Posterior Fixation “Without the Flip”                                                                                                                                                                                                                                                                                                                                                                                                                   | 2002                                               |
| 12:15–1:45 pm                     | Non-CME Sponsored Luncheon Session: See Addendum for details                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2004                                               |
| 12:15–1:45 pm                     | Non-CME Sponsored Luncheon Session: Reversal of Specific Direct Oral Anticoagulants In Patients Experiencing Life-Threatening Bleeds: Review of Clinical Evidence and Practical Recommendations for Patient Management                                                                                                                                                                                                                                                                                                                  | 2006                                               |

|              |                                                                                                                                                                                                                                                |                                                             |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| 1:00–2:00 pm | NEUROSURGERY® Publications: Meet the Editors                                                                                                                                                                                                   | 3002                                                        |
| 1:45–2:45 pm | Afternoon Beverage Break – CNS Wellness Afternoon.<br>Enjoy a fresh fruit smoothie in the Xperience Lounge and listen to Voices of Neurosurgery stories. Also see presentations from our corporate partners at the Device Innovation Showcase. | Exhibit Hall                                                |
| 1:45–2:45 pm | Resident SANS Challenge Championship Round                                                                                                                                                                                                     | 2018                                                        |
| 2:00–2:45 pm | CNS Annual Business Meeting                                                                                                                                                                                                                    | 3001                                                        |
| 2:45–4:15 pm | Council of State Neurosurgical Societies<br>What is Value?                                                                                                                                                                                     | 3016                                                        |
| 2:45–4:15 pm | Section on Cerebrovascular Surgery<br>Future Training of the Cerebrovascular Surgeon                                                                                                                                                           | 2014                                                        |
| 2:45–4:15 pm | Section on Disorders of the Spine and Peripheral Nerves<br>Spine Update: The Evidence                                                                                                                                                          | 2016                                                        |
| 2:45–4:15 pm | Section on Neurotrauma and Critical Care<br>Neuromodulation for Spinal Cord Injury                                                                                                                                                             | 3022                                                        |
| 2:45–4:15 pm | Section on Pain<br>Targets Outside the Dorsal Columns for Pain                                                                                                                                                                                 | 3024                                                        |
| 2:45–4:15 pm | Section on Pediatric Neurological Surgery<br>Post-hemorrhagic Hydrocephalus in Premature Infants: Time for a Paradigm Shift?                                                                                                                   | 3018                                                        |
| 2:45–4:15 pm | Section on Stereotactic and Functional Neurosurgery<br>Stereotactic and Functional Neurosurgery Update                                                                                                                                         | 3020                                                        |
| 2:45–4:15 pm | Section on Tumors<br>Emerging Concepts in the Management of Brain Metastases                                                                                                                                                                   | 3014                                                        |
| 4:15–5:45 pm | Operative Techniques and Case-based Discussion Session<br>CSNS: Patient Safety in Neurosurgical Practice                                                                                                                                       | 3016                                                        |
| 4:15–5:45 pm | Challenging Intrinsic Brain Tumors: Operative Techniques and Case-based Discussions                                                                                                                                                            | 3014                                                        |
| 4:15–5:45 pm | Treating Cerebral Aneurysms: Operative Techniques and Case-based Discussions                                                                                                                                                                   | 2014                                                        |
| 4:15–5:45 pm | Cervical and Thoracolumbar Trauma: Operative Techniques and Case-based Discussions                                                                                                                                                             | 2016                                                        |
| 4:15–5:45 pm | Timing of Spinal Trauma Surgery: Operative Techniques and Case-based Discussions                                                                                                                                                               | 3022                                                        |
| 4:15–5:45 pm | Neurosurgery for Pain: Operative Techniques and Case-based Discussions                                                                                                                                                                         | 3024                                                        |
| 4:15–5:45 pm | Challenges in Recurrent Pediatric Epilepsy: Operative Techniques and Case-based Discussions                                                                                                                                                    | 3018                                                        |
| 5:45–7:15 pm | Interactive Multimedia Research Presentation Session                                                                                                                                                                                           | Level 2 Lobby                                               |
| 6:30–8:30 pm | Tumor Section Young Neurosurgeon's Reception                                                                                                                                                                                                   | Nob Hill AB<br>San Francisco Marriott Marquis               |
| 6:30–8:30 pm | Women in Neurosurgery Reception                                                                                                                                                                                                                | Foothill C<br>San Francisco Marriott Marquis                |
| 7:15–8:15 pm | Duke University Alumni Reception                                                                                                                                                                                                               | Yerba Buena Salon 1<br>San Francisco Marriott Marquis       |
| 7:15–8:15 pm | Brigham & Women's Hospital Alumni Reception                                                                                                                                                                                                    | Yerba Buena Salon 2<br>San Francisco Marriott Marquis       |
| 7:15–8:15 pm | Weill Cornell Medicine Alumni Reception                                                                                                                                                                                                        | Yerba Buena Salon 3<br>San Francisco Marriott Marquis       |
| 7:30–9:30 pm | DIN4: Advances in LITT                                                                                                                                                                                                                         | Harris' Steakhouse<br>2100 Van Ness Avenue<br>San Francisco |



### Wednesday, October 23

|                   |                                                                                                                           |                                                    |
|-------------------|---------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| 6:30 am–3:15 pm   | Registration and CNS Central                                                                                              | Level 1 Lobby                                      |
| 6:30 am–3:30 pm   | Speaker Ready Room                                                                                                        | 3000                                               |
| 7:00–8:30 am      | Sunrise Science and Late-breaking Abstract Session (Stereotactic and Functional)                                          | 3020                                               |
| 7:00–8:30 am      | Sunrise Science and Late-breaking Abstract Session (Pain)                                                                 | 3024                                               |
| 7:00–8:30 am      | Cerebrovascular Guidelines: Aneurysms, Arteriovenous Malformations, and Acute Ischemic Stroke                             | 2014                                               |
| 7:00–8:30 am      | Guidelines for Management of Glioblastoma                                                                                 | 3014                                               |
| 7:00–8:30 am      | Brain and Spine Trauma Guidelines—What You Need to Know                                                                   | 2016                                               |
| 8:00–10:30 am     | Spouse Hospitality                                                                                                        | 2nd Floor Atrium<br>San Francisco Marriott Marquis |
| 8:40 am–12:10 pm  | <b>GENERAL SCIENTIFIC SESSION IV</b><br>Presiding Officer: Elad I. Levy<br>Moderators: Maya A. Babu, Praveen V. Mummaneni | Ballroom                                           |
| 8:50–9:12 am      | HONORED GUEST PRESENTATION<br>The Evolving Landscape and Management of Brain Metastases<br>Raymond Sawaya                 |                                                    |
| 9:15–9:40 am      | JOHN THOMPSON HISTORY OF MEDICINE LECTURE<br>Rebecca Skloot                                                               |                                                    |
| 10:49–11:11 am    | Controversy: Low-grade Glioma Management                                                                                  |                                                    |
| 11:30 am–12:10 pm | FEATURED SPEAKER<br>Healthcare in the U.S.<br>Aaron Carroll                                                               |                                                    |
| 9:30 am–2:00 pm   | Exhibit Hall Open – Visit the CNS Xperience Lounge!                                                                       | Exhibit Hall                                       |
| 9:40–10:40 am     | Morning Beverage Break – Visit the Exhibit Hall and enjoy a complimentary cup of coffee!                                  | Exhibit Hall                                       |
| 10:00–10:30 am    | Live Surgery in the Exhibit Hall (see page 20 for details)                                                                | CNS Xperience Lounge<br>Exhibit Hall               |
| 10:30 am–2:30 pm  | Sergeant-at-Arms Office                                                                                                   | 2022 Overlook                                      |
| 12:15–1:45 pm     | W21: Middle Meningeal Artery Embolization for Subdural Hematoma Treatment                                                 | 2001                                               |
| 12:15–1:45 pm     | W22: Contemporary and Practical Management of an Enigmatic Process: Cerebral Vasospasm (Delayed Cerebral Ischemia)        | 2003                                               |
| 12:15–1:45 pm     | W23: Novel Techniques for Management of Lumbar Spondylolisthesis                                                          | 2010                                               |
| 12:15–1:45 pm     | W24: TBI in the Elderly                                                                                                   | 2011                                               |
| 12:15–1:45 pm     | W25: Neurosurgeon Entrepreneur                                                                                            | 2005                                               |
| 12:15–1:45 pm     | W26: Chiari Malformations                                                                                                 | 2012                                               |
| 12:15–1:45 pm     | W27: Clinical Trials in Epilepsy Surgery                                                                                  | 2007                                               |
| 12:15–1:45 pm     | W28: Update on Diagnosis and Management of Low Grade Gliomas                                                              | 2008                                               |
| 12:15–1:45 pm     | W29: Advanced Imaging in Brain Tumors                                                                                     | 2009                                               |
| 12:15–1:45 pm     | W30: Branding and Social Media in your Practice                                                                           | 2000                                               |
| 1:45–3:15 pm      | Cranial Abstract Session                                                                                                  | 3020                                               |
| 1:45–3:15 pm      | Spine Abstract Session                                                                                                    | 2016                                               |
| 1:45–3:15 pm      | Late-breaking Abstract Session                                                                                            | 3024                                               |
| 1:45–4:45 pm      | Advanced Endoscopic and Exoscopic Neurosurgery Seminar                                                                    | 2014                                               |

# CONGRATULATIONS TO THE 2019 CNS ABSTRACT AWARD RECIPIENTS!

Each year, merit-based abstract awards at the CNS Annual Meeting are granted to acknowledge the achievements of residents, fellows, and attending neurosurgeons in various categories.



**Hesham M. Zakaria**  
CNS Resident Award



**Clark C. Chen**  
Preuss Research Award



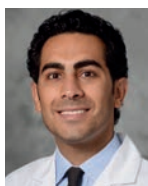
**Michael Honey**  
Ronald R. Tasker Young  
Investigator Award



**Bledi C. Brahimaj**  
Joint Tumor Section Skull  
Base Surgery Award



**Daniel A. Orringer**  
Rosenblum-Mahaley  
Clinical Research Award



**Karam P. Asmaro**  
Integra Foundation Award



**Ching-Jen Chen**  
Galbraith Award



**Matthew M. Grabowski**  
Journal of Neuro-Oncology  
Award



**Tej D. Azad**  
Julius Goodman Resident  
Award



**Matthew Shepard**  
Leksell Radiosurgery  
Award



**Hao Chen**  
BrainLab Neurosurgery  
Award



**Jack P. Rock**  
ThinkFirst Injury Prevention  
Research Award



**Bryan D. Choi**  
American Brain Tumor  
Association Young  
Investigator Award



**Connor Liu**  
Joint Tumor Section  
Neuro-Oncology Trainee  
Award



**Zachary A. Medress**  
Samuel Hassenbusch  
Young Neurosurgeon  
Award



**Conor Grady**  
Best Data Science Award



**Jignesh Tailor**  
Columbia Softball Pediatric  
Brain Tumor Award



**Courtney Pendleton**  
Sherry Apple Resident  
Travel Scholarship



**Iahn Cajigas**  
Stereotactic and  
Functional Neurosurgery  
Resident Award

## INTERNATIONAL ABSTRACT WINNERS

■ Best International Basic  
Science:  
**Museung Park**  
South Korea

■ Best International Clinical  
Research:  
**Naokado Ikeda**  
Japan

■ Best International Operative  
Technique:  
**Toshiki Endo**  
Japan

# IMMERSE YOURSELF IN THE CNS XPERIENCE LOUNGE



**RELAX** and connect with your colleagues. Grab a drink at the CNS Espresso Bar and see what's next on your agenda. Join us on designated afternoons for snacks, wine, and beer. On Tuesday, please attend our Wellness Afternoon, where we'll have a CNS sweatpants giveaway (limited quantity) as well as a bike blender to create your own smoothie.

**MEET** and interact with our Featured Speakers, and don't miss a chance to get their books signed. Also, experience live surgery via telemedicine technology, Educational Update Sessions, Innovator of the Year finalists, digital posters, NVIDIA: Artificial Intelligence for Neurosurgeons—a Hands-on Demo, and more!

**COME** pick up the latest copy of **NEUROSURGERY®** Publications, watch demos of the Surgeon's Armamentarium, listen to Neurosurgery Speaks! or chat with journal staff. Also, ask any membership questions you may have and get answers from the CNS team. We're here to help!

## MONDAY

**9:40 am**

**Book Signing:** Shankar Vedantam, "The Hidden Brain"

**Special Presentation:** Executive Presence and a Glimpse into the CNS Leadership Institute: Alan Scarrow  
Book signing immediately following

**Meet and Greet:** Honored Guest, Raymond Sawaya

**12:15 pm**

**Book Signing:** Doris Kearns Goodwin, "Leadership: In Turbulent Times"

**2:00 pm**

**Special Presentation:** Innovator of the Year Finalists

□ Harnessing AI and Smartphones to Develop the Next Generation of TBI Diagnostics  
Lynn McGrath

□ Microangiography for Endovascular Neurosurgery  
Peter Kan

□ Live Machine Learning Centered Architecture System to optimize Lumbar Stenosis Surgical Outcome  
Ghaith Habboub

## TUESDAY

**9:40 am**

**Book Signing:** Carl Zimmer, "She Has Her Mother's Laugh: The Powers, Perversions, and Potential of Heredity"

**Special Presentation:** NVIDIA: Artificial Intelligence for Neurosurgeons – A Hands-on Demo

**12:15 pm**

**Book Signing:** Bret Stephens, "America in Retreat"

**1:45 pm**

**CNS Wellness Afternoon:** Join us to receive CNS sweatpants (limited quantity), and take a ride on our smoothie blender bike.

**Special Presentation:** Voices of Neurosurgery: The Unforgettable Moments

**2:30 pm**

**Book Signing:** Gary Simonds, "The Thriving Physician: How to Avoid Burnout by Choosing Resilience Throughout Your Medical Career"

## WEDNESDAY

**9:40 am**

**Book Signing:** Rebecca Skloot, "The Immortal Life of Henrietta Lacks"

**9:40 am**

**Meet and Greet:** Gary Simonds

**12:15 pm**

**Meet and Greet:** Aaron Carroll

### HOURS:

|           |                 |
|-----------|-----------------|
| MONDAY    | 9:30 am–4:00 pm |
| TUESDAY   | 9:30 am–3:00 pm |
| WEDNESDAY | 9:30 am–2:00 pm |





# INDUSTRY INTERACTION HIGHLIGHTS

Come visit the CNS Exhibit Hall to discover cutting-edge technology to enhance your skills and your practice. Check out a variety of in-booth demonstrations with subspecialty experts and gain hands-on experience with the latest devices—all brought to you by more than 130 of our industry partners. For a complete list of exhibitors, see page 115.

## Join Us in the Exhibit Hall



### DAILY LIVE SURGERY PRESENTATIONS

Monday–Wednesday | 10:00–10:30 am

Join us in our Presentation Theater in the Xperience Lounge where surgeons from top institutions in the United States operate live via telemedicine, giving you the chance to observe and ask questions of the operating surgeon.

- Synaptive: Monday 10:00–10:30 am  
**Live Tumor Surgery in 3D** using Synaptive's Robotic Digital Microscope | Moderator: Dr. Brian Nahed  
 Surgeon: Dr. Costas Hadjipanayis from Mount Sinai
- Tuesday 10:00–10:30 am | See Addendum for details.
- Wednesday 10:00–10:30 am | See Addendum for details.

### DEVICE INNOVATION SHOWCASE



See the newest products, services and technologies from our corporate partners with these live demonstrations from our technology theater during the afternoon break on Tuesday.

- 7D Surgical

### IN-BOOTH DEMONSTRATIONS

- Synaptive Medical: Booth 318  
**Live Tumor Surgery in 3D** using Synaptive's Robotic Digital Microscope | Tuesday 9:50–10:20 am

### EXHIBIT HALL BEVERAGE BREAKS

Monday–Wednesday Morning Break: 9:40–10:40 am

Monday and Tuesday Afternoon Break: 1:45–2:45 pm

#### EXHIBIT HALL HOURS:

|           |                 |
|-----------|-----------------|
| MONDAY    | 9:30 am–4:00 pm |
| TUESDAY   | 9:30 am–3:00 pm |
| WEDNESDAY | 9:30 am–2:00 pm |

## Interact Outside of the Exhibit Hall

### INDUSTRY-SPONSORED LUNCH SYMPOSIA

(CME is NOT offered for these sessions)

Monday–Tuesday | 12:15–1:45 pm

Monday

- Medtronic: Stealth Autoguide™ Robotic Navigation | Robotic Precision | Powered by You Development and Clinical Experience by Dr. Stefan Wolfsberger | Room 2002
- Depuy Synthes: “The Art & Science of Cranial Reconstruction – Refinements & best practices learned from over 500 Cranioplasties at Johns Hopkins Multidisciplinary Adult Cranioplasty Center” | Room 2004
- Sponsored Lunch with Olympus | Room 2006

Tuesday

- Medtronic: OLIF360SM Single-Position Surgery: OLIF and Posterior Fixation “Without the Flip”  
 Faculty: Ernest Braxton, MD | Room 2002
- Sponsored Lunch with Cerenovus | Room 2004
- Portola: Reversal of Specific Direct Oral Anticoagulants In Patients Experiencing Life-Threatening Bleeds: Review of Clinical Evidence and Practical Recommendations for Patient Management  
 Faculty: Shakeel Chowdhry | Room 2006

### BREAKOUT SESSIONS DURING SYMPOSIA

During the full-day symposia on Saturday and Sunday, gain hands-on experience, training, and see demonstrations of the most advanced equipment and techniques during these 30-minute, non-CME breakout sessions. These will be held in individual rooms upstairs.



### HANDS-ON CADAVER SESSION

New this year! These educational surgical cadaver suites located in the convention center give you the opportunity to gain hands-on experience with the latest and greatest neurosurgical technology. This is brought to you by our industry sponsors.

- **Medtronic:** Monday and Tuesday all day
- **Xoran Technologies:** Tuesday | 10:30 am–12:30 pm

Please reach out to companies directly to attend.





CNS

# Thank You

The Congress of Neurological Surgeons gratefully acknowledges our Industry Allies Council Partners for their continued support.

## AMBASSADOR

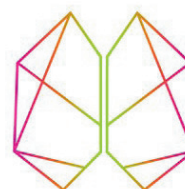
**Medtronic**

**stryker®**



**DePuy Synthes**

COMPANIES OF *Johnson & Johnson*



**CERENOVUS**

PART OF THE *Johnson & Johnson* FAMILY OF COMPANIES

## PREMIER PARTNER

**OLYMPUS®**

Your Vision, Our Future

**Synaptive**

## INDUSTRY ALLIES COUNCIL



**Penumbra**



## SUPPORTER

**70**  
SURGICAL

**AESCULAP**

**arbor**  
PHARMACEUTICALS, LLC

**Codman®**  
SPECIALTY SURGICAL

**MISONIX**  
BETTER MATTERS™

**natus.**  
neuro

**ORTHOFIX®**

**NXDC**  
NX Development Corp.

**PORTOLA®**  
PHARMACEUTICALS

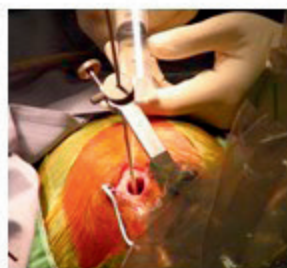
**ZIMMER BIOMET**



## Crossed-arms Neurosurgery

With the NaoTrac autopilot robot

**Make your decision, NaoTrac gives you a hand for precision.**



The unique autonomous procedure allows you to focus on surgical planning and let NaoTrac be your new assistant. NaoTrac Robot merges high-tech and your experience of to improve accuracy and outcome by streamlining surgical procedures and improving the learning curve equipped with AI, Machine Vision, and Robotic-Assisted Surgery.

Fast and precise navigation with non-contact registration, pre-operative image fusion planning, assists in choosing the surgery pathway with 3D vision for precise anatomical location.

- AUTOPILOT robot-assisted neurosurgery
- AUTOMATIC Surface Matching Facial Recognition & 3D Position Tracking
- INTELLIGENT instrument registration technology

**Join the evolution of neurosurgery at booth #127, Oct 21 & 22, 2019**

10:00 AM - Human Pilot study of NaoTrac

02:00 PM - Crossed-arm neurosurgery workshop

Share your first impression, idea, and become our partner!

# SUBSPECIALTY SESSION HIGHLIGHTS

## SP SPINE

### SATURDAY

8:00 am–4:15 pm

- **SYM1: Spine Trauma and Spinal Cord Injury Symposium**

8:00 am–4:15 pm

- **SYM5: Advanced Topics in Spinal Operative Techniques**

### SUNDAY

8:00 am–4:15 pm

- **SYM13: Spine Biomechanics and Deformity Symposium**

12:45–4:15 pm

- **SYM19: My Worst Spinal Complication: Lessons Learned**

### MONDAY

7:00–8:30 am

- **Guidelines for the Management of Metastatic Disease to the Spine: The Evidence**

7:00–8:30 am

- **Neurotrauma Debates**

12:15–1:45 pm

- **M4: Cervical Spondylotic Myelopathy—Anterior Versus Posterior**

12:15–1:45 pm

- **M5: Spinal Tumor Surgery: Case-based Management**

2:45–4:15 pm

- **Section on Disorders of the Spine and Peripheral Nerve: Spine Section Update**

4:15–5:45 pm

- **Spinal Deformity and MIS Surgery: Operative Techniques and Case-based Discussions**

7:30–9:30 pm

- **DIN3: Navigation and Robotics: Fad or Future?**

### TUESDAY

7:00–8:00 am

- **Sunrise Science and Late Breaking Abstract Session**

12:15–1:45 pm

- **T13: Peak Performance: Optimizing the Spine Surgical Patient from Pre-op to Post-op**

12:15–1:45 pm

- **T14: Controversies in Spinal Deformity Surgery**

1:45–2:45 pm

- **The FDA: Investigational Device Exemptions, Regulatory Process, and Moving Medical Devices to Patients (Non-CME)**

2:45–4:15 pm

- **Section on DSPN—Spine Update: The Evidence**

4:15–5:45 pm

- **Cervical and Thoracolumbar Trauma: Operative Techniques and Case-based Discussions**

5:45–7:15 pm

- **Interactive Multimedia Research Presentation Session**

### WEDNESDAY

7:00–8:30 am

- **Brain and Spine Trauma Guidelines—What You Need to Know**

12:15–1:45 pm

- **W23: Novel Techniques for Management of Lumbar Spondylolisthesis**

1:45–3:15 pm

- **Spine Oral Abstract Presentation Session**

1:45–4:45 pm

- **Advanced Endoscopic and Exoscopic Neurosurgery Seminar**

## CV CEREBROVASCULAR

### SATURDAY

8:00 am–4:15 pm

- **SYM4: Cerebrovascular Symposia: Stenting and Bypass**

### SUNDAY

8:00 am–4:15 pm

- **SYM10: Acute Stroke Care: Guidelines Review and Future Directions**

8:00 am–4:15 pm

- **SYM12: Advanced Techniques in Assessment and Treatment of Intracranial Aneurysms**

### MONDAY

7:00–8:30 am

- **Sunrise Science and Late Breaking Abstract Session**

12:15–1:45 pm

- **M3: Is Intracerebral Hemorrhage a Surgical Disease?**

2:45–4:15 pm

- **Section on Cerebrovascular Surgery—Artificial Intelligence in Cerebrovascular Neurosurgery**

4:15–5:45 pm

- **Treating Cerebral Vascular Malformations: Operative Techniques and Case-based Discussions**

5:45–7:15 pm

- **The International Cerebrovascular Symposium**

7:30–9:30 pm

- **DIN2: Multi-modality AVM Treatment in the Past, Present, and Future**

### TUESDAY

12:15–1:45 pm

- **T12: Carotid Artery Disease: Symptomatic/Asymptomatic/Stent/CEA**

1:45–2:45 pm

- **The FDA: Investigational Device Exemptions, Regulatory Process, and Moving Medical Devices to Patients (Non-CME)**

2:45–4:15 pm

- **Section on Cerebrovascular Surgery: Future Training of the Cerebrovascular Surgeon**

4:15–5:45 pm

- **Treating Cerebral Aneurysms: Operative Techniques and Case-based Discussion**

5:45–7:15 pm

- **Interactive Multimedia Research Presentation Session**

### WEDNESDAY

7:00–8:30 am

- **Cerebrovascular Guidelines: Aneurysms, Arteriovenous Malformations, and Acute Ischemic Stroke**

12:15–1:45 pm

- **W21: Middle Meningeal Artery Embolization for Subdural Hematoma Treatment**

12:15–1:45 pm

- **W22: Contemporary and Practical Management of and Enigmatic Process: Cerebral Vasospasm (Delayed Cerebral Ischemia)**

1:45–3:15 pm

- **Cranial Oral Abstract Presentation Session**

1:45–4:45 pm

- **Advanced Endoscopic and Exoscopic Neurosurgery Seminar**



# SUBSPECIALTY SESSION HIGHLIGHTS

## (SF) STEREOTACTIC AND FUNCTIONAL

### SATURDAY

8:00 am–4:15 pm

- **SYM2: Functional Neurosurgery Update: Emerging Concepts**

### SUNDAY

8:00 am–4:15 pm

- **SYM15: Emerging Technologies in Neurosurgery**

### MONDAY

7:00–8:30 am

- **Guidelines for DBS for Parkinson's Disease and Neuroablation for Pain**

4:15–5:45 pm

- **Section on Stereotactic and Functional Neurosurgery: The Future of Preoperative Functional Mapping**

4:15–5:45 pm

- **Challenging Cases in Epilepsy Surgery: Operative Techniques and Case-based Discussions**

5:45–7:15 pm

- **The International Functional Neurosurgery Symposium**

### TUESDAY

12:15–1:45 pm

- **T17: Clinical Trials in Movement Disorder Surgery**

1:45–2:45 pm

- **The FDA: Investigational Device Exemptions, Regulatory Process, and Moving Medical Devices to Patients (Non-CME)**

2:45–4:15 pm

- **Section on Stereotactic and Functional Neurosurgery Stereotactic and Functional Neurosurgery Update**

5:45–7:15 pm

- **Interactive Multimedia Research Presentation Session**

7:30–9:30 pm

- **DIN4: Advances in LITT**

### WEDNESDAY

7:00–8:30 am

- **Sunrise Science and Late Breaking Abstract Session**

12:15–1:45 pm

- **W27: Clinical Trials in Epilepsy Surgery**

1:45–3:15 pm

- **Cranial Oral Abstract Presentation Session**

## (RE) RESIDENT

### SATURDAY

8:00 am–4:15 pm

- **SYM3: Maximizing Your Neurosurgical Employment Opportunities**

### SUNDAY

8:00 am–4:15 pm

- **SYM17: Quality Summit Bundle**

### MONDAY

7:00–8:30 am

- **Guidelines for the Management of Metastatic Disease to the Spine: The Evidence**

7:00–8:30 am

- **Guidelines for DBS and for Parkinson's Disease**

7:00–8:30 am

- **Neurotrauma Debates**

12:15–1:45 pm

- **M1: Honored Guest Luncheon**

1:45–2:45 pm

- **ABNS Candidate Case Log: POST (Non-CME)**

5:45–7:15 pm

- **All International Symposia**

### TUESDAY

7:00–8:30 am

- **Guidelines on Management on Brain Metastases Update**

7:00–8:30 am

- **The Voice of Reason in Brain Death: From Bedside to the News**

5:45–7:15 pm

- **Interactive Multimedia Research Presentation Session**

### WEDNESDAY

7:00–8:30 am

- **Cerebrovascular Guidelines: Aneurysms, Arteriovenous Malformations, and Acute Ischemic Stroke**

7:00–8:30 am

- **Guidelines for Management of Glioblastoma**

7:00–8:30 am

- **Brain and Spine Trauma Guidelines - What you Need to Know**

## (SE) SOCIOECONOMIC

### SATURDAY

12:45–4:15 pm

- **SYM9: Appropriate Coding, ICD, and CPT 2019 Update**

6:30–8:30 pm

- **DIN1: How Do I Avoid Getting Penalized—ICD-10, CPTs, MACRA, ACOs, and APMs?**

### MONDAY

12:15–1:45 pm

- **M2: So You've Been Sued... Medical Practice 2019 Update**

2:45–4:15 pm

- **Council of State Neurosurgical Societies: Achieving High Quality**

4:15–5:45 pm

- **CSNS: How to Build a Spine Center**

5:45–7:15 pm

- **All International Symposia**

### TUESDAY

2:45–4:15 pm

- **Council of State Neurosurgical Societies—What is Value**

4:15–5:45 pm

- **CSNS: Patient Safety in Neurosurgical Practice**

5:45–7:15 pm

- **Interactive Multimedia Research Presentation Session**

### WEDNESDAY

7:00–8:30 am

- **Sunrise Science and Late Breaking Abstract Session**

12:15–1:45 pm

- **W25: Neurosurgeon Entrepreneur**

- **W30: Branding and Social Media in your Practice**



**SATURDAY**

8:00 am–4:15 pm

- **SYM6: Brain Tumor Update**

**SUNDAY**

8:00 am–4:15 pm

- **SYM14: Advanced Functional Mapping and 3D Anatomy for the Neurosurgeon**

8:00 am–4:15 pm

- **SYM15: Emerging Technologies in Neurosurgery**

12:45–4:15 pm

- **SYM20: Modern Approaches to SRS**

**MONDAY**

7:00–8:30 am

- **Sunrise Science and Late Breaking Abstract Session**

12:15–1:45 pm

- **M5: Spinal Tumor Surgery: Case-based Management**

12:15–1:45 pm

- **M9: Acoustic Neuromas: Current Management Strategies**

12:15–1:45 pm

- **M10: Harness the Immune System to Treat Brain Tumors**

2:45–4:15 pm

- **Section on Tumors—Complications in Tumor Surgery: Navigating the Unexpected**

4:15–5:45 pm

- **Challenging Skull Base Tumors: Operative Techniques and Case-based Discussions**

5:45–7:15 pm

- **The International Masters Symposium on Brain Tumor Surgery**

**TUESDAY**

7:00–8:30 am

- **Guidelines on Management on Brain Metastases Update**

12:15–1:45 pm

- **T18: Management of Pituitary Adenomas and Parasellar Pathology**

12:15–1:45 pm

- **T19: Malignant Gliomas: Advances in Surgery and Adjuvant Therapy**

2:45–4:15 pm

- **Section on Tumors—Emerging Concepts in the Management of Brain Metastases**

4:15–5:45 pm

- **Challenging Intrinsic Brain Tumors: Operative Techniques and Case-based Discussions**

7:30–9:30 pm

- **DIN4: Advances in LITT**

5:45–7:15 pm

- **Interactive Multimedia Research Presentation Session**

**WEDNESDAY**

7:00–8:30 am

- **Guidelines for Management of Glioblastoma**

12:15–1:45 pm

- **W28: Update on Diagnosis and Management of Low-grade Gliomas**

12:15–1:45 pm

- **W29: Advanced Imaging in Brain Tumors**

1:45–3:15 pm

- **Cranial Oral Abstract Presentation Session**

1:45–4:45 pm

- **Advanced Endoscopic and Exoscopic Neurosurgery Seminar**

**SATURDAY**

8:00 am–4:15 pm

- **SYM1: Spine Trauma and Spinal Cord Injury Symposium**

**SUNDAY**

8:00 am–4:15 pm

- **ANSPA Fall 2019 CME Meeting in Collaboration with Congress of Neurological Surgeons**

- **SYM17: Quality Summit Bundle**

**MONDAY**

5:45–7:15 pm

- **All International Symposia**

**TUESDAY**

5:45–7:15 pm

- **Interactive Multimedia Research Presentation Session**

**TR NEUROTRAUMA**

**SUNDAY**

8:00 am–4:15 pm

- **SYM11: Neurotrauma Update**

**MONDAY**

7:00–8:30 am

- **Neurotrauma Debates**

12:15–1:45 pm

- **M6: Peripheral Nerve Entrapment Syndromes: Diagnosis and Management**

2:45–4:15 pm

- **Section on Neurotrauma and Critical Care Session**

4:15–5:45 pm

- **Challenging Cases in ICP Management: Operative Techniques and Case-based Discussions**

**TUESDAY**

7:00–8:30 am

- **The Voice of Reason in Brain Death: From Bedside to the News**

12:15–1:45 pm

- **T15: Is There an Outcome Worse than Death: Outcome, Palliative Care, and Ethical Considerations in Neurosurgical Care**

12:15–1:45 pm

- **T16: Patient Specific Goal-directed Therapy in TBI**

2:45–4:15 pm

- **Section on Neurotrauma and Critical Care Session—Neuromodulation for Spinal Cord Injury**

4:15–5:45 pm

- **Timing of Spinal Trauma Surgery: Operative Techniques and Case-based Discussions**

5:45–7:15 pm

- **Interactive Multimedia Research Presentation Session**

**WEDNESDAY**

7:00–8:30 am

- **Brain and Spine Trauma Guidelines—What You Need to Know**

12:15–1:45 pm

- **W24: TBI in the Elderly**

1:45–3:15 pm

- **Oral Abstract Presentation Session**

1:45–4:45 pm

- **Advanced Endoscopic and Exoscopic Neurosurgery Seminar**

# SUBSPECIALTY SESSION HIGHLIGHTS

## PA PAIN

### SUNDAY

8:00 am–4:15 pm

- **SYM16: Pain and Peripheral Nerve Symposium**

### MONDAY

2:45–4:15 pm

- **Section on Pain Session—When to Use What**
- 4:15–5:45 pm
- **The Case Against Spinal Cord Stimulation: Operative Techniques and Case-based Discussion**
- 5:45–7:15 pm
- **The International Functional Neurosurgery Symposium**

### TUESDAY

12:15–1:45 pm

- **T11: Perioperative Pain Management: Opioids, Non-opioids, and Neurosurgery Advocacy**
- 2:45–4:15 pm
- **Section on Pain Session—Targets Outside the Dorsal Columns for Pain**
- 4:15–5:45 pm
- **Neurosurgery for Pain: Operative Techniques and Case-based Discussions**
- 5:45–7:15 pm
- **Interactive Multimedia Research Presentation Session**

### WEDNESDAY

7:00–8:30 am

- **Sunrise Science and Late Breaking Abstract Session**

## PE PEDIATRIC

### SUNDAY

8:00 am–4:15 pm

- **SYM15: Emerging Technologies in Neurosurgery**

### MONDAY

12:15–1:45 pm

- **M8: Pediatric Concussion**
- 2:45–4:15 pm
- **Section on Pediatric Neurological Surgery— Pediatric Brain Tumors: Advancements in Molecular Diagnosis and Updated on Clinical Trials**
- 4:15–5:45 pm
- **Recurrent Disease in Pediatric Brain Tumors Patients: Case-based Discussions and Operative Techniques**

### TUESDAY

7:00–8:00 am

- **Sunrise Science and Late Breaking Abstract Session**
- 2:45–4:15 pm
- **Post-hemorrhagic Hydrocephalus in Premature Infants: Time for a Paradigm Shift?**
- 4:15–5:45 pm
- **Challenges in Recurrent Pediatric Epilepsy: Operative Techniques and Case-based Discussions**
- 5:45–7:15 pm
- **Interactive Multimedia Research Presentation Session**

### WEDNESDAY

12:15–1:45 pm

- **W26: Chiari Malformations**

## Visit the New CNS Pop-up Shop!

We'll feature the latest trends in CNS swag—including t-shirts, jackets, umbrellas, and accessories.





**SUNDAY**

8:00 am–4:15 pm

- **SYM16: Pain and Peripheral Nerve Symposium**

**MONDAY**

12:15–1:45 pm

- **M6: Peripheral Nerve Entrapment Syndromes: Diagnosis and Management**

2:45–4:15 pm

- **Section on Peripheral Nerve—Peripheral Nerve Task Force**

4:15–5:45 pm

- **Peripheral Nerve: Operative Techniques and Case-based Discussions**

**TUESDAY**

5:45–7:15 pm

- **Interactive Multimedia Research Presentation Session**

**SATURDAY**

12:45–4:15 pm

- **SYM8: Training the Trainers**

**SUNDAY**

8:00 am–4:15 pm

- **SYM17: Quality Summit Bundle**

**MONDAY**

5:45–7:15 pm

- **All International Symposia**

**TUESDAY**

12:15–1:45 pm

- **T20: Beating Press Ganey**

5:45–7:15 pm

- **Interactive Multimedia Research Presentation Session**

**WEDNESDAY**

12:15–1:45 pm

- **W30: Branding and Social Media in your Practice**



**SUBSPECIALTY SESSION HIGHLIGHTS KEY**

**AP** ADVANCED PRACTICE PROVIDER

**CV** CEREBROVASCULAR

**TR** NEUROTRAUMA

**PA** PAIN

**PE** PEDIATRIC

**PN** PERIPHERAL NERVES

**RE** RESIDENT

**SE** SOCIOECONOMIC

**SP** SPINE

**SF** STEREOTACTIC AND FUNCTIONAL

**TU** TUMOR

**WINS** WINS

SATURDAY, OCTOBER 19

## SYMPOSIUM

## Full Day and Discounted Bundles (includes lunch):

Physician \$400, Nurse/NP/PA \$300, Resident/Fellow/Graduate Student/Post-doctoral Scholar/Medical Student \$175

Half Day: (Does not include lunch) Physician \$250, Nurse/NP/PA \$200, Resident/Fellow/Graduate Student/Post-doctoral Scholar/Medical Student \$125

(SP) (TR) 8:00 am–4:15 pm Room: 3022

**SYM1: Spine Trauma and Spinal Cord Injury Symposium**

CNS

SANS

Lifelong Learning

**Course Directors:** Sanjay S. Dhall, Michael G. Fehlings, James S. Harrop, Eve C. Tsai**Faculty:** Paul M. Arnold, Mohamad Bydon, D. Kojo Hamilton, Gregory W.J. Hawryluk, Zachary L. Hickman, Daniel J. Hoh, Paul K. Kim, Allan D. Levi, Daniel C. Lu, David O. Okonkwo, Kristine O'Phelan, Ann M. Parr, Patrick R. Pritchard, Richard B. Rodgers, Martina Stippler, Jefferson R. Wilson**Agenda Highlights**

- Research updates in spinal cord injury
- Top 3 management considerations for acute spinal cord injury and unstable fractures
- Rehabilitation and neuromodulation after spinal cord injury
- Spinal cord injury case management face offs
- Case-based discussion of central cord injury, geriatric odontoid fracture, cervical facet dislocation and unstable thoracic spinal columns fractures
- Non-operative and operative management to maximize outcomes, including timing, hemodynamics, and prognostication
- Timing of surgery for spinal trauma and spinal cord injury

(SF) 8:00 am–4:15 pm Room: 2016

**SYM2: Functional Neurosurgery Update: Emerging Concepts****Course Directors:** Ellen L. Air, Casey H. Halpern, John D. Rolston**Faculty:** Raag Airan, Nicholas M. Barbaro, Edward F. Chang, Shabbar F. Danish, Robert S. Fisher, Kelly D. Foote, Wayne Goodman, Ryder P. Gwinn, Douglas Kondziolka, Vibhor Krishna, Jean-Philippe Langevin, Paul S. Larson, Kai J. Miller, Francisco A. Ponce, Robert M. Richardson, Sameer A. Sheth, Peter A. Tass, David P. Vansickle**Agenda Highlights**

- Update on electrode implantation techniques
- Emerging concepts in movement disorders surgery
- Non-motor brain stimulation
- Emerging concepts in stereotactic lesioning
- New versus established techniques in epilepsy surgery
- Emerging concepts in restorative neurosurgery

(RE) 8:00 am–4:15 pm Room: 2011

**SYM3: Maximizing Your Neurosurgical Employment Opportunities Non-CME***Note: \$400 Physician; \$50 Nurse/NP/PA; \$50 Fellow/Resident/Medical Student***Course Directors:** Mohamad Bydon, Lola B. Chambless, Jennifer A. Sweet**Faculty:** John A. Braca, Andrew R. Conger, Timothy H. Lucas, Michael W. McDermott, Brian V. Nahed, Joseph S. Neimat, Judith Rosman, Justin A. Singer, Anand Veeravagu**Agenda Highlights**

- Critical insights and perspectives on starting your neurosurgery practice
- Advantages and considerations of distinct practice settings and models
- Valuing yourself as a neurosurgeon in the job search and in negotiations
- Do's and don'ts during job interviews
- Chair and Program Director's perspectives on establishing a new neurosurgery career
- Leadership insights and pathways

(CV) 8:00 am–4:15 pm Room: 2001

**SYM4: Cerebrovascular Symposia: Stenting and Bypasses Bundle***Comprised of 2 sessions: SYM4A & SYM4B. Select this option to take both at a discounted rate.*

(CV) 8:00 am–12:00 pm

**SYM4A: New Era in Stenting****Course Director:** Andrew W. Grande**Faculty:** Grahame C.D. Gould, Brian T. Jankowitz, Demetrius K. Lopes, Boris L. Pabon Guerreo, Ajit S. Puri, Justin G. Santarelli, Raymond D. Turner, Henry H. Woo**Agenda Highlights**

- Introduction and review of next generation low profile intracranial stents Indications for placement of next generation stents
- Technical tips for placement of next generation stents
- Hands on exposure and experience with new stents with simulators

(CV) 12:45–4:15 pm

**SYM4B: Bypass Techniques in Cerebrovascular Surgery****Course Director:** Sepideh Amin-Hanjani**Faculty:** Adib A. Abba, Amir R. Dehdashti, Michael T. Lawton, Leonardo Rangel-Castilla, Jonathan Russin, Laligam N. Sekhar, Gregory J. Zipfel**Agenda Highlights**

- EC-IC bypass for complex aneurysms
- STA-MCA bypass for ischemia – indications and technique
- STA-MCA bypass for moyamoya – indications and technique
- Posterior Circulation bypass for ischemia
- Posterior Circulation bypass for aneurysms
- Alternative donors: Imax, STA stump
- IC-IC bypass options for complex aneurysms



CNS

SANS

Lifelong Learning

*Look for this image for a SANS exam that accompanies this course and can be purchased on the Annual Meeting registration site.*



(SP) 8:00 am–4:15 pm Room 2008

### **SYM5: Advanced Topics in Spinal Operative Techniques Bundle**

*Comprised of 2 sessions: SYM5A & SYM5B. Select this option to take both at a discounted rate.*

(SP) 8:00 am–12:00 pm

#### **SYM5A: Advanced Minimally Invasive Spine Surgery—Operative Nuances, Indications, and Complication Avoidance**

**Course Directors:** Adam S. Kanter, Praveen V. Mummaneni

**Faculty:** Aaron J. Clark, Kevin T. Foley, Langston T. Holly, Catherine Miller-Simington, John Pollina, Khoi D. Than, Juan S. Uribe

#### **Agenda Highlights**

- Member-submitted case-based discussion of minimally invasive techniques and approaches to management of spinal disease
- Choosing between minimally invasive and open spine surgery
- Review of indications
- Patient selection in minimally invasive spine surgery
- Selecting the right approach for lumbar fusion: minimally invasive TLIF versus trans-psoas versus ALIF
- Complication avoidance and management in minimally invasive spine surgery

(SP) 12:45–4:15 pm

#### **SYM5B: Cervical Spine Case Management: When to Preserve Motion and When Not To—The Evidence in the Age of Reason**

**Course Directors:** Andrew T. Dailey, Charles A. Sansur  
**Faculty:** Kurt M. Eichholz, R. John Hurlbert, Sheng-fu L. Lo, Mark E. Oppenlander, Srinivas K. Prasad, Wilson Z. Ray

#### **Agenda Highlights**

- Member-submitted case-based discussion of management options and approaches of degenerative cervical spine disease
- Review of indications: Knowing when to operate
- Surgical approach: Anterior versus Posterior
- Surgical approach: Fusion versus Motion preservation
- Complication avoidance and management in cervical spine surgery

(TU) 8:00 am–4:15 pm Room: 2004

### **SYM6: Brain Tumor Update Bundle**

*Comprised of 2 sessions: SYM6A & SYM6B. Select this option to take both at a discounted rate.*

(TU) 8:00 am–12:00 pm

#### **SYM6A: Brain Tumor Update: Advanced and Minimally Invasive Techniques for Resection of Malignant Brain Tumors**

**Course Directors:** Manish K. Aghi, Andrew E. Sloan  
**Faculty:** Kaisorn L. Chaichana, Nader Sanai, Jason P. Sheehan, Michael A. Vogelbaum, Jeffrey S. Weinberg

#### **Agenda Highlights**

- Awake Craniotomy with Motor and Language Mapping
- Intra-Operative MRI (iMRI) to optimize Tumor Resection
- Fluorescent-Guided Microsurgery using 5-ALA and other fluorophores

- Minimally Invasive approaches using Exoscopes and Tubular Retractors
- Laser Interstitial Thermotherapy/Stereotactic Laser Ablation (LITT/SLA)
- Convection Enhanced Delivery (CED) (Breakout Session with NX Development from 10–10:30 am in Room 2006.)
- Stereotactic Radiosurgery

(TU) 12:45–4:15 pm

#### **SYM6B: Brain Tumor Update: Benign Brain Tumors**

**Course Directors:** Ian F. Dunn, Koji Yoshimoto

**Faculty:** Mustafa K. Baskaya, Anand V. Germanwala, Albert H. Kim, John Y.K. Lee, James K. Liu, Jacques J. Morcos, Akash J. Patel, Walavan Sivakumar, Gabriel Zada

#### **Agenda Highlights**

- The role of microsurgery and endoscopy in the management of benign tumors
- Contemporary management of specific tumor histologies, including skull base meningiomas, pituitary adenomas, acoustic neuromas, chordomas, peripheral nerve tumors, and pediatric tumors
- Stereotactic Radiosurgery for benign tumors

(GE) 8:00 am–12:00 pm Room: 2007

### **SYM7: Morbidity and Mortality**

*Space is limited, check at registration for availability*

**Course Director:** Mark E. Shaffrey

**Faculty:** Won Kim, Philipp Taussky, G. Edward Vates

#### **Agenda Highlights**

- Satisfy ABNS MOC requirement for quarterly participation in morbidity and mortality
- Case-based discussion of member submitted complications
- Identify opportunity to surgical technique and systems of care improvement
- Implementing improvements in clinical care
- Creating a no-blame environment for case review

(WINS) 12:45–4:15 pm

Room: 2007

### **SYM8: Residency Program Update & Training the Trainers**

*This program is designed for Program Directors and Program Coordinators.*

**Course Director:** Sarah Woodrow

**Faculty:** Ellen L. Air, Garni Barkhoudarian, Lola B. Chambliss, Lawrence S. Chin, Catherine A. Mazzola, Daniel K. Resnick, Alan M. Scarrow, Warren R. Selman, Nathan R. Selden, Stacey Q. Wolfe, Nishant Yagnick, Gregory J. Zipfel

#### **Agenda Highlights**

- Overview of new ABNS milestones
- Adult learning theory
- Teaching to millennials/ diversity
- Different models of feedback
- Intra-operative teaching
- Incorporating structured teaching into rounds
- Teaching “soft” skills (communication, giving bad news, collaboration with other services)
- How to identify learning gaps and learning styles
- Giving feedback to a learner

(SE) 12:45–4:15 pm Room: 2012

### **SYM9: Appropriate Coding, ICD, and CPT—2019 Update**

**Course Directors:** Mark E. Oppenlander, Clemens M. Schirmer

**Faculty:** Joseph S. Cheng, Scott A. Meyer, Kim Pollock, John K. Ratliff, Khoi D. Than, Luis M. Tumialan, Anand Veeravagu

#### **Agenda Highlights**

- ❑ Medicare update modifiers
- ❑ Evaluation and management coding
- ❑ CD-10 coding and hospital coding for surgeons
- ❑ Revenue cycle optimization to ensure payment, PA/NP billing

4:15–5:45 pm Room: 2000

### **CNS RESIDENT SOCIAL AND CSNS YOUNG NEUROSURGEONS RECEPTION**

All residents are invited to attend and network with their peers. Recruiters will be available to assist with your future job search. Beer, wine, and appetizers will be served.

## **INTERNATIONAL RECEPTION**

Saturday, October 19 | 5:30–7:00 pm

San Francisco Marriott Marquis | Yerba Buena Salon 7



Join your colleagues from around the world at the CNS International Reception. Enjoy hors d'oeuvres and cocktails while chatting with some of the top international professionals in the field of neurological surgery. All international registered attendees and their registered guests are invited to attend.

### **DINNER SEMINAR 1 | SATURDAY, OCTOBER 19 | 6:30–8:30 PM**

\$190 (includes three-course dinner and beverages)

#### **(SE) DIN1: How Do I Avoid Getting Penalized—ICD-10, CPTs, MACRA, ACOs, and APMs?**

**Moderator:** John K. Ratliff

**Faculty:** Atman Desai, Rachel Groman, Kim Pollock, Cheerag D. Upadhyaya



#### **BOULEVARD**

This high-end San Francisco landmark showcasing the culinary vision of Nancy Oakes continues to excel thanks to the robust flavors of its mind-blowing, market-driven American cuisine paired with a terrific wine list and served with the ultimate professionalism amid spectacular Bay Bridge views.

Boulevard is recognized on Zagat's "Most Popular" and "Best Business Dinners" lists in San Francisco.

*Complimentary shuttle service will depart from the San Francisco Marriott Marquis at 6:15 pm.*

**Full Day and Discounted Bundles (includes lunch):**

Physician \$400, Nurse/NP/PA \$300, Resident/Fellow/Graduate Student/Post-doctoral Scholar/Medical Student \$175

**Half Day:** (Does not include lunch) Physician \$250, Nurse/NP/PA \$200, Resident/Fellow/Graduate Student/Post-doctoral Scholar/Medical Student \$125**(AP)** 8:00 am–4:15 pm Room: 3014**Association of Neurosurgical Physician Assistants (ANSPA) Fall 2019 CME Meeting Presented in Collaboration with Congress of Neurological Surgeons (CNS)***Complimentary to registered ANSPA members, Nurse/PA registrants***Moderators:** Grace H. Bryan, Alice Edwards**Speakers:** Rachelle Chua, Hugh G. Deen, Ricardo A. Hanel, Ronald Reimer, Leslie C. Schlachter, JoDee Winter**(CV)** 8:00 am–4:15 pm Room: 3018**SYM10: Acute Stroke Care: Guidelines Review and Future Directions****Course Directors:** Mohammad A. Aziz-Sultan, Mandy J. Binning, R. Webster Crowley**Faculty:** Andrei V. Alexandrov, Sepideh Amin-Hanjani, Jan-Karl Burkhardt, Paul J. Camarata, Geoffrey P. Colby, Robert J. Dempsey, Justin F. Fraser, Nestor R. Gonzalez, Mark R. Harrigan, Christopher P. Kellner, Demetrius K. Lopes, Grace K. Mandigo, J D. Mocco, Maxim Mokin, Thomas Oxley, Eric C. Peterson, Gustavo Pradilla, Matthew Reynolds, Robert H. Rosenwasser, Lauren Sansing, Alejandro M. Spiotta, Fernando Testai, Michael Tymianski, Stacey Q. Wolfe**Agenda Highlights**

- Guidelines for the Pre-hospital Triage of Patients with Acute Stroke (Breakout Session with Penumbra from 2:00–2:30 pm in Room 3016.)
- Management of Emergent Large Vessel Occlusion: Medical and Interventional Management
- Stroke Systems of Care
- New Technology and Artificial Intelligence for the Pre-hospital Triage of Acute Stroke
- Surgical Options for Stroke: Decompressive craniectomy, stenting, and bypass
- Thrombectomy Tools and Techniques
- The Management of Tandem Lesions
- Surgical Management of Intracerebral Hemorrhage: Minimally invasive and endoscopic approaches
- Translational Science in Acute Stroke

**(TR)** 8:00 am–4:15 pm Room: 3022**SYM11: Neurotrauma Update****Course Directors:** Gregory W.J. Hawryluk, Shelly D. Timmons**Faculty:** Randy S. Bell, Tene A. Cage, Rodrigo M. Faleiro, Ramesh Grandhi, Alan S. Hoffer, Ryan S. Kitagawa, Laura B. Ngwenya, Richard B. Rodgers, Uzma Samadani, Emily P. Sieg, Martina Stippler, Jamie S. Ullman**Agenda Highlights**

- Severe TBI and Advanced Neuromonitoring



Look for this image for a SANS exam that accompanies this course and can be purchased on the Annual Meeting registration site.

- Common Indications and Complications of Decompressive Craniectomy
- TBI in the Elderly and Disparities in TBI care
- Controversies in Hyperosmolar Therapy
- Update in Critical Care for the Neurosurgeon
- Cerebral Autoregulation: What a Neurosurgeon Should Know
- VTE Prophylaxis in TBI8. Objective Measures of Acute TBI: Ocular, Serum, and Radiographic (Breakout Session with Natus Neurology from 9:00–9:30 am in Room 3024)

**(CV)** 8:00 am–4:15 pm Room: 2016**SYM12: A Comprehensive and Evidenced-based Guidelines Review for the Treatment of Intracranial Aneurysms****Course Directors:** Peter Kan, Stacey Q. Wolfe**Faculty:** Adib A. Abila, Peter S. Amenta, Sepideh Amin-Hanjani, Adam S. Arthur, Mandy J. Binning, W. Christopher Fox, David M. Hasan, Babak S. Jahromi, Michael T. Lawton, Michael R. Levitt, R. Loch Macdonald, Adel M. Malek, Charles C. Matouk, J D. Mocco, Deanna M. Sasaki-Adams, Adnan H. Siddiqui, Michelle J. Smith, Robert M. Starke, Alejandro M. Spiotta, Richard W. Williamson**Agenda Highlights**

- Guidelines for The Management of Unruptured and Ruptured Intracranial Aneurysms
- Imaging Guidelines for Small Unruptured Intracranial Aneurysms
- An Evidence Based Approach to Clip versus Coil for Unruptured and Ruptured Aneurysms
- New Horizons in the Treatment of Cerebral Vasospasm: Devices and Drugs
- Bifurcation aneurysms
- Treatment strategies for internal carotid aneurysms
- Guidelines for the Outpatient Management of Dual Anti-platelet Agents
- Endovascular Management of Basilar Apex Aneurysms—Management Strategies for Vertebral, Vertebrobasilar and Mid-Basilar Aneurysms

**(SP)** 8:00 am–4:15 pm Room: 2011**SYM13: Spine Biomechanics and Deformity Symposium***Comprised of 2 sessions: SYM13A & SYM13B. Select this option to take both at a discounted rate.***(SP)** 8:00 am–12:00 pm**SYM13A: Spinal Biomechanics for the Practicing Neurosurgeon: What I Need to Know for My Practice****Course Directors:** Joseph S. Cheng, Tyler R. Koski**Faculty:** Nader S. Dahdaleh, Aruna Ganju, Ajit A. Krishnaney, Christopher M. Maulucci, Rani Nasser, Zachary A. Smith, Jay D. Turner, Michael S. Virk, Rishi K. Wadhwa**Agenda Highlights**

- Relevance of biomechanics in the management of degenerative, traumatic, and deformity-related spine disease

- Integrating biomechanics into surgical reconstructive plans
- Which biomechanical measures matter and how much
- Selecting spinal constructs based on biomechanical insights
- Complication avoidance and management based on an understanding of optimal biomechanical principles of spine alignment

(SP) 12:45–4:15 pm

### **SYM13B: Thoracolumbar Spinal Deformity for the Non-deformity Spine Surgeon**

**Course Directors:** Dean Chou, Christopher I. Shaffrey  
**Faculty:** Kai-Ming G. Fu, D. Kojo Hamilton, Paul Park, Rod J. Oskouian, John H. Shin, Justin S. Smith, Lee A. Tan  
**Agenda Highlights**

- Case-based review of thoracolumbar deformity management
- Indications for larger spinal constructs versus minimal approaches
- Measures for diagnosis and classification of thoracolumbar deformity
- Techniques for correction of thoracolumbar spinal deformity
- Complication avoidance and management based of thoracolumbar deformity

(TU) 8:00 am–4:15 pm Room: 2004

### **SYM14: Advanced Functional Mapping and 3D Anatomy for the Neurosurgeon**

*Comprised of 2 sessions: SYM14A & SYM14B. Select this option to take both at a discounted rate.*

(TU) 8:00 am–12:00 pm

### **SYM14A: Surgical Management of Eloquent Area Tumors: Functional Mapping and/or Navigation**



**SANS**  
Lifelong Learning

**Course Directors:** Mitchel S. Berger, Sunit Das  
**Faculty:** Lorenzo Bello, Richard W. Byrne, Edward F. Chang, Hugues Duffau, Shawn L. Hervey-Jumper, Jason Heth, Eric C. Leuthardt, George Samandouras, Michael E. Sughrue, Phiroz E. Tarapore

#### **Agenda Highlights**

- Preoperative assessment using structural and functional imaging
- Novel preoperative functional mapping techniques
- Intraoperative mapping: Surgical and anesthetic considerations
- Adjuncts to define and direct resection: Costas Hadjapanayis
- Case-based discussion

(TU) 12:45–4:15 pm

### **SYM14B: 3D Surgical Neuroanatomy**

**Course Director:** Juan C. Fernandez-Miranda  
**Faculty:** Mustafa K. Baskaya, Vladimir Benes, Spiros L. Blackburn, Aaron A. Cohen-Gadol, Paul A. Gardner,

Jeffrey M. Sorenson, Necmettin Tanriover, Ugur Ture

#### **Agenda Highlights**

- Review relevant surgical neuroanatomy using 3D stereoscopic projection and high-definition fiber tractography (HDFT), including cortical and white matter anatomy, cerebrovascular, and skull base anatomy
- Review of intricate anatomical regions such as insula, ventricles, basal cisterns, middle fossa, and cavernous sinus
- Surgical approaches to cerebellum and fourth ventricle, posterior circulation, and lateral and posterior skull base approaches, including the cerebello-pontine angle, clival and petroclival region, jugular foramen, and foramen magnum

(SF) (PE) 8:00 am–4:15 pm Room: 2008

### **SYM15: Emerging Technologies in Neurosurgery**

*Comprised of 2 sessions: SYM15A & SYM15B. Select this option to take both at a discounted rate.*

(SF) (PE) 8:00 am–12:00 pm

### **SYM15A: Intraoperative Technological Adjuncts: Indications and Techniques for Laser Therapy, Robotics, and Exoscopes**

**Course Director:** Daniel Curry  
**Faculty:** David D. Gonda, Jeffrey S. Raskin, Mitesh V. Shah, Scellig S. D. Stone, Jon T. Willie

#### **Agenda Highlights**

- Survey of current robotic technologies and applications across neurosurgical specialties
- Laser technology options, indications, limitations, and complication avoidance and management
- Exoscope technologies, including visualization advantages, indications, and limitations
- Assessment of published outcomes using various new intraoperative adjunctive technologies, with a focus on specific advantages of each
- Complication avoidance and management with each adjunct
- Hands on experience with relevant technologies

(SF) (TU) 12:45–4:15 pm

### **SYM15B: Virtual and Augmented Reality: Science and Clinical Applications**

**Course Directors:** Walter C. Jean, Cameron C. McIntyre  
**Faculty:** Harith Akram, Joshua B. Bederson, Raphael Guzman, Alfred M.C. Illoreta, Paul S. Larson, Robert G. Louis, Nader Pouratian

#### **Agenda Highlights**

- Virtual Reality: Utility in surgical rehearsal, teaching and patient engagement
- Augmented Reality: Microscopes, endoscopies, and holography
- Image rendering: Novel MR sequences and analyses, tractography, and segmentation to guide surgical procedures

(PA) (PN) 8:00 am–4:15 pm Room: 3003

### **SYM16: Pain and Peripheral Nerve Symposium**

*Comprised of 2 sessions: SYM16A & SYM16B. Select this option to take both at a discounted rate.*

(PA) (PN) 8:00 am–12:00 pm

### **SYM16A: Non-spinal Targets for Pain: Nerve, DRG, and Brain**

**Course Directors:** Sean J. Nagel, Jennifer A. Sweet



**SANS**  
Lifelong Learning

*Look for this image for a SANS exam that accompanies this course and can be purchased on the Annual Meeting registration site.*



**Faculty:** Steven M. Falowski, Brian H. Kopell, Jean-Philippe Langevin, Andre Machado, Julie G. Pilitsis, Ahmed M.T. Raslan

#### Agenda Highlights

- History & Review of Targets
- Recent Clinical Trials & DBS for Pain
- DRG for pain
- Peripheral Stim for pain
- MRgFUS for pain
- Radiofrequency ablation for pain
- DBS and Future Treatments for pain

(PA) (PN) 12:45–4:15 pm

#### **SYM16B: Peripheral Nerve Surgery: Techniques and Exposure**

**Course Directors:** Rajiv Midha, Robert J. Spinner

**Faculty:** Justin M. Brown, Amgad S. Hanna, Marie-Noelle Hebert-Blouin, Line G. Jacques, Allan D. Levi, Mark A. Mahan, Elias B. Rizk, Thomas J. Wilson, Eric L. Zager

#### Agenda Highlights

- Basics of history and physical exam
- Basics of nerve injury and regeneration
- Brachial plexus disorders, anatomy, and exposure
- Upper and lower extremity entrapments
- Peripheral nerve surgery emergencies
- Peripheral Nerve Tumors

(AP) (GE) (RE) 8:00 am–4:15 pm Room: 2014

#### **SYM17: Quality Summit Bundle**

*Comprised of 2 sessions: SYM17A & SYM17B. Select this option to take both at a discounted rate.*

8:00 am–12:00 pm

#### **SYM17A: QI: Implementation and Results**

**Course Directors:** Mohamad Bydon, Jeremy T. Phelps

**Faculty:** Erica F. Bisson, Zoher Ghogawala, Michael Glantz, Elizabeth B. Habermann, John J. Knightly, Mark E. Shaffrey, Jonathan Slotkin

#### Agenda Highlights

- Quality Improvement
- Patient Reported Outcomes
- Trial Design
- Evidence based Medicine
- Registry Establishment
- National Benchmarking and MCID
- Cost equations and Risk adjustment

12:45–4:15 pm

#### **SYM17B: Using Big Data to Help Neurosurgeons and Their Patients**

**Course Directors:** Katie Link, Eric K. Oermann

**Faculty:** Lola B. Chambless, Jason Davies, Mona Flores, Elizabeth B. Habermann, Andriy Myronenko

#### Agenda Highlights

- Machine learning overview
- Deep neural networks
- Analysis of Administrative Datasets
- Analysis of registry data
- Descriptive analytics
- Translating big data into practice

(GE) 8:00 am–12:00 pm Room: 2007

#### **SYM18: Morbidity and Mortality**

**Course Directors:** Mark E. Shaffrey

**Faculty:** Judy Huang, Won Kim, Philip V. Theodosopoulos

#### Agenda Highlights

- Satisfy ABNS MOC requirement for quarterly participation in morbidity and mortality
- Case-based discussion of member submitted complications
- Identify opportunity to surgical technique and systems of care improvement
- Implementing improvements in clinical care
- Creating a no-blame environment for case review

(SP) 12:45–4:15 pm Room: 2012

#### **SYM19: My Worst Spinal Complication: Lessons Learned**

**Course Directors:** Daniel K. Resnick, Luis M. Tumialan

**Faculty:** Mark H. Bilsky, Richard G. Fessler, Michael W. Groff, Shekar N. Kurpad, Gerald E. Rodts, Hesham M. Soliman, Michael P. Steinmetz, Michael Y. Wang

#### Agenda Highlights

- Case-based discussion of recent complications
- Complication avoidance in spine surgery
- Complication management in spine surgery

(SF) (TU) 12:45–4:15 pm Room: 2007

#### **SYM20: Modern Approaches to SRS**

**Course Directors:** Gordon Li, Jason P. Sheehan

**Faculty:** John R. Adler, Iris C. Gibbs, Douglas Kondziolka, David Mathieu, Michael W. McDermott, Hirofumi Nakatomi, Manjul Tripathi, Masaaki Yamamoto

#### Agenda Highlights

- Stereotactic Radiosurgery for Acoustic Neuromas
- Stereotactic Radiosurgery for Meningiomas
- Stereotactic Radiosurgery for Trigeminal Neuralgia and Other Functional Indications
- Stereotactic Radiosurgery for Brain Metastasis
- Stereotactic Radiosurgery: Guidelines and What the Evidence Supports
- Stereotactic Radiosurgery: Evolutions in the field and the Role of Neurosurgeons

#### **Join us to Watch the Riveting Live SANS Challenge!**

Preliminary Rounds: Sunday, October 20,

1:00–3:00 pm **Room 2018**

Championship Round: Tuesday, October 22,

1:45–2:45 pm **Room 2018**

Jackson Memorial Hospital/University of Miami

National Capital Consortium

Ohio State University Hospital

Sidney Kimmel Medical College at Thomas Jefferson University/TJUH

University of Chicago Department of Neurosurgery

University of Cincinnati Medical Center/College of Medicine

University of Colorado School of Medicine

University of Kansas School of Medicine

University of Kentucky College of Medicine

University of Texas Health Science Center School of Medicine at San Antonio

University of Washington

Vanderbilt University Medical Center

Wake Forest School of Medicine



SUNDAY, OCTOBER 20 | 4:30–6:30 PM | BALLROOM

# GENERAL SCIENTIFIC SESSION I

Presiding Officer: Ganesh Rao

Moderators: Lola B. Chambless, Alexander A. Khalessi

4:30–4:41 pm

## Welcome to the 2019 CNS Annual Meeting

Ganesh Rao

4:41–4:49 pm

## Neurosurgery Update: Cutting Edge in Neuro-oncology

Mitchel S. Berger

4:49–4:57 pm

## Neurosurgery Update: Cutting Edge in Spinal Surgery – Prospective Studies versus Registries in the Age of Reason

Zoher Ghogawala

4:57–5:03 pm

## Operative Technique Demonstration

Michael T. Lawton

5:03–5:07 pm

## Introduction of Controversy: Chronic Traumatic Encephalopathy (CTE)

Joseph C. Maroon

5:07–5:25 pm

## Controversies: The Evidence for CTE is Compelling

Julian E. Bailes

5:25–5:43 pm

## Controversies: The Evidence for CTE is Underwhelming

Peter Cummings

5:43–5:47 pm

## Controversies: Discussion and Outcomes

Joseph C. Maroon

5:47–5:49 pm

## Introduction of Brain Tumor Guha Award

Manish K. Aghi

5:49–5:56 pm

## Brain Tumor Guha Award Presentation

David H. Gutmann

5:56–5:59 pm

## Introduction of Lucy Kalanithi

Anil Nanda and Julie G. Pilitsis



5:59–6:30 pm

## FEATURED SPEAKER

## A Conversation with Lucy Kalanithi

Lucy Kalanithi



Lucy Kalanithi

will be signing copies of the book “When Breath Becomes Air” immediately following the conclusion of her lecture.



# JOIN US AT THE OPENING RECEPTION

6:30–8:30 pm

Moscone West Convention Center – Level 2 Lobby

# GUIDELINES AND SUNRISE SCIENCE

7:00–8:30 am Room: 3014

## TUMOR SUNRISE SCIENCE AND LATE-BREAKING ABSTRACT SESSION

**Moderators:** Maryam Rahman, Nader Sanai

*For a listing of Sunrise Science and Late-breaking Oral Presentations, please see page 61.*

7:00–8:30 am Room: 2014

## CEREBROVASCULAR SUNRISE SCIENCE AND LATE-BREAKING ABSTRACT SESSION

**Moderators:** Jan-Karl Burkhardt, Rohan V. Chitale

*For a listing of Sunrise Science and Late-breaking Oral Presentations, please see pages 60-61.*

(SP) 7:00–8:30 am Room: 2016

## Guidelines for the Management of Metastatic Disease to the Spine: The Evidence

**Moderators:** Sanjay S. Dhall, John E. O'Toole

**Speakers:** Kurt M. Eichholz, Benjamin D. Elder, Langston T. Holly, Todd D. McCall, Timothy C. Ryken, Daniel M. Sciubba, Nicholas J. Szerlip

7:00–7:06 am

### Introduction

Timothy C. Ryken

7:06–7:20 am

### Role of Radiotherapy and Radiosurgery in the Treatment of Patients with Metastatic Spine Disease

Nicholas J. Szerlip

7:20–7:34 am

### Role of Combination Surgery and Radiotherapy in the Treatment of Patients with Symptomatic/Asymptomatic Metastatic Spinal Cord Compression

Langston T. Holly

7:34–7:48 am

### Pre-Operative Embolization for the Management of Patients with Metastatic Spinal Disease

Kurt M. Eichholz

7:48–8:02 am

### Spinal Instability and Risk of Pathological Fracture for Patients with Metastatic Spine Disease

Benjamin D. Elder

8:02–8:16 am

### Non-chemotherapeutic Medical Treatment for the Management of Patients with Metastatic Spinal Disease

Daniel M. Sciubba

8:16–8:30 am

### Role of Vertebral Augmentation in Patients with Metastatic Spine Disease

Todd D. McCall

(SF) 7:00–8:30 am Room: 3020

## Guidelines for DBS for Parkinson's Disease

**Moderators:** Clement Hamani, Ahmed M.T. Raslan

**Speakers:** Kelly D. Foote, Julie G. Pilitsis, Anand I. Rughani, Jason M. Schwalb

7:00–7:17 am

### STN Versus GPI Efficacy in Treating Motor Symptoms of PD

Jason M. Schwalb

7:17–7:34 am

### STN Versus GPI for Reduction of Dopaminergic Meds, How to Assess This in Your Clinical Practice

Kelly D. Foote

7:34–7:51 am

### STN Versus GPI for Dyskinesias and Quality of Life

Clement Hamani

7:51–8:08 am

### STN Versus GPI for Concern of Cognitive Decline, Depression, and Quality of Life

Julie G. Pilitsis

8:08–8:25 am

### STN Versus GPI in Risk of Surgical Adverse Events

Anand I. Rughani

8:25–8:30 am

### Questions and Discussion

(SP) (TR) 7:00–8:30 am Room: 3022

## Neurotrauma Debates

**Moderators:** Odette Harris, David O. Okonkwo

**Speakers:** Bizhan Aarabi, Ryan S. Kitagawa, Patricia B. Raksin, Christian B. Ricks, Jamie S. Ullman

7:00–7:30 am

### An MRI is Necessary In Acute Management of SCI

7:00–7:10 am

#### Yes

Bizhan Aarabi

7:10–7:20 am

#### No

Christian B. Ricks

7:20–7:25 am

**Rebuttal Supporting the Notion**

Bizhan Aarabi

7:25–7:30 am

**Rebuttal Opposing the Notion**

Christian B. Ricks

7:30–8:00 am

**Decompressive Hemicraniectomy Is Here to Stay**

7:30–7:40 am

**Yes**

Jamie S. Ullman

7:40–7:50 am

**No**

Ryan S. Kitagawa

7:50–7:55 am

**Rebuttal Supporting the Notion**

Jamie S. Ullman

7:55–8:00 am

**Rebuttal Opposing the Notion**

Ryan S. Kitagawa

8:00–8:30 am

**Hypothermia Is Dead**

8:00–8:10 am

**Yes**

Patricia B. Raksin

8:10–8:20 am

**No**

Ryan S. Kitagawa

8:20–8:25 am

**Rebuttal Supporting the Notion**

Patricia B. Raksin

8:25–8:30 am

**Rebuttal Opposing the Notion**

Ryan S. Kitagawa

# WELCOME SPOUSES & GUESTS!

Please plan to join us for complimentary breakfast  
Monday, Tuesday, and Wednesday morning  
from 8:00–10:30 in the 2nd Floor Atrium at the  
San Francisco Marriott Marquis Hotel.

And don't miss all of the exciting speakers during  
the General Scientific Sessions each day and  
the events happening in the CNS Xperience Lounge.

## WE'RE GLAD YOU ARE HERE!

**SUBSPECIALTY SESSION HIGHLIGHTS KEY**

ⓐP ADVANCED PRACTICE PROVIDER

ⓐV CEREBROVASCULAR

ⓐR NEUROTRAUMA

ⓐA PAIN

ⓐE PEDIATRIC

ⓐN PERIPHERAL NERVES

ⓐE RESIDENT

ⓐE SOCIOECONOMIC

ⓐP SPINE

ⓐF STEREOTACTIC AND FUNCTIONAL

ⓐU TUMOR

ⓐS WINS



# GENERAL SCIENTIFIC SESSION II

Presiding Officer: Steven N. Kalkanis

Moderators: Nader Pouratian, Martina Stippler

8:40–8:48 am  
**GSS II Kickoff**  
Steven N. Kalkanis

8:48–8:51 am  
**Introduction of Shankar Vedantam**  
Akash J. Patel



8:51–9:13 am  
**FEATURED  
SPEAKER**  
**Hidden Brain**  
Shankar Vedantam



Shankar Vedantam will be

signing copies of his book, “The Hidden Brain” in the CNS Xperience Lounge during the morning beverage break.

9:13–9:18 am  
**Introduction of Honored Guest**  
Frederick F. Lang



9:18–9:40 am  
**Honored Guest  
Presentation:**  
**Role of Resection  
for Glioblastoma:  
Can Technology  
Overcome Biology?**  
Raymond Sawaya

9:40–10:40 am  
**MORNING BEVERAGE BREAK**  
Visit the Exhibit Hall and enjoy a complimentary cup of coffee!

10:00–10:30 am  
**LIVE SURGERY  
IN THE EXHIBIT HALL**  
See page 20 for details.

10:40–10:46 am  
**Operative Neurosurgery Highlight**  
Laurence D. Rhines

10:46–10:48 am  
**CNS Foundation Update**  
Elad I. Levy



10:48–10:55 am  
**Japanese CNS  
Presidential Address**  
Yukihiro Sonoda

10:55–11:01 am  
**CNS Resident Award Presentation**  
**Ambulation on POD#0 is Associated  
with Decreased Adverse Events  
After Elective Lumbar Spine  
Surgery: Analysis of the Michigan  
Spine Surgery Improvement  
Collaborative (MSSIC)**  
Hesham M. Zakaria

11:01–11:03 am  
**Introduction of CNS President**  
Adam S. Arthur



11:03–11:23 am  
**Presidential  
Address:**  
**The Age of Reason  
for Neurosurgery**  
Ganesh Rao

11:23–11:26 am  
**Introduction of Doris Kearns  
Goodwin**  
Daniel J. Hoh



11:26 am–12:10 pm  
**WALTER E. DANDY  
ORATOR**  
**Leadership in  
Turbulent Times**  
Doris Kearns  
Goodwin

 Doris Kearns Goodwin will be signing copies of her book, “Leadership: In Turbulent Times,” in the CNS Xperience Lounge immediately following the conclusion of this session.

MONDAY, OCTOBER 21 | 12:15–1:45 pm

# LUNCHEON SEMINARS

All Luncheon Seminars include a plated lunch served in the seminar room.

Luncheon Seminar fee is \$95 each (\$75 for residents, fellows, graduate students/post-doctoral scholars, medical students, and advance practice providers). Add a Luncheon Seminar to your profile at registration.

Room: 2001

**(RE) M1: Honored Guest Luncheon: Leadership Engagements**

*Complimentary advanced registration recommended*

**Speaker:** Raymond Sawaya

Room: 2012

**(SE) M2: So You've Been Sued... Medical Practice 2019 Update**

**Moderators:** Bharat Guthikonda, Rishi K. Wadhwa

**Faculty:** Deborah L. Benzil, Lawrence M. Shuer, James T. Tran, Richard N. Wohns

Room: 2003

**(CV) M3: Is Intracerebral Hemorrhage a Surgical Disease?**

**Moderator:** J D. Mocco

**Faculty:** Mark D. Bain, Abel P. Huang, Christopher P. Kellner, Gustavo Pradilla, Lauren Sansing, Alejandro M. Spiotta

Room: 2005



**CNS**

**SANS**

Lifelong Learning

**(SP) M4: Cervical Spondylotic Myelopathy—Anterior Versus Posterior**

**Moderator:** Zohar Ghogawala

**Faculty:** Erica F. Bisson, Perry P.S. Dhaliwal, Asdrubal Falavigna, Iain H. Kalfas, Vincent C. Traynelis, Luis M. Tumialan, Christopher E. Wolfla, Takao Yasuhara

Room: 2007

**(SP) (TU) M5: Spinal Tumor Surgery: Case-based Management**

**Moderators:** Joseph S. Cheng, Ziya L. Gokaslan

**Faculty:** Mark H. Bilsky, Dean Chou, Michelle J. Clarke, Charles Fisher, Ilya Laufer, Paul C. McCormick, Laurence D. Rhines

Room: 2008



**CNS**

**SANS**

Lifelong Learning

**(PN) M6: Peripheral Nerve Entrapment Syndromes: Diagnosis and Management**

**Moderator:** Line G. Jacques

**Faculty:** Jason H. Huang, Mark A. Mahan, Gabriel C. Tender, Christopher J. Winfree, Lynda J. Yang



**CNS**

**SANS**

Lifelong Learning

Look for this image for a SANS exam that accompanies this course and can be purchased on the Annual Meeting registration site.

Room: 2009

**(TR) M7: Neurocritical Care: A Multidisciplinary Collaboration**

**Moderator:** Joshua E. Medow

**Faculty:** Nicholas J. Brandmeir, Kristine O'Phelan, Lori Shutter

Room: 2000

**(PE) M8: Pediatric Concussion**

**Moderator:** Susan R. Durham

**Faculty:** Robert J. Bollo, Meeryo C. Choe, Michael L. Levy, Carolyn Quinsey, Christina M. Sayama

Room: 2010

**(TU) M9: Acoustic Neuromas: Current Management Strategies**

**Moderators:** William T. Couldwell, Steven L. Giannotta

**Faculty:** Frederick G. Barker, Lola B. Chambless, John G. Golfinos, Michael J. Link, Jacques J. Morcos, Marc S. Schwartz

Room: 2011

**(TU) M10: Harnessing the Immune System to Treat Brain Tumors**

**Moderators:** Hideho Okada, E. Antonia Chiocca

**Faculty:** Gavin P. Dunn, Peter Fecci, Amy B. Heimberger, Michael Lim, Yoshitaka Narita

1:45–2:45 pm

**AFTERNOON BEVERAGE BREAK**

Visit the Exhibit Hall and enjoy a complimentary beverage. Coffee will be served throughout the Exhibit Hall and beer, wine, and snacks will be served in the CNS Xperience Lounge!

## Give to the Future of Neurosurgery

Please visit the CNS Foundation booth and silent auction across from registration on Level 1 of Moscone West. Donate today!

The CNS Foundation's philanthropic mission is to improve worldwide patient health by supporting innovative programs that allow neurosurgeons to collaborate globally as researchers, learners, educators, and caregivers. Visit [cns.org/Foundation](http://cns.org/Foundation) to help us achieve our goals.



**CNS**

Foundation

**Special Session: The FDA: Investigational Device Exemptions, Regulatory Process, and Moving Medical Devices to Patients (Non-CME)**

**Speakers:** Carlos Pena, Mohamad Bydon

The United States (U.S.) Food and Drug Administration (FDA) ensures that patients in the U.S. have access to safe and effective medical devices. The Division of Neurological and Physical Medicine Devices reviews medical devices that interface with the nervous system. This presentation will assist attendees in how to navigate the FDA's regulatory landscape to successfully move medical devices to patients.

- Agency Overview and Organization
- Neurological Medical Device Review and Oversight
- Clinical Overview and Perspectives
- Broader Engagement and Best Practices for FDA Engagement

**(RE) Special Session: ABNS Candidate Case Log: POST (Non-CME)**

**Course Directors:** John J. Knightly, Elad I. Levy

**Speakers:** Carl Heilman, John J. Knightly, Betsy Koehnen, Elad I. Levy

**Session Description:** Case reviews are a critical part of the certification process for the ABNS. In this high yield seminar, ABNS officers will provide a detailed yet focused review of how to use ABNS POST, the integrated platform for case submission. Officers will review what case information should be entered, what ABNS officers assess for each case that is submitted, and expectations for the “Cases” part of the oral certification exam.

1:45–1:55 pm

**Getting Set Up in ABNS POST to Start Entering Cases**

Betsy Koehnen

1:55–2:10 pm

**What Case Information Should Be Entered into POST?**

Elad I. Levy

2:10–2:25 pm

**How an ABNS Director Reviews a POST Case Log**

John J. Knightly

2:25–2:40 pm

**The “Cases” Section of the Oral Exam**

Carl Heilman

2:40–2:45 pm

**Questions and Discussion**



*Join Us for a Special Presentation by  
Dr. Alan Scarrow:*

**Executive Presence and a Glimpse  
into the CNS Leadership Institute**

Immediately following: Meet and greet, and book signing of his new release, “Hope over Experience: How Big Data, Automation, and AI Can Fix Healthcare”

Monday, October 21, at 9:40 am  
in the Xperience Lounge!



# AFTERNOON SESSIONS

## SECTION SESSIONS

(SE) 2:45–4:15 pm Room: 3016  
**COUNCIL OF STATE NEUROSURGICAL SOCIETIES**

### Achieving High Quality

**Moderators:** Darlene A. Mayo, Paul L. Penar

**Speakers:** Anthony L. Asher, Rachel Groman, John J. Knightly, Ahilan Sivaganesan

2:45–2:59 pm

### Data to Drive Quality Improvement

Anthony L. Asher

3:00–3:14 pm

### How Do I Implement Quality?

John J. Knightly

3:15–3:24 pm

### What Does the Government and CMS Think?

Rachel Groman

3:25–3:27 pm

### Questions and Discussion

3:27–3:33 pm

**Neurosurgery Socioeconomics, Health Policy, and Law Paper of the Year: Drivers of Variability in 90-day Cost for Elective Laminectomy and Fusion for Lumbar Degenerative Disease**

Ahilan Sivaganesan

3:33–4:15 pm

### Oral Abstract Presentations

*For a listing of Oral Presentations, see page 62.*

(CV) 2:45–4:15 pm Room: 2014

## SECTION ON CEREBROVASCULAR SURGERY

### Artificial Intelligence in Cerebrovascular Neurosurgery

**Moderator:** E. Sander Connolly

**Speakers:** Sepideh Amin-Hanjani, Hormuzdiyar H. Dasenbrock, Johanna Fifi, Eric K. Oermann, Alejandro M. Spiotta

2:45–2:55 pm

### AI in the Management of Acute Stroke

Johanna Fifi

2:55–3:05 pm

### AI as a Database Research Tool

Hormuzdiyar H. Dasenbrock

3:05–3:15 pm

### AI in Neuroimaging of Acute Neurologic Disease

Eric K. Oermann

3:15–3:25 pm

### AI in Clinical Decision Making

Alejandro M. Spiotta

3:25–3:27 pm

### Questions and Discussion

3:27–3:33 pm

**Neurosurgery Cerebrovascular Paper of the Year: Accuracy in Identifying the Source of Subarachnoid Hemorrhage in the Setting of Multiple Intracranial Aneurysms**

Sepideh Amin-Hanjani

3:33–4:15 pm

### Oral Abstract Presentations

*For a listing of Oral Presentations, see page 62.*

(SP) 2:45–4:15 pm Room: 2016

## SECTION ON DISORDERS OF THE SPINE AND PERIPHERAL NERVES

### Spine Section Update

**Moderators:** Domagoj Coric, Michael P. Steinmetz

**Speakers:** Regis W. Haid, Paul K. Kim, Paul Park, Kevin M. Walsh, Michael Y. Wang

2:45–2:53 pm

### Outpatient Degenerative Spine Surgery: Patient Outcomes, Realities, and Finances

Paul K. Kim

2:54–3:02 pm

### Pushing the Envelope of Spine Surgery: Update on ERAS, Outpatient Surgery, and Awake TLIFs

Michael Y. Wang

3:03–3:11 pm

**Cervical Stenosis Without Myelopathy in Lumbar Pathology Patients: Do We Really Always Need to Decompress the Cervical Spine Before Lumbar Surgery?**

Paul Park

3:12–3:20 pm

### Cervical Laminectomy and Fusion: Should We Always Go to T1 or is Stopping at C7 Just as Good?

Kevin M. Walsh

3:21–3:28 pm

### Interbody Surface Technology Update: Is it Worth the Additional Cost? The Evidence

Regis W. Haid

3:29–4:15 pm

### Oral Abstract Presentations

*For a listing of Oral Presentations, see pages 62–63.*

(TR) 2:45–4:15 pm Room: 3022

## SECTION ON NEUROTRAUMA AND CRITICAL CARE

**Moderators:** Ramesh Grandhi, Daniel B. Michael

**Speakers:** Richard G. Fessler, D. Jay McCracken, J. Marc Simard

2:45–3:05 pm

### Charles Tator Lecture – Bench to Bedside to Bench: A Physician-scientists 30-Year Journey in the World of Spinal Cord Injury

Richard G. Fessler

3:05–3:25 pm

### Edema in Traumatic Brain Injury

J. Marc Simard

3:25–3:31 pm

### Neurosurgery Neurotrauma and Critical Care Paper of the Year: The Intracerebral Hemorrhage Score: A Self-Fulfilling Prophecy?

D. Jay McCracken

3:31–4:15 pm

### Oral Abstract Presentations

*For a listing of Oral Presentations, see page 63.*



(PA) 2:45–4:15 pm Room: 3024

### SECTION ON PAIN

#### Complex Facial Pain: When to Use What

Moderators: Sean J. Nagel, Ahmed M.T. Raslan

Speakers: Sharona Ben-Haim, Sean J. Nagel, Julie G. Pilitsis, Konstantin V. Slavin, Doris D. Wang

2:45–2:55 pm

#### Characterization of Complex Facial Pain Syndromes

Sharona Ben-Haim

2:56–3:06 pm

#### Neuromodulation Options for Complex Facial Pain

Konstantin V. Slavin

3:07–3:17 pm

#### Management of Recurrent TN/Revision MVD

Doris D. Wang

3:18–3:28 pm

#### When to Use What: Lesioning Versus Decompression Versus Neuromodulation for Complex Facial Pain

Sean J. Nagel

3:28–3:34 pm

#### Neurosurgery Pain Paper of the Year: Spinal Cord Stimulation for the Treatment of Chronic Pain Reduces Opioid Use and Results in Superior Clinical Outcomes When Used Without Opioids

Julie G. Pilitsis

3:34–4:15 pm

#### Oral Abstract Presentations

For a listing of Oral Presentations, see pages 63–64.

(PE) 2:45–4:15 pm Room: 3018

### SECTION ON PEDIATRIC NEUROLOGICAL SURGERY

#### Pediatric Brain Tumors: Advancements in Molecular Diagnosis and Update on Clinical Trials

Moderators: Toba Niazi, Amanda Muhs Saratsis

Speakers: Paul Klimo, Alyssa Reddy

2:45–3:19 pm

#### Discussion and Update on Advancements in Pediatric Brain Tumors, the Molecular Basis of Diagnosis, Current and Upcoming Clinical Trials, and Personalized Medicine

Alyssa Reddy

3:20–3:27 pm

#### Questions and Discussion

3:27–3:33 pm

#### Neurosurgery Pediatrics Paper of the Year: The Preventable Shunt Revision Rate: A Multicenter Evaluation

Paul Klimo, Jr.

3:33–4:15 pm

#### Oral Abstract Presentations

For a listing of Oral Presentations, see page 64.

(PN) 2:45–4:15 pm Room: 2018

### SECTION ON PERIPHERAL NERVES

#### Peripheral Nerve Task Force

Moderators: Lukas G. Rasulic, Lynda J. Yang

Speakers: B. Indira Devi, Mark A. Mahan, Wilson Z. Ray

2:45–3:02 pm

#### Nerve Transfers for Spinal Cord Injury: Results of a Prospective Trial

Wilson Z. Ray

3:03–3:20 pm

#### Targeted Muscle Reinnervation: Ready for Prime Time?

Mark A. Mahan

3:20–3:26 pm

#### Neurosurgery Peripheral Nerve Paper of the Year: Novel Findings in Obstetric Brachial Plexus Palsy: A Study of Corpus Callosum Volumetry and Resting-State Functional Magnetic Resonance Imaging of Sensorimotor Network

B. Indira Devi

3:26–4:15 pm

#### Oral Abstract Presentations

For a listing of Oral Presentations, see pages 64–65.

(SF) 2:45–4:15 pm Room: 3020

### SECTION ON STEREOTACTIC AND FUNCTIONAL NEUROSURGERY

#### The Future of Preoperative Functional Mapping

Moderators: Ellen L. Air, Nitin Tandon

Speakers: Raag Airan, Dario J. Englot, Hui Ming Khoo, Bomin Sun

2:45–2:58 pm

#### EEG-fMRI and Network-based Mapping for Localizing Epilepsy Foci

Hui Ming Khoo

2:59–3:12 pm

#### Focused US for Non-invasively Probing Brain Circuits

Raag Airan

3:13–3:26 pm

#### Connectivity-based Preoperative Functional Mapping to Predict Outcomes

Dario J. Englot

3:27–3:33 pm

#### Neurosurgery Stereotactic and Functional Paper of the Year: Long-Term Follow-up Study of MRI-Guided Bilateral Anterior Capsulotomy in Patients With Refractory Anorexia Nervosa

Bomin Sun

3:34–4:15 pm

#### Oral Abstract Presentations

For a listing of Oral Presentations, see page 65.

(TU) 2:45–4:15 pm Room: 3014

### SECTION ON TUMORS

#### Complications in Tumor Surgery: Navigating the Unexpected

Moderators: Wenya L. Bi, Walavan Sivakumar

Speakers: Frederick G. Barker, Mitchel S. Berger, William T. Couldwell, Daniel F. Kelly, Michael A. Vogelbaum

2:45–2:55 pm

#### Open Skull Base

William T. Couldwell

2:55–3:05 pm

#### Glioma Tumor Surgery Complications

Mitchel S. Berger

3:05–3:15 pm

#### Navigating Medicolegal Complications

Frederick G. Barker

3:15–3:25 pm

#### Endoscopic and Keyhole Surgery Complications

Daniel F. Kelly

3:25–3:28 pm

#### Questions and Discussion

3:28–3:34 pm

**Neurosurgery Tumor Paper of the Year: Phase I Trial of Radiosurgery Dose Escalation Plus Bevacizumab in Patients With Recurrent/Progressive Glioblastoma**  
Michael A. Vogelbaum

## OPERATIVE TECHNIQUES AND CASE-BASED DISCUSSION SESSIONS

(SE) 4:15–5:45 pm Room: 3016

### **CSNS: How to Build a Spine Center**

**Moderators:** James S. Harrop, Anand Veeravagu

**Speakers:** Khalid M. Abbed, James S.

Harrop, Richard N. Wohns

4:16–4:30 pm

### **Lessons Learned from Working with our Orthopedic Colleagues**

James S. Harrop

4:31–4:45 pm

### **Building a Regional Network**

Khalid M. Abbed

4:46–5:00 pm

### **Lessons on ASCs and Outpatient Surgery**

Richard N. Wohns

5:01–5:15 pm

### **Questions and Discussion**

5:16–5:40 pm

### **Abstract Presentations**

*For a listing of Oral Presentations, see page 66.*

5:41–5:45 pm

### **Questions and Discussion**

(TU) 4:15–5:45 pm Room: 3014

### **Challenging Skull Based Tumors: Operative Techniques and Case-based Discussions**

**Moderator:** Jacques J. Morcos

**Case Discussants:** Lola B. Chambless, John G. Golfinos,

Anil Nanda, Nelson M. Oyesiku, Marc S. Schwartz

**Speakers:** Juan C. Fernandez-Miranda, Akihide Kondo, Soichi Oya

4:16–4:25 pm

### **Surgeries for Optic Nerve Tumors**

Akihide Kondo

4:26–4:35 pm

### **Extended Middle Fossa Approach with Anterior Petrosectomy and Anterior Clinoidectomy for Resection of Spheno-Cavernous-Tentorial Meningioma: The Hakuba-Kawase-Dolenc Approach: 3-Dimensional Operative Video**

Juan C. Fernandez-Miranda

4:36–4:45 pm

### **Ultra-Early Optic Nerve Decompression for the Resection of Anterior Clinoidal Meningioma**

Soichi Oya

4:46–4:59 pm

### **Abstract Presentations**

*For a listing of Oral Presentations, see pages 67-68.*

5:00–5:45 pm

### **Case-based Discussion**

3:34–4:15 pm

### **Oral Abstract Presentations**

*For a listing of Oral Presentations, see page 65.*

(CV) 4:15–5:45 pm Room: 2014

### **Treating Cerebral Vascular Malformations: Operative Techniques and Case-based Discussions**

**Moderator:** Joshua W. Osbun

**Case Discussants:** Daniel L. Barrow, C. Michael Cawley, Andrew F. Ducruet, Michael R. Levitt, Min S. Park, Jonathan Russin, Linda Xu, Gregory J. Zipfel

**Speakers:** Joshua B. Bederson, Jan-Karl Burkhardt

4:16–4:25 pm

### **A Virtual-reality, 360-degree Fly-through of an Arteriovenous Malformation Resection: 2-dimensional Operative Video**

Joshua B. Bederson

4:26–4:35 pm

### **Combination Superficial Temporal Artery-Middle Cerebral Artery Bypass and M2–M2 Reanastomosis With Trapping of a Stented Distal Middle Cerebral Artery Aneurysm: 3-Dimensional Operative Video**

Jan-Karl Burkhardt

4:36–5:00 pm

### **Abstract Presentations**

*For a listing of Oral Presentations, see page 66.*

5:00–5:45 pm

### **Case-based Discussion**

(SP) 4:15–5:45 pm Room: 2016

### **Spinal Deformity and MIS Surgery: Operative Techniques and Case-based Discussions**

**Moderators:** Yi Lu, Alfred T. Ogden

**Case Discussants:** Ali A. Baaj, Tyler R. Koski, Catherine Miller-Simington, Ron I. Riesenburger, Alexander E. Ropper, Charles A. Sansur

**Speakers:** Rajiv Iyer, Joshua W. Lucas

4:16–4:25 pm

### **Minimally Invasive Extraforaminal Discectomy Operative Neurosurgery Video**

Joshua W. Lucas

4:26–4:35 pm

### **Use of an Articulating Hinge to Facilitate Cervicothoracic Deformity Correction During Vertebral Column Resection Operative Neurosurgery Video**

Rajiv Iyer

4:36–5:00 pm

### **Abstract Presentations**

*For a listing of Oral Presentations, see page 66.*

5:00–5:45 pm

### **Case-based Discussion**

(TR) 4:15–5:45 pm Room: 3022

### **TBI and AI: Operative Techniques and Case-based Discussions**

**Moderators:** Gregory J. Murad, Martina Stippler

**Case Discussants:** Samuel R. Browd, Ramesh

Grandhi, Emily P. Sieg, Eve C. Tsai

4:15–4:39 pm

#### **Abstract Presentations**

*For a listing of Oral Presentations, see pages 66–67.*

4:40–5:45 pm

#### **Case-based Discussion**

(PA) 4:15–5:45 pm Room: 3024

### **The Case Against Spinal Cord Stimulation: Operative Techniques and Case-based Discussion**

**Moderators:** Gaddum D. Reddy, Jason M. Schwalb

**Speakers and Case Discussants:** Steven M. Falowski, Wendall B. Lake, Jason M. Schwalb, Konstantin V. Slavin, Christopher J. Winfree

4:17–4:26 pm

#### **Review the Literature that Shows Poor Outcomes/Poor Responders/Placebo Effect**

Steven M. Falowski

4:27–4:36 pm

#### **Why Does SCS Fail Long Term**

Wendall B. Lake

4:37–4:46 pm

#### **Complications and Patient Complaints**

Konstantin V. Slavin

4:47–4:56 pm

#### **Cost Analysis**

Jason M. Schwalb

4:57–5:06 pm

### **Alternatives-revision Spine Surgery: Medications and Marijuana**

Christopher J. Winfree

5:06–5:45 pm

#### **Oral Abstract Presentations**

5:30–5:45 pm

#### **Case-based Discussion**

(PE) 4:15–5:45 pm Room: 3018

### **Recurrent Disease in Pediatric Brain Tumors Patients: Case-based Discussions and Operative Techniques**

**Moderator:** Liliana Goumnerova

**Case Discussants:** Susan R. Durham, Stephanie Greene,

Jason S. Hauptman, Eric M. Jackson, Mark D. Krieger,

Amanda M. Saratsis

**Speakers:** William T. Couldwell, Thomas Santarius

4:16–4:25 pm

### **Management of Complex Pediatric Chordoma: Transnasal and Bilateral Far-lateral Approach for Resection with O-C4 Fusion: 3-Dimensional Operative Neurosurgery Video**

William T. Couldwell

4:26–4:35 pm

### **Radical, Staged Approach to Extensive Posterior Fossa Pediatric Ependymoma: 3-Dimensional Operative Neurosurgery Video**

Thomas Santarius

4:36–4:54 pm

#### **Abstract Presentations**

*For a listing of Oral Presentations, see page 67.*

4:55–5:45 pm

#### **Case-based Discussion**

(SF) 4:15–5:45 pm Room: 3020

### **Challenging Cases in Epilepsy Surgery: Operative Techniques and Case-based Discussions**

**Moderator:** Joseph S. Neimat

**Case Discussants:** Ausaf A. Bari, Sharona Ben-Haim, Robert A. McGovern

**Speakers:** N. U. Farrukh Hameed, Jorge A. Gonzalez-Martinez

4:16–4:25 pm

#### **sEEG Implant Strategies: Operative Neurosurgery Video**

Jorge A. Gonzalez-Martinez

4:26–4:35 pm

### **Perioperative Multimodal Evaluation and Surgical Tactics of Tumor-Related Epilepsy: 2-Dimensional Operative Neurosurgery Video**

N. U. Farrukh Hameed,

4:36–5:00 pm

#### **Abstract Presentations**

*For a listing of Oral Presentations, see page 67.*

5:00–5:45 pm

#### **Case-based Discussion**

(PN) 4:15–5:45 pm Room: 2018

### **Peripheral Nerve: Operative Techniques and Case-based Discussions**

**Moderators:** Rajiv Midha, Robert J. Spinner, Gabriel C. Tender, Eric L. Zager

**Discussants:** Zarina S. Ali, Justin M. Brown, Amgad S. Hanna, Line G. Jacques, Mark A. Mahan, Shaun T. O'Leary, Christopher J. Winfree

4:15–4:35 pm

### **Technical Nuances and Cases: Benign Peripheral Nerve Tumors**

**Moderator:** Robert J. Spinner

**Discussants:** Zarina S. Ali, Line G. Jacques

4:35–4:55 pm

### **Technical Nuances and Cases: Carpal Tunnel Release (Endoscopic Versus Open)**

**Moderator:** Gabriel C. Tender

**Discussants:** Mark A. Mahan, Christopher J. Winfree

4:55–5:15 pm

### **Technical Nuances and Cases: Ulnar Nerve Decompression (Anterior Transposition Versus in Situ)**

**Moderator:** Rajiv Midha

**Discussants:** Justin M. Brown, Shaun T. O'Leary

5:15–5:35 pm

### **Technical Nuances and Cases: Meralgia Paresthetica (Neurectomy Versus Decompression)**

**Moderator:** Eric L. Zager

**Discussants:** Amgad S. Hanna, Line G. Jacques

5:35–5:45 pm

#### **Questions on the Case Discussion**

Line G. Jacques, Robert J. Spinner

## INTERNATIONAL SYMPOSIA

**NEW** to the 2019 Scientific Program are three International Symposia, which feature world-renowned neurosurgeons sharing their insights on these cutting-edge topics.

**TU** 5:45–7:15 pm Room: 3001

### THE INTERNATIONAL MASTERS SYMPOSIUM ON BRAIN TUMOR SURGERY

**Moderators:** Mitchel S. Berger, George Samandouras

**Speakers:** Mitchel S. Berger, Fred Gentili, Takeshi Kawase, George Samandouras, Theodore H. Schwartz

5:45–6:02 pm

#### USA—Mapping Techniques for Low-grade Gliomas

Mitchel S. Berger

6:03–6:20 pm

#### Japan—Surgery in the Cavernous Sinus

Takeshi Kawase

6:21–6:38 pm

#### Canada—Skull Base Meningioma Surgery

Fred Gentili

6:39–6:56 pm

#### Endoscopic Pituitary Surgery

Theodore H. Schwartz

6:57–7:14 pm

#### UK—Surgery for Insular Gliomas

George Samandouras

7:14–7:15 pm

#### Questions and Discussion

**CV** 5:45–7:15 pm Room: 3003

### THE INTERNATIONAL CEREBROVASCULAR SYMPOSIUM

**Moderators:** Miki Fujimura, Clemens M. Schirmer

**Speakers:** Tomohito Hishikawa, Ichiro Nakagawa, Philipp Taussky

5:45–5:55 pm

#### Natural History and Management Strategy for Intracranial Aneurysms

Tomohito Hishikawa

5:56–6:10 pm

#### Endovascular Management of Complex Intracranial Aneurysms

Philipp Taussky

6:11–6:21 pm

#### Management Strategy for Cervical ICA: Hybrid Surgeon's Choice

Ichiro Nakagawa

6:22–6:32 pm

#### Current Status of EC-IC Bypass: New Evidence in Moyamoya Disease

Miki Fujimura

6:33–6:38 pm

#### Questions and Discussion

6:39–7:15 pm

#### International Oral Abstract Presentations

For a listing of Oral Presentations, see page 68.

**SF** 5:45–7:15 pm Room: 3002

### THE INTERNATIONAL FUNCTIONAL NEUROSURGERY SYMPOSIUM

**Moderators:** Jorge A. Gonzalez-Martinez, Makoto Taniguchi

**Speakers:** Masaki Iwasaki, Hui Ming Khoo, Takaomi Taira

5:45–6:00 pm

#### Current Status and Future Perspective of Epilepsy Surgery in Japan

Masaki Iwasaki

6:01–6:16 pm

#### Recent Advance in Epilepsy Research

Hui Ming Khoo

6:17–6:32 pm

#### Stereotactic Lesioning for Dystonia and Movement Disorders

Takaomi Taira

6:33–6:38 pm

#### Questions and Discussion

6:39–7:15 pm

#### International Oral Abstract Presentations

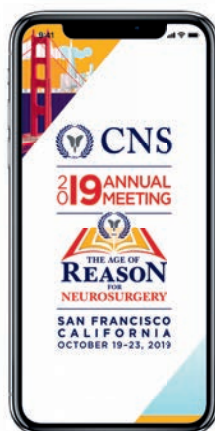
For a listing of Oral Presentations, see page 68.

## STAY CONNECTED

**DOWNLOAD** the 2019 CNS Annual Meeting App to have the latest schedules, breaking updates, and content in the palm of your hand.

Visit <https://ativ.me/cns2019>, click on your preferred platform (iOS, Android, or web) and follow the prompts to download.

- Review all courses, speakers, exhibitors, and events
- View all meeting abstracts
- Create your own preferred schedule each day
- Keep notes and activity logs in real time, in one place



Manage your schedule  
Download the free app

Scan the QR code or enter the URL in your device browser to download



Powered by **EventPilot®**



# THANK YOU

## INDUSTRY AMBASSADOR



**DePuy Synthes**

COMPANIES OF *Johnson & Johnson*



**CERENOVUS**

PART OF THE *Johnson & Johnson* FAMILY OF COMPANIES

## FOR YOUR VALUABLE SUPPORT!



## DINNER SEMINAR 2 | MONDAY, OCTOBER 21 | 7:30–9:30 PM

\$190 (includes three-course dinner and beverages)

### CV **DIN2: Multi-modality AVM Treatment in the Past, Present, and Future**

**Moderator:** E. Sander Connolly

**Faculty:** Kevin M. Cockroft, Jason Davies, Iris C. Gibbs, Douglas Kondziolka, Babu G. Welch



#### **PROSPECT**

Prospect hosts a warm and modern urban environment, with high service standards and exceptional cuisine. The restaurant offers local sustainable, organic ingredients staying consistent with what you would expect from this San Francisco gem.

On Zagat's Best Restaurant and Best Craft Cocktails lists in SoMa (South of Market neighborhood).

*Complimentary shuttle service will depart from the San Francisco Marriott Marquis at 7:15 pm.*

## DINNER SEMINAR 3 | MONDAY, OCTOBER 21 | 7:30–9:30 PM

\$190 (includes three-course dinner and beverages)

### SP **DIN3: Navigation and Robotics: Fad or Future?**

**Moderators:** Paul Park, Mark E. Shaffrey

**Faculty:** Victor W. Chang, Domagoj Coric, Laura A. Snyder, Nicholas Theodore, Juan S. Uribe, Michael Y. Wang



#### **MORTON'S**

Enjoy a classic steakhouse experience with perfectly cooked chops and welcoming service at Morton's. This high-end restaurant is newly renovated and offers an award-winning wine list.

Morton's Steakhouse is the top-scoring Fine-dining Chain in National Restaurant News' Consumer Picks of 2016.

*Complimentary shuttle service will depart from the San Francisco Marriott Marquis at 7:15 pm.*

## Visit the CNS Xperience Lounge in the Exhibit Hall

***Connect with colleagues, grab a beverage, and see what's next on your agenda!***

- Connect with the CNS Membership Team
- Innovator of the Year Finalists
- Digital Posters
- Book signings with Featured Speakers
- Meet Honored Guest, Raymond Sawaya, MD
- Alan Scarrow Presentation and Book Signing
- Voices of Neurosurgery: The Unforgettable Moments
- Gary Simonds Presentation and Book Signing
- NVIDIA: Artificial Intelligence for Neurosurgeons – A Hands-on Demo
- Wellness Afternoon: Tuesday at 1:45–2:45 pm

**For a complete schedule check the CNS Meeting App!**

# GUIDELINES AND SUNRISE SCIENCE

7:00–8:30 am

Room: 2016

## SPINE SUNRISE SCIENCE AND LATE-BREAKING ABSTRACT SESSION

Moderators: Nathaniel P. Brooks, Kevin M. Walsh

For a listing of Sunrise Science and Late-breaking Oral Presentations, please see page 70.

7:00–8:30 am

Room: 3018

## PEDIATRIC SUNRISE SCIENCE AND LATE-BREAKING ABSTRACT SESSION

Moderators: Stephanie Greene, David S. Hong

For a listing of Sunrise Science and Late-breaking Oral Presentations, please see page 71.

7:00–8:30 am

Room: 3016

## COUNCIL OF STATE NEUROSURGICAL SOCIETIES SUNRISE SCIENCE AND LATE-BREAKING ABSTRACT SESSION

Moderators: Kristopher T. Kimmell, Analiz Rodriguez

For a listing of Sunrise Science and Late-breaking Oral Presentations, please see page 69.

**TU** 7:00–8:30 am

Room: 3014

## Guidelines on Management on Brain Metastases Update

Moderators: Melanie H. Gephart, Jonathan H. Sherman

Speakers: James B. Elder, Ricardo J. Komotar, Michael A. Vogelbaum, Y. Josh Yamada

7:00–7:05 am

### Introduction

7:05–7:25 am

### Treatment Strategies for Single Versus Multiple Metastases

Ricardo J. Komotar

7:25–7:45 am

### The Tipping Point: When to use SRS Versus WBRT

Y. Josh Yamada

7:45–8:05 am

### The Role of Emerging Therapies Including LITT and Brachytherapy: The Need for Clinical Trials

James B. Elder

8:05–8:25 am

### Brain Metastasis Guidelines: A Critical Overview

Michael A. Vogelbaum

8:25–8:30 am

### Questions and Discussion

**TR** 7:00–8:30 am

Room: 3022

## The Voice of Reason in Brain Death: From Bedside to the News

Moderators: Kathryn M. Beauchamp, Jamie S. Ullman

Speakers: Justin Davanzo, Flora Hammond, Shaun D. Rodgers, Uzma Samadani

7:00–7:20 am

### Status Quo of Brain Death: Guidelines and Protocols

Justin Davanzo

7:20–7:50 am

### Behavioral Recovery and Early Decision-making in Disorders of Consciousness

Flora Hammond

7:50–8:10 am

### Brain Death in the Media

Uzma Samadani

8:10–8:30 am

### Mastering Pediatric Brain Death Determination

Shaun D. Rodgers

## SUBSPECIALTY SESSION HIGHLIGHTS KEY

**AP** ADVANCED PRACTICE PROVIDER

**CV** CEREBROVASCULAR

**TR** NEUROTRAUMA

**PA** PAIN

**PE** PEDIATRIC

**PN** PERIPHERAL NERVES

**RE** RESIDENT

**SE** SOCIOECONOMIC

**SP** SPINE

**SF** STEREOTACTIC AND FUNCTIONAL

**TU** TUMOR

**WINS** WINS



TUESDAY, OCTOBER 22 | 8:40 AM–12:10 PM | BALLROOM

# GENERAL SCIENTIFIC SESSION III

Presiding Officer: Brian L. Hoh

Moderators: Ashok R. Asthagiri, Jennifer A. Sweet

8:40–8:42 am

## Introduction and Disclosures

Brian L. Hoh

8:42–8:45 am

## NEUROSURGERY® Publications Update

Nelson M. Oyesiku

8:45–8:51 am

## Neurosurgery Top and Spine Paper of the Year: Symptomatic Adjacent Level Disease Requiring Surgery: Analysis of 10-Year Results From a Prospective, Randomized, Clinical Trial Comparing Cervical Disc Arthroplasty to Anterior Cervical Fusion

Allan D. Levi



8:51–9:13 am

## Honored Guest Presentation: Evidence-based Medicine Through Development of Home-grown Databases

Raymond Sawaya

9:13–9:15 am

## Introduction of Carl Zimmer

Garni Barkhoudarian



9:15–9:40 am

## FEATURED SPEAKER Journey to the Center of the Brain

Carl Zimmer



Carl Zimmer

will be signing copies of his book, “She Has Her Mother’s Laugh: The Powers, Perversions, and Potential of Heredity,” in the CNS Xperience Lounge during the morning beverage break.

9:40–10:40 am

## MORNING BEVERAGE BREAK Visit the Exhibit Hall and enjoy a complimentary cup of coffee!

10:00–10:30 am

## LIVE SURGERY IN THE EXHIBIT HALL

See page 20 for details.

10:40–10:44 am

## AANS President

Christopher I. Shaffrey

10:44–10:49 am

## Washington Committee

Ann R. Stroink

10:49–10:51 am

## Introduction of Controversy: Clinical Trials, Ethics, and Stem Cells: Are RCTs Necessary to Validate a Novel Therapy?

Robert E. Gross

10:51–10:59 am

## Controversies: RCTs Are Not Necessary and Might Not Be Ethical

Richard G. Fessler

10:59–11:07 am

## Controversies: RCTs are Always Necessary for New Therapies

Gary K. Steinberg

11:07–11:12 am

## Controversies: Discussion and Outcomes

Robert E. Gross

11:12–11:20 am

## Neurosurgery Update: Cutting Edge in NeuroTrauma: Severe TBI Algorithm

Randall M. Chesnut

11:20–11:28 am

## Neurosurgery Update: Cutting Edge in Cerebrovascular Surgery

Adnan H. Siddiqui



11:28–11:30 am

## Educator of the Year Award Presentation

Neil E. Roundy

Presented by Ganesh Rao



11:30–11:33 am

## Distinguished Service Award Presentation

David C. Berg

Presented by Ashwini D. Sharan



11:33–11:36 am

## Founder’s Laurel Award Presentation

Daniel L. Barrow

Presented by Ashwini D. Sharan

11:36–11:41 am

## SNS Update

Karin M. Muraszko

11:41–11:43 am

## Introduction of Bret Stephens

Nicholas C. Bambakidis



11:43–12:10 pm

## FEATURED SPEAKER U.S. Foreign Policy and the World

Bret Stephens



Bret Stephens will be signing copies of his book, “America in Retreat,” in the CNS Xperience Lounge immediately following the conclusion of this session.



# LUNCHEON SEMINARS

All Luncheon Seminars include a plated lunch served in the seminar room.

Luncheon Seminar fee is \$95 each (\$75 for residents, fellows, graduate students/post-doctoral scholars, medical students, and advance practice providers). Add a Luncheon Seminar to your profile at registration.

Room: 2001

**(PA) T11: Perioperative Pain Management: Opioids, Non-opioids, and Neurosurgery Advocacy**

**Moderators:** Robert F. Heary, Christopher J. Winfree

**Faculty:** Victor W. Chang, Joshua M. Rosenow, Jason M. Schwalb, Jennifer A. Sweet

Room: 2003

**(CV) T12: Carotid Artery Disease: Symptomatic/Asymptomatic/Stent/CEA**

**Moderator:** Stacey Q. Wolfe

**Faculty:** Mark R. Harrigan, Brian T. Jankowitz, Adnan H. Siddiqui, Justin A. Singer, John A. Wilson

Room: 2005

**(SP) T13: Peak Performance: Optimizing the Spine Surgical Patient from Pre-op to Post-op**

**Moderators:** Scott A. Meyer, Laura A. Snyder, Marjorie C. Wang

**Faculty:** Christopher M. Holland, Luke Macyszyn, Hesham M. Soliman, Michael S. Virk, Robert G. Whitmore

Room: 2007

**(SP) T14: Controversies in Spinal Deformity Surgery**

**Moderator:** Christopher P. Ames

**Faculty:** Richard G. Fessler, Kai-Ming G. Fu, Robert F. Heary, Justin S. Smith, Jay D. Turner, Juan S. Uribe

Room: 2008

**(TR) T15: Is There an Outcome Worse than Death: Outcome, Palliative Care, and Ethical Considerations in Neurosurgical Care**

**Moderator:** Martina Stippler

**Faculty:** Nicholas J. Brandmeir, Flora Hammond, Kimberly P. Kicielski

Room: 2009

**(TR) T16: Patient Specific Goal-directed Therapy in TBI**

**Moderator:** Julian E. Bailes Jr.

**Faculty:** Randall M. Chesnut, Gregory W.J. Hawryluk, Laura B. Ngwenya, Eiichi Suehiro, Lori Shutter

Room: 2010

**(SF) T17: Clinical Trials in Movement Disorder Surgery**

**Moderators:** Sharona Ben-Haim, Ashwin Viswanathan

**Faculty:** H. Isaac Chen, John D. Rolston

Room: 2012

**(TU) T18: Management of Pituitary Adenomas and Parasellar Pathology**

**Moderators:** Daniel F. Kelly, Pamela S. Jones

**Faculty:** Paul A. Gardner, Anand V. Germanwala, Nelson M. Oyesiku, Dimitris G. Placantonakis, Daniel M. Prevedello, Gabriel Zada

Room: 2011

**(TU) T19: Malignant Gliomas: Advances in Surgery and Adjuvant Therapy**

**Moderators:** Jeffrey N. Bruce, James B. Elder

**Faculty:** E. Antonio Chiocca, Gavin P. Dunn, Constantinos G. Hadjipanayis, Melanie Hayden Gephart

Room: 2000

**(WINS) T20: Beating Press Ganey**

**Moderator:** Ellen L. Air

**Faculty:** Sharona Ben-Haim, Sheri Dewan, Lauren Ostling

1:00–2:00 pm Room 3002

**NEUROSURGERY® PUBLICATIONS:**

**MEET THE EDITORS**

Hear from leading voices in scholarly publishing! The NEUROSURGERY® Publications: Meet the Editors Session is open to all attendees free of charge. Attendees will hear from the following editors of leading neurosurgical journals:

**Edward C. Benzel, MD**

Editor-in-Chief,  
*World Neurosurgery*

**Nancy E. Epstein, MD, FACS**

Editor-in-Chief,  
*Surgical Neurology International*

**Tiit Mathiesen, MD, PhD**

Editor-in-Chief,  
*Acta Neurochirurgica*

**Nelson M. Oyesiku, MD, PhD, FACS**

Editor-in-Chief,  
NEUROSURGERY® Publications

**James T. Rutka, MD, PhD**

Editor-in-Chief,  
Journal of Neurosurgery Publishing Group

**Peter C. Warnke, MD, Dr.med., FRCS**

Associate Editor,  
*Journal of Neurology, Neurosurgery and Psychiatry*

1:45–2:45 pm Room: 2018

## RESIDENT SANS CHALLENGE CHAMPIONSHIP ROUND



1:45–2:45 pm

## AFTERNOON BEVERAGE BREAK

Visit the Exhibit Hall and enjoy a complimentary beverage. Coffee will be served throughout the Exhibit Hall and fresh fruit smoothies will be served in the CNS Xperience Lounge!

2:00–2:45 pm Room: 3001

## ANNUAL BUSINESS MEETING

Please plan to attend the Annual Business Meeting to hear an update on CNS business from the past year. CNS members will have the opportunity to vote on any proposed bylaws amendments. **All Members Welcome!**

TUESDAY, OCTOBER 22

# AFTERNOON SESSIONS

## SECTION SESSIONS

(SE) 2:45–4:15 pm Room: 3016

### COUNCIL OF STATE NEUROSURGICAL SOCIETIES

#### What Is Value

**Moderators:** Joseph S. Cheng, Deborah L. Benzil

**Speakers:** Deborah L. Benzil, John K. Ratliff

2:45–3:03 pm

#### Value—An Easily Defined Concept

Deborah L. Benzil

3:04–3:22 pm

#### Value-based Care

John K. Ratliff

3:23–3:27 pm

#### Questions and Discussion

3:27–4:15 pm

#### Oral Abstract Presentations

*For a listing of Oral Presentations, see page 72.*

(CV) 2:45–4:15 pm Room: 2014

### SECTION ON CEREBROVASCULAR SURGERY

#### Future Training of the Cerebrovascular Surgeon

**Moderators:** Judy Huang, Murat Gunel

**Speakers:** Daniel L. Barrow, C. Michael Cawley, Brian L. Hoh, Louis J. Kim, Elad I. Levy

2:45–2:55 pm

#### Modern Open Cerebrovascular Training

Daniel L. Barrow

2:55–3:05 pm

#### Modern Endovascular Training

Elad I. Levy

3:05–3:15 pm

#### Simultaneous Combined Training

C. Michael Cawley

3:15–3:27 pm

#### Questions for the Panel

3:27–4:15 pm

#### Oral Abstract Presentations

*For a listing of Oral Presentations, see pages 72-73.*

(PN) (SP) 2:45–4:15 pm Room: 2016

### SECTION ON DISORDERS OF THE SPINE AND PERIPHERAL NERVES

#### Spine Update: The Evidence

**Moderators:** Erica F. Bisson, John H. Chi, Eric A. Potts, John H. Shin

**Speakers:** Dean Chou, Zoher Ghogawala, Praveen V. Mummaneni, William R. Taylor, Juan S. Uribe

2:45–2:53 pm

#### Lateral Stand-alone Corrects Stenosis and Does Not Subside: The Evidence

William R. Taylor

2:54–3:02 pm

#### Lateral Stand-alone Subsides and Fails to Correct Stenosis: The Evidence

Juan S. Uribe

3:03–3:11 pm

#### Discussant: Lateral Stand-alone Versus with Posterior Fixation: The Final Analysis

Dean Chou

3:12–3:20 pm

#### Degenerative Adult Scoliosis: Is MIS Ready for Prime Time or Should We Really Just Do These Open?

Praveen V. Mummaneni

3:21–3:29 pm

#### L4-5 Degenerative Spondylolisthesis with Stenosis: Decompression Only—Are we Just Avoiding the Inevitable Fusion Later?

Zoher Ghogawala

3:29–4:15 pm

#### Oral Abstract Presentations

*For a listing of Oral Presentations, see page 73.*

(SF) (TR) 2:45–4:15 pm Room: 3022

## SECTION ON NEUROTRAUMA AND CRITICAL CARE

### Neuromodulation for Spinal Cord Injury

Moderators: Ann M. Parr, Craig H. Rabb

Speaker: V. Reggie Edgerton

2:45–3:14 pm

### Epidural Stimulation in Patients with Spinal Cord Injury

V. Reggie Edgerton

3:15–3:27 pm

### Questions and Discussion

3:28–4:15 pm

### Oral Abstract Presentations

For a listing of Oral Presentations, see pages 73-74.

(PA) 2:45–4:15 pm Room: 3024

## SECTION ON PAIN

### Targets Outside the Dorsal Columns for Pain

Moderators: Nicholas Au Yong, Ashwin Viswanathan

Speakers: Ausaf A. Bari, Nicholas M. Boulis, Sameer A. Sheth, Ido Strauss, Ashwin Viswanathan

2:45–2:53 pm

### Cingulotomy & Capsulotomy for Pain

Sameer A. Sheth

2:54–3:02 pm

### DBS for Pain

Ausaf A. Bari

3:03–3:11 pm

### DRG Stimulation for Pain

Ashwin Viswanathan

3:12–3:20 pm

### Peripheral Nerve Stimulation

Nicholas M. Boulis

3:21–3:29 pm

### Future Therapies for Pain

Ido Strauss

3:29–4:15 pm

### Oral Abstract Presentations

For a listing of Oral Presentations, see page 74.

(PE) 2:45–4:15 pm Room: 3018

## SECTION ON PEDIATRIC NEUROLOGICAL SURGERY

### Post-hemorrhagic Hydrocephalus in Premature Infants: Time for a Paradigm Shift?

Moderators: Sandi Lam, Brandon G. Rocque

Speakers: Edward S. Ahn, Samuel R. Browd

### Post-hemorrhagic Hydrocephalus in Premature Infants: Time for a Paradigm Shift?

2:45–3:02 pm

Samuel R. Browd

3:03–3:20 pm

Edward S. Ahn

3:21–3:27 pm

### Questions and Discussion

3:27–4:15 pm

### Oral Abstract Presentations

For a listing of Oral Presentations, see pages 74-75.

(SF) 2:45–4:15 pm Room: 3020

## SECTION ON STEREOTACTIC AND FUNCTIONAL NEUROSURGERY

### Stereotactic and Functional Neurosurgery Update

Moderators: Guy M. McKhann, Doris D. Wang

2:45–3:27 pm

*Didactic Session is combined with the Neurotrauma and Critical Care Session in Room 3022*

3:27–4:15 pm

### Oral Abstract Presentations

For a listing of Oral Presentation, see page 75.

(TU) 2:45–4:15 pm Room: 3014

## SECTION ON TUMORS

### Emerging Concepts in the Management of Brain Metastases

Moderators: Albert H. Kim, Gelareh Zadeh

Speakers: Manmeet Ahluwalia, Steven N. Kalkanis, Teddy Kim, Jennifer A. Moliterno Gunel

2:45–2:59 pm

### Surgical Management of Mets: Surgery, SRS, WBRT, Evidence, and Case-based Talk

Steven N. Kalkanis

3:00–3:13 pm

### Treatment of Recurrent/Refractory Mets and Radiation Necrosis: Redo RT or SRS?

Jennifer A. Moliterno Gunel

3:14–3:27 pm

### How Precision Medicine and Immunotherapy are Changing the Management of Mets

Manmeet Ahluwalia

3:28–3:33 pm

### Andrew T. Parsa Research Fellowship Presentation: VSV-LASV as Oncolytic Virus Therapy for Glioblastoma

Teddy Kim

3:33–4:15 pm

### Oral Abstract Presentations

For a listing of Oral Presentation, see pages 75-76.

## OPERATIVE TECHNIQUES AND CASE-BASED DISCUSSION SESSIONS

(SE) 4:15–5:45 pm Room: 3016

### CSNS: Patient Safety in Neurosurgical Practice

Moderators: Zarina S. Ali, Kristopher T. Kimmell

Speakers: Kristopher T. Kimmell, Brad E. Zacharia

4:16–4:27 pm

### Anti-coagulation Protocols

Kristopher T. Kimmell

4:28 pm–4:39 pm

### Wrong Side, Wrong Level Protocols

Brad E. Zacharia

4:40–4:51 pm

### Safety in Practice

Kristopher T. Kimmell

4:51–5:15 pm

### Oral Abstract Presentations

For a listing of Oral Presentation, see page 76.

5:16–5:45 pm

### Case Presentations and Discussion

**(TU) 4:15–5:45 pm Room: 3014**  
**Challenging Brain Tumors: Operative Techniques and Case-based Discussions**

**Moderator:** Manish K. Aghi  
**Case Discussants:** Mitchel S. Berger, William T. Curry, Frederick F. Lang, Marie Roguski  
**Speakers:** Akihide Kondo, James K. Liu, Ugur Ture

4:16–4:25 pm  
**Microneurosurgical Removal of a Posterior Thalamic Glioma Via Posterior Interhemispheric Subsplenial Approach in Lateral Oblique Position: Operative Neurosurgery Video**

Ugur Türe

4:26–4:35 pm  
**Operative Nuances for Complex Tumors of the Skull Base: Operative Neurosurgery Video**

James K. Liu

4:36–4:45 pm  
**Reconsideration of the Dolenc Approach**  
 Akihide Kondo

4:45–5:03 pm  
**Oral Abstract Presentations**  
*For a listing of Oral Presentation, see page 77.*

5:04–5:45 pm  
**Case Presentations and Discussion**

**(CV) 4:15–5:45 pm Room: 2014**  
**Treating Cerebral Aneurysms: Operative Techniques and Case-based Discussions**

**Moderator:** Scott D. Simon  
**Case Discussants:** Sepideh Amin-Hanjani, Geoffrey P. Colby, Sean D. Lavine, Stavropoula I. Tjounmakaris, Erol Veznedaroglu  
**Speakers:** Elad I. Levy, Leonardo Rangel-Castilla

4:16–4:25 pm  
**Novel Endovascular Neck Reconstruction and Coiling Technique for the Treatment of a Large Wide-necked Basilar Apex Aneurysm Through a Radial Artery Approach: 2-Dimensional Operative Neurosurgery Video**  
 Leonardo Rangel-Castilla

4:26–4:43 pm  
**Novel Endovascular Treatment of a Large Basilar Apex Aneurysm with Neck Reconstruction (Barrel Stent) and Coiling Technique: 2-Dimensional Operative Neurosurgery Video**

Elad I. Levy  
 4:44–5:02 pm  
**Oral Abstract Presentations**  
*For a listing of Oral Presentations, see page 76.*

5:03–5:45 pm  
**Case Presentations and Discussion**

**(SP) 4:15–5:45 pm Room: 2016**  
**Cervical and Thoracolumbar Trauma: Operative Techniques and Case-based Discussions**

**Moderators:** Daniel C. Lu, Justin S. Smith  
**Discussants:** Victor W. Chang, Bradley Jacobs, Rod J. Oskouian, Eric A. Potts, Laura A. Snyder, Cheerag D. Upadhyaya, Todd D. Vogel, Lynda J. Yang  
**Speakers:** Christopher P. Ames, Pravin Salunke

4:16–4:25 pm  
**Safeguarding the Anomalous Vertebral Artery While Dissecting, Drilling, and Instrumentation of C1-2 Joint for Congenital Atlantoaxial Dislocation: 2-Dimensional Operative Neurosurgery Video**  
 Pravin Salunke

4:26–4:35 pm  
**Proximal Junctional Kyphosis Prevention Strategies: A Video Technique Guide**  
 Christopher P. Ames

4:36–5:00 pm  
**Oral Abstract Presentations**  
*For a listing of Oral Presentations, see page 76.*

5:00–5:45 pm  
**Case Presentations and Discussion**

**(TR) 4:15–5:45 pm Room: 3022**  
**Timing of Spinal Trauma Surgery: Operative Techniques and Case Based Discussions**

**Moderators:** Ann M. Parr, Craig H. Rabb  
**Discussants:** Maya A. Babu, Randy S. Bell, Alan S. Hoffer, Ryan S. Kitagawa, Patricia B. Raksin

4:15–4:39 pm  
**Oral Abstract Presentations**  
*For a listing of Oral Presentations, see pages 76-77.*

4:40–5:45 pm  
**Case-based Discussion**

**(PA) 4:15–5:45 pm Room: 3024**  
**Neurosurgery for Pain: Operative Techniques and Case-based Discussions**

**Moderator:** Julie G. Pilitsis  
**Discussants:** Sharona Ben-Haim, Jason M. Schwalb, Jennifer A. Sweet, Christopher J. Winfree  
**Speakers:** Jason M. Schwalb, Ido Strauss

4:16–4:25 pm  
**Cordotomy for Pain**  
 Jason M. Schwalb

4:26–4:35 pm  
**Cingulotomy for Pain**  
 Ido Strauss

4:36–4:54 pm  
**Oral Abstract Presentations**  
*For a listing of Oral Presentations, see page 77.*

4:55–5:45 pm  
**Case Presentations and Discussion**

**(PE) 4:15–5:45 pm Room: 3018**  
**Challenges in Recurrent Pediatric Epilepsy: Operative Techniques and Case-based Discussions**

**Moderator:** Gary W. Mathern  
**Case Discussants:** David F. Bauer, Daniel Curry, David D. Gonda, Jeffrey S. Raskin

4:15–4:39 pm  
**Oral Abstract Presentations**  
*For a listing of Oral Presentations, see page 77.*

4:40–5:45 pm  
**Case Presentations and Discussion**



5:45–7:15 pm

Level 2 Lobby

**NEW INTERACTIVE MULTIMEDIA RESEARCH PRESENTATION SESSION**

**Moderators:** Sharona Ben-Haim, Erica F. Bisson, Orin Bloch, Nicholas M. Boulis, Justin M. Brown, Mohamad Bydon, Domenic P. Esposito, Melanie Hayden Gephart, Shawn L. Hervey-Jumper, Alan S. Hoffer, Mark D. Krieger, Sandi Lam, Guy M. McKhann, Scott A. Meyer, Ann M. Parr, Julie G. Pilitsis, Dimitri Sigounas, Scott D. Simon, Robert M. Starke

The Interactive Multimedia Research Presentation Session aims to invigorate scientific presentation and discussion and engage attendees with presenters in exciting and compelling conversations. Enjoy a glass of wine and cheese during this interactive session consisting of both mini-oral presentations and posters.

There will be four podium presentation stages integrated throughout the poster area, and selected poster authors will present “mini-podium talks” during the Interactive Multimedia Research Presentation session, highlighting key advances in neurosurgery. Don’t miss this exciting new session!

For a listing of Mini-Podium Oral Presentations, see pages 77-84.

For a listing of Poster Presentations, see pages 92-108.

**DINNER SEMINAR 4 | TUESDAY, OCTOBER 22 | 7:30–9:30 PM**

\$190 (includes three-course dinner and beverages)

(SF) (TU) **DIN4: Advances in LITT**

**Moderators:** Gene H. Barnett, Shabbar F. Danish

**Faculty:** Robert E. Gross, Jonathan R. Jagid, Alireza M. Mohammadi, Dimitris G. Placantonakis

**HARRIS' THE SAN FRANCISCO STEAKHOUSE**

Celebrating their 35th year, Harris' continues the rich tradition of luxurious dining in a warm, comfortable, sophisticated environment. Harris' Steakhouse has become a household name in the Bay Area. Their commitment to the classic traditions of an elegant atmosphere, exceptional service, and extraordinary cuisine have made them the San Francisco Steakhouse.

In 2019, Eater San Francisco recognized Harris' as one of the Top 14 Steakhouses in San Francisco. The San Francisco Chronicle recognized Harris' as one of the most beautiful restaurants in San Francisco in 2018.

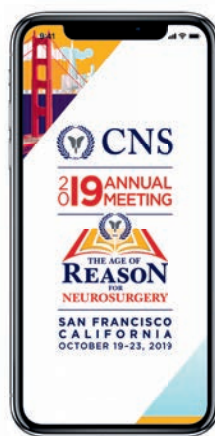
*Complimentary shuttle service will depart from the San Francisco Marriott Marquis at 7:15 pm.*

**STAY CONNECTED**

**DOWNLOAD** the 2019 CNS Annual Meeting App to have the latest schedules, breaking updates, and content in the palm of your hand.

Visit <https://ativ.me/cns2019>, click on your preferred platform (iOS, Android, or web) and follow the prompts to download.

- Review all courses, speakers, exhibitors, and events
- View all meeting abstracts
- Create your own preferred schedule each day
- Keep notes and activity logs in real time, in one place



Manage your schedule  
Download the free app

Scan the QR code or enter the URL in your device browser to download



<https://ativ.me/pb5>



<https://ativ.me/pb6>



<https://ativ.me/cns2019>



Powered by **EventPilot®**

# GUIDELINES AND SUNRISE SCIENCE

7:00–8:30 am Room: 3024

## **PAIN SCIENCE AND LATE-BREAKING ABSTRACT SESSION**

**Moderators:** Ausaf A. Bari, Sharona Ben-Haim*For a listing of Sunrise Science and Late-breaking Oral Presentations, please see page 85.*

7:00–8:30 am Room: 3020

## **STEREOTACTIC AND FUNCTIONAL SUNRISE SCIENCE AND LATE-BREAKING ABSTRACT SESSION**

**Moderators:** Emad N. Eskandar, Jon T. Willie*For a listing of Sunrise Science and Late-breaking Oral Presentations, please see page 86.*

CV 7:00–8:30 am Room: 2014

### **Cerebrovascular Guidelines: Aneurysms, Arteriovenous Malformations, and Acute Ischemic Stroke**

**Moderators:** Scott D. Simon, Stavropoula I. Tjoumakaris**Speakers:** Sepideh Amin-Hanjani, Mark D. Bain, Kevin M. Cockroft, Aaron S. Dumont, J D. Mocco, Clemens M. Schirmer, Babu G. Welch, Stacey Q. Wolfe

7:00–7:30 am

#### **Guidelines for the Treatment of Cerebral Arteriovenous Malformations**

7:00–7:10 am

##### **Natural History and Management of Unruptured AVMs**

Sepideh Amin-Hanjani

7:10–7:20 am

##### **Management of Ruptured AVMs**

Clemens M. Schirmer

7:20–7:30 am

##### **Management of Dural AVFs**

Stacey Q. Wolfe

7:30–8:00 am

#### **Guidelines for the Treatment of Cerebral Aneurysms**

7:30–7:40 am

##### **Screening, Natural History, and Medical Management**

Aaron S. Dumont

7:40–7:50 am

##### **Indications and Outcomes of Surgery for Cerebral Aneurysms**

Kevin M. Cockroft

7:50–8:00 am

##### **Indications and Outcomes of Endovascular Surgery for Cerebral Aneurysms**

Babu G. Welch

8:00–8:15 am

#### **Guidelines for the Neurosurgical Treatment of Acute Ischemic Stroke: Update on Trials**

J D. Mocco

8:15–8:30 am

#### **Guidelines for the Neurosurgical Treatment of Spontaneous Intraparenchymal Hemorrhage: Update on Trials**

Mark D. Bain

TU 7:00–8:30 am Room: 3014

### **Guidelines for Management of Glioblastoma**

**Moderators:** S. Kathleen Bandt, Ricardo J. Komotar**Speakers:** Mitchel S. Berger, Susan M. Chang, Ali Jalali, Eric C. Leuthardt, Taiichi Saito, Adam M. Sonabend

7:00–7:15 am

#### **Active Surgical Clinical Trials**

Adam M. Sonabend

7:15–7:30 am

#### **Surgical Update on Glioblastoma Genetics**

Ali Jalali

7:30–7:45 am

#### **Re-evaluating the Evidence for Extent of Resection in Glioblastoma**

Mitchel S. Berger

7:45–8:00 am

#### **Recommended Practices for Neuro-monitoring in Glioblastoma**

Taiichi Saito

8:00–8:15 am

#### **Evidence for LITT in Glioblastoma**

Eric C. Leuthardt

8:15–8:30 am

#### **Personalized Medicine and Chemotherapy in the Management of Glioblastoma**

Susan M. Chang

TR SP 7:00–8:30 am Room: 2016

### **Brain and Spine Trauma Guidelines—What you Need to Know**

**Moderators:** Paul M. Arnold, Patricia B. Raksin**Speakers:** Randall M. Chestnut, John H. Chi, Sanjay S. Dhall, R. John Hurlbert, Daniel M. Sciubba, Emily P. Sieg, Michael F. Stiefel, Eve C. Tsai

7:00–7:10 am

#### **BTF Guidelines 4: Are They Still Useful? Next steps**

Randall M. Chesnut

7:10–7:20 am

#### **ICP and Decompressive Craniectomy According to the 4th Edition Guidelines**

Emily P. Sieg

7:20–7:30 am  
**Guideline for Reversal of Antithrombotics in Intracranial Hemorrhage**  
 Michael F. Stiefel

7:30–7:40 am  
**Update on NOACs Not in the Guidelines**  
 Eve C. Tsai

7:40–7:50 am  
**Thoracolumbar Spine Trauma Operative Versus Non-operative Treatment**  
 Daniel M. Sciubba

7:50–8:00 am  
**Timing of Surgical Intervention in Spine Trauma**  
 John H. Chi

8:00–8:10 am  
**Hemodynamics and Spinal Cord Perfusion in SC**  
 Sanjay S. Dhall

8:10–8:20 am  
**Pharmacologic Treatment of Acute Spinal Cord Injury**  
 R. John Hurlbert

8:20–8:30 am  
**Questions and Discussion**



**THANK YOU**  
**PREMIER PARTNER**  
**Synaptive**  
**FOR YOUR**  
**VALUABLE SUPPORT!**

#### SUBSPECIALTY SESSION HIGHLIGHTS KEY

(AP) ADVANCED PRACTICE PROVIDER  
 (CV) CEREBROVASCULAR  
 (TR) NEUROTRAUMA  
 (PA) PAIN

(PE) PEDIATRIC  
 (PN) PERIPHERAL NERVES  
 (RE) RESIDENT  
 (SE) SOCIOECONOMIC

(SP) SPINE  
 (SF) STEREOTACTIC AND FUNCTIONAL  
 (TU) TUMOR  
 (WINS) WINS

**THANK YOU**  
INDUSTRY AMBASSADOR

**Medtronic**

FOR YOUR  
VALUABLE SUPPORT!





# GENERAL SCIENTIFIC SESSION IV

Presiding Officer: Elad I. Levy

Moderators: Maya A. Babu, Praveen V. Mummaneni

8:40–8:43 am

## Introduction and Disclosures

Elad I. Levy

8:43–8:50 am

## Operative Neurosurgery Highlight: The Role of Endoscopic Endonasal Approaches for the Surgical Management of Anterior Skull Base Meningiomas

Daniel M. Prevedello



8:50–9:12 am

## Honored Guest Presentation: The Evolving Landscape and Management of Brain Metastases

Raymond Sawaya

9:12–9:15 am

## Introduction of Rebecca Skloot

Brian V. Nahed



9:15–9:40 am

## JOHN THOMPSON HISTORY OF MEDICINE LECTURE

Rebecca Skloot

Rebecca Skloot will be signing copies

of the book, “The Immortal Life of Henrietta Lacks,” in the CNS Xperience Lounge during the morning beverage break.

9:40–10:40 am

## MORNING BEVERAGE BREAK

Visit the Exhibit Hall and enjoy a complimentary cup of coffee!

10:00–10:30 AM

## LIVE SURGERY

## IN THE EXHIBIT HALL

See page 20 for details.

10:40–10:43 am

## Announcement of SANS Challenge Winners, Top Posters, and Residency Program Abstract Competition Winners

Maya A. Babu

10:43–10:46 am

## Announcement of Innovator of the Year

Lola B. Chambless

10:46–10:49 am

## Preview of 2020 CNS Annual Meeting in Miami

Steven N. Kalkanis

10:49–10:51 am

## Introduction of Controversy: Low-grade Glioma Management

Manish K. Aghi

10:51–10:59 am

## Controversies: Supramaximal Resection

Hugues Duffau

10:59–11:07 am

## Controversies: A Conservative Approach to Low-grade Gliomas

Gelareh Zadeh

11:07–11:11 am

## Controversies: Discussion and Outcomes

Manish K. Aghi

11:11–11:19 am

## Neurosurgery Update: Cutting Edge in Stereotactic and Functional: Dramatic Clinical Improvement on Children Affected by AADC Mutation after MR-guided AAV2-AADC Gene Therapy into the Midbrain

Krystof S. Bankiewicz

11:19–11:26 am

## Central Atlantoaxial Instability – Changing Paradigm in Craniovertebral Junction Surgery

Atul H. Goel

11:26–11:31 am

## Update from the ABNS

Carl B. Heilman

11:31–11:33 am

## Introduction of Aaron Carroll

Mohamad Bydon



11:33 am–12:10 pm

## FEATURED SPEAKER Healthcare in the U.S.

Aaron Carroll

Meet Aaron Carroll

in the CNS Xperience Lounge immediately following the conclusion of this session!

WEDNESDAY, OCTOBER 23 | 12:15–1:45 PM

# LUNCHEON SEMINARS

All Luncheon Seminars include a plated lunch served in the seminar room.

Luncheon Seminar fee is \$95 each (\$75 for residents, fellows, graduate students/post-doctoral scholars, medical students, and advance practice providers). Add a Luncheon Seminar to your profile at registration.

Room: 2001

**(CV) W21: Middle Meningeal Artery Embolization for Subdural Hematoma Treatment**

**Moderator:** Christopher P. Kellner

**Faculty:** Bradley N. Bohnstedt, Peter Kan, Jared Knopman, Adnan H. Siddiqui

Room: 2003

**(CV) W22: Contemporary and Practical Management of an Enigmatic Process: Cerebral Vasospasm (Delayed Cerebral Ischemia)**

**Moderator:** Brian M. Howard

**Faculty:** Spiros L. Blackburn, Peng R. Chen, R. Loch Macdonald, Matthew Reynolds, Edgar Samaniego

Room: 2010

**(SP) W23: Novel Techniques for Management of Lumbar Spondylolisthesis**

**Moderators:** Noojan Kazemi, Randy Kritzer

**Faculty:** Deb A. Bhowmick, Nathaniel P. Brooks, John H. Chi, John H. Shin

Room: 2011

**(TR) W24: TBI in the Elderly**

**Moderator:** Daniel B. Michael

**Faculty:** Gary Abrams, Jack Jallo, Emily P. Sieg, Eve C. Tsai

Room: 2005

**(SE) W25: Neurosurgeon Entrepreneur**

**Moderators:** John R. Adler, Jeremy T. Phelps

**Faculty:** Nandan Lad, Ramin Rak, Edie E. Zusman

Room: 2012

**(PE) W26: Chiari Malformations**

**Moderator:** David D. Limbrick

**Faculty:** Ulrich Batzdorf, David M. Frim, Jeffrey R. Leonard, Karin M. Muraszko

Room: 2007

**(SF) W27: Clinical Trials in Epilepsy Surgery**

**Moderator:** Aviva Abosch

**Faculty:** Jorge A. Gonzalez-Martinez, Robert E. Gross, Timothy H. Lucas

Room: 2008

**(TU) W28: Update on Diagnosis and Management of Low Grade Gliomas**

**Moderators:** Susan M. Chang, Viviane S. Taber

**Faculty:** Cameron W. Brennan, Daniel P. Cahill, Jennifer A. Moliterno Gunel, Daniel A. Orringer

Room: 2009

**(TU) W29: Advanced Imaging in Brain Tumors**

**Moderator:** Shawn L. Hervey-Jumper

**Faculty:** S. Kathleen Bandt, Sunit Das, Alexandra J. Golby, Javier E. Villanueva-Meyer, Masahiko Wanibuchi

Room: 2000

**(WINS) (GE) (AP) (RE) W30: Branding and Social Media in your Practice**

**Moderator:** Isaac Yang

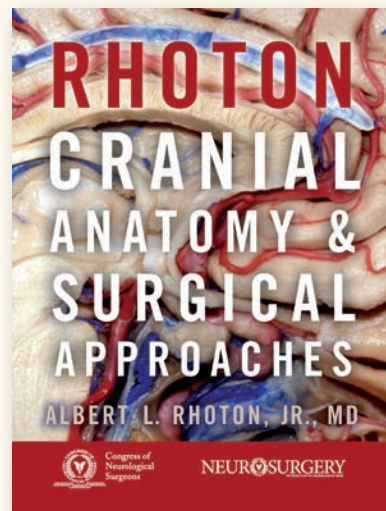
**Faculty:** Christopher S. Graffeo, Michael E. Ivan, Carrie R. Muh, Faith C. Robertson, Linda Xu

## The Defining Work in Neurosurgery

Featuring more than 2000 full-color illustrations, this definitive text on the microsurgical anatomy of the brain remains an essential tool for the education and enrichment of neurosurgeons at any career stage.

Use the coupon code **NEURO30!** to **save 30 percent** on this item through the end of October when ordering your book. It is now available for pre-orders and will ship on October 3, 2019.

Vist <http://www.oup.com/academic/medicine> to place your order.



1:45–3:15 pm

Room: 2016

**SPINE AFTERNOON SCIENCE ABSTRACT SESSION****Moderators:** Yi Lu, Laura A. Snyder*For a listing of Oral Presentations, please see pages 87-88.*

1:45–3:15 pm

Room: 3020

**CRANIAL AFTERNOON SCIENCE ABSTRACT SESSION****Moderators:** Isabelle M. Germano, Sean D. Lavine*For a listing of Oral Presentations, please see pages 86-87.*

1:45–3:15 pm

Room: 3022

**NEUROTRAUMA AFTERNOON SCIENCE ABSTRACT SESSION****Moderators:** Ronald A. Torres, Sarah Woodrow*For a listing of Oral Presentations, please see pages 88-89.*

1:45–3:15 pm

Room: 3024

**LATE-BREAKING ABSTRACT SESSION****Moderators:** Orin Bloch, Michael S. Virk*For a listing of Oral Presentations, please see pages 89-90.*

1:45–4:45 pm

Room: 2014

**ADVANCED ENDOSCOPIC AND EXOSCOPIC NEUROSURGERY SEMINAR****Course Directors:** William T. Curry, Brian V. Nahed**Faculty:** John A. Boockvar, Christopher J. Farrell, Juan C. Fernandez-Miranda, Paul A. Gardner, Constantinos G. Hadjipanayis, Peter Nakaji, Shaan M. Raza

**THANK YOU  
PREMIER PARTNER**

**OLYMPUS®**

Your Vision, Our Future

**FOR YOUR  
VALUABLE SUPPORT!**

# ORAL ABSTRACT PRESENTATIONS

## MONDAY, OCTOBER 21



### SUNRISE SCIENCE ORAL PRESENTATIONS SESSION

Room 2014

7:00–7:06 am

#### **300 Wall Enhancement in Evolving Cerebral Aneurysms on MR Vessel Wall Imaging**

Shunsuke Omodaka, Hidenori Endo, Kuniyasu Niizuma, Miki Fujimura, Takashi Inoue, Toshiki Endo, Teiji Tominaga

7:06–7:12 am

#### **301 Lessons Learned from the Initial Experience with Pedicled Temporoparietal Fascial Flap for Combined Revascularization in Moyamoya Angiopathy: A Case Series**

Kristine Ravina, Paul Kim, Robert Rennert, Erik M. Wolfswinkel, Ben A. Strickland, Joseph Carey, Jonathan Russin

7:12–7:18 am

#### **302 Cost-Effectiveness Analysis of Active Surveillance for Small Asymptomatic Intracranial Aneurysms**

David M. Panczykowski, Clark Veet, Natasha Parekh, Spiros L. Blackburn

7:18–7:24 am

#### **303 Identification of PPIL4 as a Disease Causing Gene in Intracranial Aneurysms and its Role in Vertebrate CNS Specific Angiogenesis**

Tanyeri Barak, Adife Gulhan Ercan Sencicek, Danielle F. Miyagishima, Octavian Henegariu, Ketu Mishra Gorur, Kaya Bilguvar, Murat Gunel

7:24–7:30 am

#### **304 Decreased Time to Evacuation Improves Long-term Functional Outcome in Minimally Invasive Endoscopic Intracerebral Hemorrhage Evacuation**

Christopher P. Kellner, Rui Song, Dominic A. Nistal, Ian T. McNeill, Hasitha M. Samarage, Jacopo Scaggiante, Neha S. Dangayach, Joshua B. Bederson, J D. Mocco

7:30–7:36 am

#### **305 Metabolite Profiling the Cerebral Spinal Fluid in Subarachnoid Hemorrhage: Insights into Patient Outcomes.**

Matthew J. Koch, Zsuzsanna Ament, Christina Hansen, Matthew Bevers, Christopher J. Stapleton, Aman B. Patel, W. Taylor Kimberly

7:36–7:42 am

#### **306 The R2eD AVM Score: A Novel Predictive Tool for Arteriovenous Malformation Presentation with Hemorrhage.**

James Feghali, Wuyang Yang, Risheng Xu, Jason Liew, Cameron G. McDougall, Justin M. Caplan, Rafael J. Tamargo, Judy Huang

7:42–7:48 am

#### **307 Frailty Predicts Decreased Survival, More Complications, and Higher Hunt & Hess and Fisher Scores following an Aneurysmal Subarachnoid Hemorrhage**

Matthew McIntyre, Vikas Patel, Andrew Long, Alex Vonhoof, Boyi Li, Adil Afridi, Mohamed Halabi, Fawaz Al-Mufti, Chirag D. Gandhi, Justin G. Santarelli, Meic H. Schmidt, Chad D. Cole, Christian A. Bowers

7:48–7:54 am

#### **308 The Efficacy and Safety of Middle Meningeal Artery Embolization in the Management of Chronic Subdural Hematomas: Systematic Review and Meta-analysis**

Fareed Jumah, Muhammad Osama, Abdurrahman Islim, Ammar Jumah, Devi Prasad Patra, Vinatak Narayan, Rimal Hanif H. Hanif

7:54–8:00 am

#### **309 Inverse National Trends in Decompressive Craniectomy versus Endovascular Thrombectomy for Stroke**

Nicolas K. Khattar, Beatrice Ugiliweneza, Mayur Sharma, Enzo Fortuny, Shawn W. Adams, Kimberly Sue Meyer, Maxwell Boakye, Robert F. James, Dale Ding

8:00–8:06 am

#### **900 Increasing the Utility of Administrative Databases for Clinical Research of Stroke Patients Treated with a Mechanical Thrombectomy**

Pious D. Patel, Sanjana Salwi, Campbell Liles, Akshitkumar Mistry, Eva Mistry, Rohan V. Chitale, Matthew Fusco, Chevis N. Shannon

8:06–8:12 am

#### **901 Middle Meningeal Artery Embolization for Chronic Subdural Hematoma: A Multi-center Experience of 160 Consecutive Embolizations**

Peter Kan, Georgios Maragkos, Aditya Srivatsan, Visish M. Srinivasan, Jeremiah N. Johnson, Jan-Karl Burkhardt, Stephen Chen, Christopher S. Ogilvy, Justin M. Moore, Howard A. Riina, Omar Tanweer, Elad I. Levy, Alejandro M. Spiotta, Sami A. Kasab, Bradley A. Gross, Brian T. Jankowitz, Jacob Cherian, C. Michael Cawley, Brian M. Howard, Alexander A. Khalessi, Aditya S. Pandey, Andrew J. Ringer, Ricardo A. Hanel, Rafael A. Ortiz, David J. Langer, Michael Levitt, Ajith J. Thomas

8:12–8:18 am

#### **902 Stereotactic Direct-coiling of Intracranial Aneurysms**

Arun-Angelo Patil, Sidharta Kumar, Megha Jacob

8:18–8:24 am

#### **903 Utility of CT Angiography of the Head in Patients with Intracerebral Hemorrhage**

Richard J. Garling, Bryan Lieber, Catherine Peterson, Shiwei Huang, Ari D. Kappel, Miles Hudson, Hassan A. Fadel, Robert R. Johnson, II



8:24–8:30 am

**904 The Flow Redirection Intraluminal Device (FRED) for Cerebral Aneurysms of the Posterior Circulation: A Subgroup Analysis of the EuFRED Registry**

Christoph J. Griessenauer, Markus Möhlenbruch, Philipp Hendrix, Christian Ulfert, Naci Kocer, Civan Islak, Michael Sonnberger, Tobias Engelhorn, Erasmia Müller-Thies-Broussalis, Thomas Finkenzeller, Markus Holtmannspötter, Jan-Hendrik Buhk, Wolfgang Reith, Andreas Simgen, Hendrik Janssen, Monika Killer-Oberpfalzer



**SUNRISE SCIENCE ORAL PRESENTATIONS SESSION**

Room 3014

7:00–7:06 am

**310 High Sensitivity and Specificity Detection of Protoporphyrin IX Fluorescence in GBM by Means of Simultaneous 2-photon Microscopy and Stimulated Raman Histology**

Constantinos G. Hadjipanayis, Alexandros Bouras, Joe Gerald Jesu Raj, Dominique Bozec, Daniel Rivera

7:06–7:12 am

**311 Genomic Analysis of Temozolomide-Related Hypermutation in Adult Diffuse Glioma**

Anzhela D. Moskalik, Floris P. Barthel, Kevin C. Johnson, Roel Verhaak

7:12–7:18 am

**312 Stem Cell Delivery of Oncolytic Adenovirus DNX-2401 Following Surgical Resection for the Treatment of Glioblastoma in a Murine Model**

Sricharan Gopakumar, Joy Gumin, Marc Daou, Daniel Ledbetter, Brittany Parker-Kerrigan, Frederick F. Lang

7:18–7:24 am

**313 Combination Therapy with Anti-PD-1 and Anti-BTLA Results in a Synergistic Therapeutic Effect Against Murine Glioblastoma**

John Choi, Laura Saleh, Ayush Pant, Denis Routkevitch, Luqing Tong, Young-Hoon Kim, Yuanxuan Xia, Christopher M. Jackson, Christina Jackson, Michael Lim

7:24–7:30 am

**314 Pro-tumoral Effects of Intra-tumoral Neutrophils in the Glioblastoma Microenvironment**

Sumedh S. Shah, Garima Yagnik, Alan T. Nguyen, Harsh Wadhwa, Jordan Spatz, Michael Safaee, Justin Cheng, Manish K. Aghi

7:30–7:36 am

**315 Regulation of Amino Acid Transport in Glioma**

Stephanie Robert, Robyn Umans, Joelle Martin, Harald Sontheimer

7:36–7:42 am

**316 Targeting TIP1 Results in Cytotoxic and Radiosensitizing Effects in Cancer**

David Yaw Amoah Dadey

7:42–7:48 am

**317 Multiplatform Molecular Profiling of Vestibular Schwannoma Reveals 2 Subgroups of Tumors with Distinct Radiographic Features and a Methylation-based Predictor of Local Recurrence**

Jonathan D. Breshears, S. John Liu, Harish Vasudevan, Melike Pekmezci, Maria G. Castro, Ursula Lang, William Chen, Abrar Choudhury, Stephen T. Magill, Steve Braunstein, Chetna Gopinath, Jean L. Nakamura, Penny Sneed, Arie Perry, Michael W. McDermott, Javier E. Villanueva-Meyer, David R. Raleigh, Philip V. Theodosopoulos

7:48–7:54 am

**BEST DATA SCIENCE AWARD**

**318 Predicting Growth Trajectory in Vestibular Schwannoma from Radiomic Data Using Supervised Machine Learning Techniques**

Conor Grady, Hesheng Wang, Zane Schnurman, Tanxia Qu, Douglas Kondziolka

7:54–8:00 am

**319 The Impact of Insulin-like Growth Factor Index and Biological Effective Dose on Outcomes After Stereotactic Radiosurgery for Acromegaly**

Christopher S. Graffeo, Diane Donegan, Dana Erickson, Paul D. Brown, Avital Perry, Michael J. Link, William F. Young, Jr., Bruce E. Pollock

8:00–8:06 am

**905 The Natural Growth Rate of Metastatic Cancer to the Brain**

Andrew J. Kobets, Phillip C. Cezayirli, Ryan Holland, Rose Fluss, Reid Backus, Patrick A. Lasala

8:06–8:12 am

**906 Precision Targeting Therapy of Malignant Brain Tumor by a Local Interstitial Delivery System Loading with a Small Molecule Drug<sup>†</sup>First in Human Trial**

Shinn-Zong (John) Lin, Tsung-Lang Chiu, Sheng-Tzung Tsai, Horng-Jyh Harn, Sheng-Huang Lin, Yi-Fen Wang, Pao-Hui Tseng, Tzyy-Wen Chiou, Pei-Wen Chou, Hsin-I Ma

8:12–8:18 am

**907 Brain Tumor Organoid (BTO) Platform as a Unique Tool in Discovery of Novel Therapy Approaches and Stratifying Treatment Regimens**

Dorota Lubanska, Swati Kulkarni, Mohamed A.R. Soliman, Abdalla Shamisa, Ana DeCarvalho, Alexander Rodzinka, Adit Nyayachavadi, Simon Rondeau-Gagné, Lisa Porter

8:18–8:24 pm

**908 Mini Beam Radiation Treatment- Final Report of a Randomized Phase III Study of Treating Canine De-novo Brain Tumors - New Kid on the Block**

Vijayananda Kundapur, Monique Mayer, Andrew Alexander, Sheldon Wiebe, Narinder Sidhu, Gavin C. Sargison, Susan L. Kraft

8:24–8:30 am

**909 The CREB-binding Protein Inhibitor ICG-001 Underlying a Promising Therapeutic Strategy in NF2-associated Meningiomas**

Hongda Zhu, Jiaojiao Deng, Lingyang Hua, Shuchen Sun, Ye Gong

## GENERAL SCIENTIFIC SESSION II

Ballroom

10:53–11:00 am

### CNS RESIDENT AWARD

**100 Ambulation on POD#0 is Associated with Decreased Adverse Events After Elective Lumbar Spine Surgery: Analysis of the Michigan Spine Surgery Improvement Collaborative (MSSIC)**

Hesham M. Zakaria, Rachel J. Hunt, Theresa A. Elder, Michael Bazydlo, Lonni Schultz, Muwaffak Abdulhak, David Nerenz, Victor W. Chang, Jason M. Schwalb

## COUNCIL OF STATE NEUROSURGICAL SOCIETIES ORAL PRESENTATIONS

Room 3016

3:33–3:39 pm

**101 Patterns of Opioid and Benzodiazepine Use in Opioid-Naïve Patients With Newly Diagnosed Low Back and Lower Extremity Pain**

Tej D. Azad, Yi J. Zhang, Martin N. Stienen, Daniel Vail, Jason Bentley, Allen L. Ho, Paras Fatemi, Lily H. Kim, Anand Veeravagu, John K. Ratliff

3:39–3:45 pm

**102 Enhanced Peri-operative Care Decreases Cost after Major Spinal Surgery**

Daniel A. Carr, Rajiv Saigal, Armagan Dagal

3:45–3:51 pm

**103 The Impact of Hospital Safety-Net Burden on Outcomes for Primary Supratentorial Brain Tumor Surgery**

Oliver Y. Tang, Anna Kimata, Steven A. Toms

3:51–3:57 pm

**104 Medico-legal Implications of Video Recording Patient-provider Communication**

Komal Naeem, Malika Bhargava, Randall W. Porter

3:57–4:03 pm

**105 Regional Variation in 90-day Postoperative Costs Among Patients Undergoing Posterior Lumbar Fusion (PLF): Insights from the OPTUM Labs Data Warehouse (OLDW)**

Panagiotis Kerezoudis, Mohammed A. Alvi, Anshit Goyal, Yagiz U. Yolcu, Stephanie Payne, Lindsey Sangaralingham, Molly Jeffery, Mohamad Bydon

4:03–4:09 pm

**106 Impact of CMS Non-Reimbursement on Hospital-Acquired Conditions Following Spine Procedures**

Layton Lamsam, Michael Zhang, Marc Carmichael, Hriday Bhambhani, Ian D. Connolly, Tina Hernandez-Boussard, Anand Veeravagu, John K. Ratliff

## SECTION ON CEREBROVASCULAR SURGERY ORAL PRESENTATIONS

Room 2014

3:33–3:39 pm

### GALBRAITH AWARD

**107 Stereotactic Radiosurgery for Pediatric Brain Arteriovenous Malformations: Long-Term Outcomes**

Ching-Jen Chen, Cheng-Chia Lee, Kathryn N. Kearns, Dale Ding, Douglas Kondziolka, L. Dade Lunsford, Jason P. Sheehan

3:39–3:45 pm

**108 Blockade of the Platelet-driven CXCL7-CXCR1/2 Pathway Prevents Cerebral Aneurysm Formation**

Kamil W. Nowicki, Michael P. D'Angelo, Wendy Fellows-Mayle, Michael M. McDowell, Robert M. Friedlander

3:45–3:51 pm

**109 Inflammation in Murine Aneurysm Healing: The Role of CXCL1**

Devan Patel, Kartik Motwani, Koji Hosaka, Brian L. Hoh

3:51–3:57 pm

**110 Treatment of Acutely Ruptured Cerebral Aneurysms with the Woven EndoBridge (WEB) Flow Disruptor: A Multicenter Experience**

Fadi Al Saiegh, David M. Hasan, Nikolaos Mouchtouris, Mario Zanaty, Nohra Chalouhi, Ritam Ghosh, Ahmad Sweid, Stavropoula I. Tjoumakaris, M. Reid Gooch, Robert H. Rosenwasser, Pascal Jabbour

3:57–4:03 pm

**111 Preventing Microthrombi Formation Improves Function After Subarachnoid Hemorrhage in Mice**

Hussein Zeineddine, Spiros L. Blackburn, Remya Veettil, Kanako Matsumura, Devin McBride

4:03–4:09 pm

**112 Small Aneurysms with Low Rupture Risk Account for a Majority of Subarachnoid Hemorrhage**

Caleb Rutledge, Soren Jonzson, Ethan A. Winkler, Kunal P. Raygor, Michael T. Lawton, Adib A. Abila

## SECTION ON DISORDERS OF THE SPINE ORAL PRESENTATIONS

Room 2016

3:29–3:35 pm

**113 Addition of Fusion to Decompression for Grade I Degenerative Lumbar Spondylolisthesis is Associated with Greater Patient-Reported Outcome Improvements at 24-Month Follow-Up: A Multicenter Study Using the Quality Outcomes Database**

Jian Guan, Erica F. Bisson, Mohamad Bydon, Mohammed A. Alvi, Steven D. Glassman, Kevin T. Foley, Eric A. Potts, Christopher I. Shaffrey, Mark E. Shaffrey, Domagoj Coric, John J. Knightly, Paul Park, Michael Y. Wang, Kai-Ming G. Fu, Jonathan R. Slotkin, Anthony L. Asher, Michael S. Virk, Panagiotis Kerezoudis, Regis W. Haid, Andrew Kai-Hong Chan, Praveen V. Mummaneni

3:35–3:41 pm

**114 Trends in Spine Surgery Training During Neurological and Orthopedic Surgery Residency: A Ten-Year Analysis of ACGME Case Log Data**

Martin H. Pham, Andre M. Jakoi, Arvin R. Wali, Lawrence Lenke

3:41–3:47 pm

**115 Towards Opioid-Free Elective Spine Surgery: A Prospective Cohort Study**

Ahilan Sivaganesan, Amanda Wright, Regis W. Haid, Jr., Praveen V. Mummaneni, Richard Berkman

3:47–3:53 pm

**116 The Impact of Preoperative Mindfulness-Based Stress Reduction on Postoperative Patient-Reported Pain, Disability, Quality of Life, and Prescription Opioid Use in Lumbar Spine Degenerative Disease: 3- and 12-Month Results**

Juneyoung L. Chavez, Christina A. Porucznik, Lisa H. Gren, Jian Guan, Evan Joyce, Darrel S. Brodke, Andrew T. Dailey, Mark A. Mahan, Robert S. Hood, Brandon Lawrence, William R. Spiker, Nicholas T. Spina, Erica F. Bisson

3:53–3:59 pm

**117 Changes in the Operative Corridor in Oblique Lumbar Interbody Fusion Between Pre-operative Imaging and Intraoperative Cone-beam Computed Tomography Using Morphometric Analysis**

Aqib Zehri, Hector E. Soriano-Baron, Wesley Hsu, Matthew Neal, Jonathan L. Wilson

3:59–4:05 pm

**118 Sexual Dysfunction: Prevalence and Prognosis in Patients Operated for Degenerative Lumbar Spondylolisthesis**

Andrew K. Chan, Erica F. Bisson, Kai-Ming G. Fu, Paul Park, Leslie Robinson, Mohamad Bydon, Steven D. Glassman, Kevin T. Foley, Christopher I. Shaffrey, Eric A. Potts, Mark E. Shaffrey, Domagoj Coric, John J. Knightly, Michael Y. Wang, Jonathan Slotkin, Anthony L. Asher, Michael S. Virk, Panagiotis Kerezoudis, Mohammed A. Alvi, Jian Guan, Regis W. Haid, Praveen V. Mummaneni

4:05–4:11 pm

**119 Complications of Robotic Spine Surgery**

Daniel Myers, Gordon Mao, Alexander K. Yu, Donald M. Whiting

**SECTION ON NEUROTRAUMA AND CRITICAL CARE ORAL PRESENTATIONS**

Room 3022

3:31–3:37 pm

**120 Long Term Prognosis of Severe Traumatic Brain Injured Patients Using Acute Phase Neurophysiology Testing**

Joshua S. Bauer, David M. Panczykowski, Ava Puccio, David O. Okonkwo, Jeffrey Balzer, Phillip Choi, Benjamin Zusman

3:37–3:43 pm

**121 Brain Derived Neurotrophic Factor (BDNF) Val66Met Single Nucleotide Polymorphism (rs6265) is Associated with Decreased Functional Outcome After Traumatic Brain Injury: A Multicenter Cohort Study**

John K. Yue, Ethan A. Winkler, Hansen Deng, Ryan R. L. Phelps, Ankush Chandra, Mary J. Vassar, David M. Schnyer, Ava Puccio, Hester F. Lingsma, Esther Yuh, Pratik Mukherjee, Alex B. Valadka, David O. Okonkwo, Geoffrey T. Manley

3:43–3:49 pm

**122 Early Versus Late Surgical Decompression for Acute Spinal Cord Injury: An Individual Patient Data Meta-Analysis of 1,548 Patients**

Jetan H. Badhiwala, Christopher D. Witiw, Jefferson R. Wilson, Michael G. Fehlings

3:49–3:55 pm

**123 MRI Tracking of iPS Cells-Induced Neural Stem Cells in Traumatic Brain Injury Rats**

Hailiang Tang

3:55–4:01 pm

**124 The Hematoma Evacuation Score: Reducing 30-day Postoperative Mortality in Intracranial Subdural and Epidural Hematomas**

Andrew K. Rock, Nora T. Poulos, Matthew T. Carr, Alper Dincer, Charles F. Opalak, William C. Broadus

4:01–4:07 pm

**125 Traumatic Brain Injury as a Risk Factor for Dementia: An 18-Year, Two Institution Clinical Experience**

Elisabetta Mezzalana, Brittany M. Stopa, Ajaz Khawaja, Saef Izzy, William B. Gormley

4:07–4:13 pm

**THINKFIRST INJURY PREVENTION RESEARCH AWARD****126 Developing an Adjunct to an Electronic Medical Records System in a Developing Country: Establishing the First Electronic Traumatic Brain Injury Database in Yangon, Myanmar**

Aung Thurein Win, Su Myat Moe, Nang Saw Myat Hnin Aye, Aye Mya Phyu, Thet Maung Maung, Ei Ei Khaing, Zayya Naung, Karam P. Asmaro, Kyi Hlaing, Win Myaing, Tyler Prentiss, Robert J. Dempsey, Jack P. Rock

**SECTION ON PAIN ORAL PRESENTATIONS**

Room 3024

3:34–3:40 pm

**RONALD R. TASKER YOUNG INVESTIGATOR AWARD****127 Defining the Somatotopy of the Human Spinothalamic Tract: CT Guided Mapping and Physiologic Responses in Patients Undergoing Awake Percutaneous Cervical Cordotomy**

Michael Honey, Zurab Ivanishvili, Christopher Honey, Manraj S. Heran

3:40–3:46 pm

**128 Randomized, Double-Blind Trial of Evoked Compound Action Potential (ECAP)-Controlled Closed-Loop Spinal Cord Stimulation for Patients with Chronic Trunk and/or Limb Pain**

Steven M. Falowski

3:46–3:52 pm

**129 The Impact of Preventative Multimodal Analgesia on Postoperative Opioid Requirement and Pain Control in Patients Undergoing Lumbar Fusions**

Sharad Rajpal, Steven L. Hobbs, Ewell L. Nelson, Alan T. Villavicencio, Christopher Zielenski, Kara D. Beasley, Vinod Kantha, Jamie Mesenbrink, Sigita Burneikiene

3:52–3:58 pm

**130 Prescriber Aimed Intervention to Optimize Opioid Prescribing Patterns After Intracranial Surgery: Addressing the Nation's Opioid Epidemic and Decreasing the Neurosurgeon's Narcotic Footprint**

Karam P. Asmaro, Sameah A. Haider, Ankush Chandra, Edwin Telemi, Tarek R. Mansour, Hesham M. Zakaria, Adam M. Robin, Ian Y. Lee, Ellen L. Air, Jack P. Rock, Steven N. Kalkanis, Jason M. Schwalb

3:58–4:04 pm

**131 Trends in Utilization and Cost of Spinal Cord Stimulation Surgery: Insights from the National Inpatient Sample Database, 2008 to 2014**

Anshit Goyal, Archis Bhandarkar, Mohammed A. Alvi, Yagiz U. Yolcu, Mohamad Bydon

4:04–4:10 pm

**132 Radiosurgery to the Spinal Dorsal Root Ganglion Induces Fibrosis and Inhibits Peripheral Glial Cell Activation While Preserving Axonal Neurotransmission**

Ezequiel Goldschmidt, Wendy Fellows-Mayle, Ajay Niranjana, John Flickinger, L. Dade Lunsford, Peter C. Gerszten

**SECTION ON PEDIATRIC NEUROLOGICAL SURGERY ORAL PRESENTATIONS**

Room 3018

3:33–3:39 pm

**133 Intraoperative Detection of Pediatric Brain Tumor Margins Using Raman Spectroscopy.**

Rashad Jabarkheel, Jonathon J. Parker, Chi-Sing Ho, Travis Shaffer, Sanjiv Gambhir, Gerald A. Grant, Derek W. Yecies

3:39–3:45 pm

**134 Exome Sequencing Implicates SWI/SNF Chromatin Remodeling Genes in Human Congenital Hydrocephalus.**

August A. Allocco, Sheng C. Jin, Weilai Dong, Xue Zeng, Sierra B. Conine, Charuta G. Furey, Priya P. Date, Jonathan Gaillard, Carol Nelson-Williams, Ashley Dunbar, Tyrone DeSpensa, Jr., Engin Deniz, Mustafa K. Khokha, Richard P. Lifton, Kristopher T. Kahle

3:45–3:51 pm

**135 Intraventricular Hemorrhage Induces Rapid Calcium Signaling and Transcriptional Changes in the Developing Choroid Plexus**

Cameron Sadegh, Huixin Xu, Frederick Shipley, Neil Dani, Maria K. Lehtinen

3:51–3:57 pm

**136 Risk of Subsequent Primary Cancers After External Beam Radiotherapy Treatment of Pediatric Low Grade Gliomas: A SEER Analysis 1973-2015**

Adrian Rodrigues, Michael C. Jin, Adela Wu, Gordon Li, Gerald A. Grant

3:57–4:03 pm

**137 The Effectiveness of Medical and Surgical Treatment for Children with Refractory Epilepsy**

Melissa LoPresti, Iwen Pan, Dave Clarke, Sandi Lam

4:03–4:09 pm

**138 Pediatric Firearm-related Traumatic Brain Injury in United States Trauma Centers**

Hansen Deng, John K. Yue, Ethan A. Winkler, Sanjay S. Dhall, Geoffrey T. Manley, Phiroz E. Tarapore

**SECTION ON PERIPHERAL NERVES ORAL PRESENTATIONS**

Room 2018

3:26–3:32 pm

**139 Integrated Multi-Omics Characterization of Neurofibromatosis Type 1 Related Peripheral Nerve Sheath Tumors Identifies Two Distinct Malignant Peripheral Nerve Sheath Tumors Subtypes with SHH or WNT Pathway Activation**

Suganth Suppiah, Jeff Liu, Qingxia Wei, Yasin Mamatjan, Pardeep Heir, Farshad Nassiri, Sheila Mansouri, Kenneth Aldape, Gelareh Zadeh

3:32–3:38 pm

**140 Mineral Coated Microparticle Sutures Impregnated with GDNF (Glial Derived Neurotrophic Factor) and NGF (Nerve Growth Factor) Improve Axonal Growth and Functional Recovery in Rat Sciatic Nerve Injuries**

Clayton Haldeman, Amgad S. Hanna

3:38–3:44 pm

**141 Functional Restoration of Elbow Flexion in Non-Obstetric Brachial Plexus Injuries: A Meta-Analysis of Nerve Transfers Versus Grafts**

Pavlos Texakalidis, Nathan Hardcastle, Muhibullah S. Tora, Nicholas M. Boulis

3:44–3:50 pm

**142 Imaging Predictors for Significant Lower Motor Neuron Injury in Traumatic Cervical Spinal Cord Injury**

Mehrnoosh Gorjian, Justin M. Brown

3:50–3:56 pm

**143 Neuralgic Amyotrophy : Clinical and Epidemiological Features from a Spine Neurosurgeon's Perspective**

Yong-Jun Cho, Museung Park, Suk H. Kang

3:56–4:02 pm

**144 Fascicle Sparing Capsular Resections of Atypical Neurofibromas in Neurofibromatosis 1**

Charlie Nelson, Eva Dombi, Jared S. Rosenblum, Markku Miettinen, Tanya Lehy, Patricia Whitcomb, Christina Hayes, Gretchen Scott, Sarah Benzo, Brigitte Widemann, Prashant Chittiboina

4:02–4:08 pm

**145 One Year Follow-Up of a Randomized, Double-Blind, Placebo-Controlled Trial of Percutaneous Peripheral Nerve Stimulation for Chronic Neuropathic Pain Following Amputation**

Joshua M. Rosenow, Christopher Gilmore, Brian M. Ilfeld, Sean Li, Mehul J. Desai, Corey Hunter, Richard Rauck, Leonardo Kapural, Antoun Nader, John Mak, Steven P. Cohen, Nate Crosby, Josh W. Boggs



4:08–4:14 pm

**146 Functional Recovery via Preregenerated Nerve Graft in Rat Sciatic Nerve Injury Model**

Umang Khandpur, Ying Yan, Wilson Z. Ray, Matthew R. MacEwan

**SECTION IN STEREOTACTIC AND FUNCTIONAL NEUROSURGERY ORAL PRESENTATIONS**

Room 3020

3:34–3:40 pm

**147 Early Feasibility Study of a Neurostimulator to Create Artificial Vision**

Nader Pouratian, Daniel Yoshor, Soroush Niketeghad, Jessy Dorn, Robert Greenberg

3:40–3:46 pm

**148 Distributed Global Functional Connectivity Networks Predict Responsiveness to L-DOPA and Subthalamic Deep Brain Stimulation**

Chengyuan Wu, Thomas Foltynie, Patricia Limousin, Ludvic Zrinzo, Harith Akram

3:46–3:52 pm

**STEREOTACTIC AND FUNCTIONAL NEUROSURGERY RESIDENT AWARD**

**149 A Fully Implantable Brain Machine Interface for Volitional Hand Grasp Restoration in Cervical Quadriplegia**

Iahn Cajigas, Noeline W. Prins, Sebastian Gallo, Jasim A. Naeem, Santiago Guerra, Brandon Parks, Anne Palermo, Audrey Wilson, Letitia Fisher, Steven Vanni, Michael E. Ivan, Abhishek Prasad, Jonathan R. Jagid

3:52–3:58 pm

**150 Tackling Big Data in Human Intracranial EEG Recordings**

Patrick J. Karas, John F. Magnotti, Zhengjia Wang, Daniel Yoshor, Michael S. Beauchamp

3:58–4:04 pm

**151 Thalamic Arousal Network Disturbances in Temporal Lobe Epilepsy and Improvement After Surgery**

Dario J. Englot, Srijata Chakravorti

4:04–4:10 pm

**152 Sphenopalatine Ganglion Stimulation Upregulates Transport of Intra-arterial Temozolomide Across the Blood-Brain Barrier**

Thana N. Theofanis, Ankit Rochani, Richard F. Schmidt, Michael J. Lang, Geoffrey Stricsek, Gagan Kaushal, Lorraine Iacovitti, Ashwini D. Sharan, Robert H. Rosenwasser

**SECTION ON TUMORS ORAL PRESENTATIONS**

Room 3014

3:34–3:40 pm

**ROSENBLUM-MAHALEY CLINICAL RESEARCH AWARD**

**153 First in Human Phase I Trial of Dual Vector (HSV1-TK, F1t3L) Immunotherapy for the Treatment of Newly Diagnosed High-Grade Glioma: Initial Results**

Daniel A. Orringer, Oren Sagher, Jason Heth, Shawn L.

Hervey-Jumper, Aaron Mammoser, Larry Junck, Denise Leung, Yoshie Umemura, Theodore Lawrence, Michelle Kim, Dan Wahl, Paul McKeever, Sandra Camelo-Piragua, Andrew Lieberman, Sriram Venneti, Kait Verbal, Karen Sagher, Patrick Dunn, Daniel Zamler, Vivek Yadav, Andrea Comba, David Altshuler, L. Zhao, Karin M. Muraszko, Maria G. Castro, Pedro Lowenstein

3:40–3:46 pm

**JOINT SECTION ON TUMOR NEURO-ONCOLOGY TRAINEE AWARD**

**154 Combination Immune Treatment of a Highly Aggressive Orthotopic Murine Glioblastoma with Checkpoint Blockade Inhibition and Neoantigen Vaccination**

Connor Liu, Maximilian Schaettler, Jay Bowman-Kirigin, Diane Bender, Dale K. Kobayashi, Chris A. Miller, Tanner M. Johanns, Gavin P. Dunn

3:46–3:52 pm

**AMERICAN BRAIN TUMOR ASSOCIATION YOUNG INVESTIGATOR AWARD**

**155 BiTE-armored CAR T Cells Overcome Antigen Escape from EGFRvIII-Targeted Therapy for Glioblastoma**

Bryan D. Choi, Xiaoling Yu, Ana P. Castano, Amanda A. Bouffard, Andrea Schmidts, Rebecca C. Larson, Stefanie R. Bailey, Angela C. Boroughs, Matthew J. Frigault, Mark B. Leick, Irene Scarfo, Curtis L. Cetrulo, Shadmehr Demehri, Brian V. Nahed, Daniel P. Cahill, Hiroaki Wakimoto, William T. Curry, Bob S. Carter, Marcela V. Maus

3:52–3:58 pm

**PREUSS RESEARCH AWARD**

**156 Immuno-stimulatory Effects of Mechanical and Thermal High Intensity Focused Ultrasound**

James Wang, Chin-Hsin Huang, Oscar H. Echeagaray, Siamak Amirfakhri, Sarah L. Blair, William C. Trogler, Andrew C. Kummel, Clark C. Chen

3:58–4:04 pm

**JOINT SECTION SKULL BASE SURGERY AWARD**

**157 Dural Venous Sinus Thrombosis After Vestibular Schwannoma Surgery: The Anticoagulation Dilemma**

Bledi C. Brahimaj, Andre Beer-Furlan, Fred C. Crawford, Ravi S. Nunna, Matthew Urban, Gary Wu, Eric Abello, Vikrant Chauhan, Mehmet Kocak, Richard M. Wiet, Richard W. Byrne

4:04–4:10 pm

**INTEGRA FOUNDATION AWARD**

**158 Candidate Regulatory Elements in Coding and Noncoding Regions are Associated with Invasive Behavior in Pituitary Tumors**

Karam P. Asmaro, Maritza S. Mosella, Michael Wells, Thais Sadedot, Tathiane Malta, Kevin Nelson, James Snyder, Ana DeCarvalho, Abir Mukherjee, Dhananjay Chitale, Todd Aho, Adam M. Robin, Mark L. Rosenblum, Tom Mikkelsen, Laila Poisson, Ian Y. Lee, Tobias Walbert, Arti Bhan, Steven N. Kalkanis, Jack P. Rock, Houtan Noushmehr, Anavaleria Castro

## CSNS CASE-BASED DISCUSSION ORAL PRESENTATIONS

Room 3016

5:16–5:22 pm

**400 Disparities in Patient Outcomes After Elective Lumbar Fusions in Single-Level Lumbar Disc Pathologies**  
Abhinav K. Reddy, Philip B. Ostrov, James S. Ryoo, Soobin Kim, Ankit Indravadan Mehta

5:22–5:28 pm

**401 A Multidisciplinary Spine Clinic Model Significantly Reduces Lead Times for Appropriate Specialist Visit and Appropriate Intervention in an Underserved Population: A Case Control Pilot Study**  
Michael Longo, Yaroslav J. Gelfand, Andrew I. Gitkind, Reza Yassari, Vijay Yanamadala

5:28–5:34 pm

**402 The Potential Effect of Racial Disparities on Outcomes After Spine Surgery: A Michigan Spine Surgery Improvement Collaborative (MSSIC) Study**  
Mohamed Macki, Michael Bazydlo, Hesham M. Zakaria, Lonni Shultz, Jad Khalil, Mick J. Perez-Cruet, Ilyas Aleem, Paul Park, David Nerenz, Jason M. Schwalb, Muwaffak Abdulhak, Victor W. Chang

5:34–5:40 pm

**403 Cervical Spine Surgery: Improved Surgical Outcomes Using Enhanced Recovery After Surgery (ERAS) Pathways**  
Ryan P. Monaghan, Mary K. Robertson, Scott C. Robertson



## CEREBROVASCULAR OPERATIVE TECHNIQUES AND CASE-BASED DISCUSSION ORAL PRESENTATIONS

Room 2014

4:36–4:42 pm

**404 Use of Virtual Reality Platforms in the Preoperative Planning and Intraoperative Navigation of Deep-seated Cavernomas**  
Carolina Gesteira-Benjamin, Omar Tanweer, Monica Mureb, Keiji Drysdale, Timothy M. Shepherd, John G. Golfinos, Howard A. Riina

4:42–4:48 pm

**405 Direct Access Embolization of Intracranial Vascular Pathology: Preliminary Experience and Technical Notes**  
Min S. Park, Daniel Raper, Stepan Capek, Jeffrey Hakim, David Asuzu, M. Yashar S. Kalani

4:48–4:54 pm

**406 Morphometric Comparison of the Pterional Trans-sylvian and the Pretemporal Trans-clinoidal Approaches to Posterior Communicating Artery Aneurysms: Anatomical Study**  
Jaafar Basma, Kenneth Moore, Tarek Abuelem, Khaled Krisht, L. Madison Michael, II, Ali F. Krisht

4:54–5:00 pm

**407 Accessing the Medial Surface of the Paraclinoid Internal Carotid Artery via the Contralateral Inter-optic Trajectory: An Anatomical Study**  
Xiaochun Zhao, Ali Tayebi-Meybodi, Mohamed Labib, Evgenii Belykh, Leandro Borba Moreira, Sirin Gandhi, Peter Nakaji, Mark C. Preul, Michael T. Lawton

## SPINE OPERATIVE TECHNIQUES AND CASE-BASED DISCUSSION ORAL PRESENTATIONS

Room 2016

4:36–4:42 pm

**408 Outcomes of Surgical Treatment for 138 Patients with Severe Sagittal Deformity at a Minimum 2-Year Follow Up**  
Justin K. Scheer, Lawrence Lenke, Justin S. Smith, Peter G. Passias, Han Jo Kim, Shay Bess, Themistocles Protopsaltis, Douglas C. Burton, Eric Klineberg, Virginie Lafage, Frank Schwab, Christopher I. Shaffrey, Sr., Christopher P. Ames

4:42–4:48 pm

**409 C2 versus C3 as the Upper Instrumented Vertebra for Cervicothoracic Posterior Laminectomy and Fusion Demonstrate Equivalent Postoperative Outcomes**  
Ryan K. Badiie, Andrew Kai-Hong Chan, Joshua Rivera, Chih-Chang Chang, Dean Chou, Praveen V. Mummaneni, Lee A. Tan

4:48–4:54 pm

**410 Preoperative SPECT Imaging as a Tool for Surgical Planning in Patients with Axial Neck and Back Pain**  
G. Damian Brusko, Roberto Perez-Roman, Harold Tampano, Michael Y. Wang

4:54–5:00 pm

**411 A Comparison of Minimally Invasive and Open Transforaminal Lumbar Interbody Fusion for Grade 1 Degenerative Lumbar Spondylolisthesis: An Analysis of the Prospective Quality Outcomes Database**  
Andrew Kai-Hong Chan, Erica F. Bisson, Mohamad Bydon, Steven D. Glassman, Kevin T. Foley, Christopher I. Shaffrey, Eric A. Potts, Mark E. Shaffrey, Domagoj Coric, John J. Knightly, Paul Park, Michael Y. Wang, Kai-Ming G. Fu, Jonathan Slotkin, Anthony L. Asher, Michael S. Virk, Panagiotis Kerezoudis, Mohammed A. Alvi, Jian Guan, Regis W. Haid, Praveen V. Mummaneni

## NEUROTRAUMA OPERATIVE TECHNIQUES AND CASE-BASED DISCUSSION ORAL PRESENTATIONS

Room 3022

4:15–4:21 pm

**412 Important Predictors of In-hospital Mortality in Patients with Acute Subdural Hematomas using Machine Learning**  
Aaron McPheters, Andrew Donovan, Nicolas K. Khattar, Jacob R. Shpilberg, Kevin John, Quan H. Do, Daniella Patton, Emily P. Sieg

4:21–4:27 pm

**413 Prognostic Value of Admission Parameters in a Machine Learning Predictive Model in Patients with Severe Traumatic Brain Injury and Acute Subdural Hematomas**

Kevin John, Aaron McPheters, Andrew Donovan, Nicolas K. Khattar, Jacob R. Shpilberg, Quan H. Do, Emily P. Sieg

4:27–4:33 pm

**414 Augmented Reality Systems for Improved Operating Room Workflow**

Nhu Q. Nguyen, Jillian Cardinell, Joel Ramjist, Yuta Dobashi, Dimitrios Androustos, Victor Xiao Dong Yang

4:33–4:39 pm

**415 Segmentation and Measurement of Ventricular and Cranial Vault Volumes in 15,223 Subjects Using Artificial Intelligence**

Georgios Maragkos, Sasank Chilamkurthy, Santiago Gomez-Paz, Mohamed M. Salem, Swetha Tanamala, Pooja Rao, David Hackney, Ajith J. Thomas

**PAIN OPERATIVE TECHNIQUES AND CASE-BASED DISCUSSION ORAL PRESENTATIONS**

Room 3024

5:06–5:12 pm

**416 Flat Panel Fluoroscopy (O-arm) Guided Percutaneous Radiofrequency Anterolateral Cordotomy.**

Zaid Aljuboori, Joseph Samir Neimat

5:12–5:18 pm

**417 Bi-Plane Fluoroscopic-Guided Balloon Rhizotomy for Trigeminal Neuralgia: A Technical Note**

Awais Vance, Tarek Youssef El Ahmadi, Zachary Christian, Salah G. Aoun, Samuel L. Barnett, Jonathan A. White

5:18–5:24 pm

**418 Complex Regional Pain Syndrome and Failed Back Surgery Syndrome with Failed High-Frequency Spinal Cord Stimulation Salvaged with Arthrodesis Revision Surgery and Burst Therapy.**

Erin McCormack, Mansour H. Mathkour, Lora Wallis-Kahn, Maged Guirguis, Gassan Chaiban, Reda Tolba, Daniel Denis

5:24–5:30 pm

**419 Onyike Grading Scale: A Clinical Classification System for the Diagnosis and Management of Bertolotti Syndrome**

Joshua Knopf, Subin Lee, Ketan R. Bulsara, Hilary C. Onyike, David B. Choi, Isaac Moss

**PEDIATRICS OPERATIVE TECHNIQUES AND CASE-BASED DISCUSSION ORAL PRESENTATIONS**

Room 3018

4:36–4:42 pm

**420 True FISP Cardiac Gated CSF Flow Dynamic Imaging of Chiari Malformation**

Alon Kashanian, Moise Danielpour

4:42–4:48 PM

**421 Autologous Partial Thickness Calvarial Graft Sphenocranioplasty for Congenital Transsphenoidal Encephalocele**

M. Burhan Janjua, Gopi B. Shah, Dale Swift

4:48–4:54 pm

**422 Laser and the Tuber: Thermal Dynamic and Volumetric Factors Influencing Seizure Outcomes in Pediatric Subjects with Tuberous Sclerosis Undergoing Stereoecephalography-directed Laser Ablation of Tubers**

Michael A. Stellon, Kelsey D. Cobourn, Matthew Whitehead, Nancy Elling, William McClintock, Chima Oluigbo

**STEREOTACTIC AND FUNCTIONAL OPERATIVE TECHNIQUES AND CASE-BASED DISCUSSION ORAL PRESENTATIONS**

Room 3020

4:36–4:42 pm

**424 Stereotactic ROBOT-assisted Deep Brain Stimulation Workflow: Incorporating the ROSA-Brain System into the Functional Neurosurgical Practice**

Amir H. Faraji, Vasileios Kokkinos, James C. Sweat, Robert M. Richardson

4:42–4:48 pm

**425 Vagal Nerve Stimulator Lead Revision Using Needle-Tip Cautery: Case Series, Literature Review, and Technical Note**

Vyacheslav I. Makler, Erin D'Agostino, David F. Bauer

4:48–4:54 pm

**426 Robotic Orthogonal Implantation of Responsive Neurostimulation (RNS) Depth Electrodes in Patients with Unilateral Mesial Temporal Lobe Seizure Onset**

Alvin Y. Chan, Sumeet Vadera

4:54–5:00 pm

**427 Accuracy of SEEG Electrodes Implanted in Lateral Position Versus Supine Position**

Caio M. Matias, Sandeep Kandregula, Chengyuan Wu, Ashwini D. Sharan

**TUMOR OPERATIVE TECHNIQUES AND CASE-BASED DISCUSSION ORAL PRESENTATIONS**

Room 3014

4:45–4:51 pm

**428 Minimally Invasive Endoscopic Keyhole Approach for Meningiomas**

Tadashi Watanabe

4:51–4:57 pm

**429 Extra-arachnoidal Dissection for Excision of Giant Vestibular Schwannomas: Improved Facial Nerve Preservation**

Sunil K. Gupta

4:57–5:03 pm

**430 Step-wise Algorithm for Skull Base Reconstruction in Endoscopic Endonasal Surgery: From the Simple to the Complex**

Maria Belen Vega, Philippe Lavigne, Vanessa Hernandez-Hernandez, Aldo Eguiluz-Menendez, Eric Wang, Carl H. Snyderman, Paul A. Gardner

5:03–5:09 pm

**431 Surgical Nuances of Endoscopic Endonasal Upper Clivectomy for Radical Resection of Central Skull Base Tumors: 2-Dimensional Operative Videos**

Alhusain Nagm, Takeo Goto, Kenji Ohata

**THE INTERNATIONAL CEREBROVASCULAR SYMPOSIUM ORAL PRESENTATIONS**

Room 3003

6:39–6:45 pm

**500 Analysis of Gene Expression in Intracranial Aneurysms**

Jia Wang

6:45–6:51 pm

**501 Comparative Effectiveness of Preventive and Treatment Interventions for Cerebral Hyperperfusion Syndrome Following Bypass Surgery**

Georgios P. Skandalakis, Aristotelis Kalyvas, Evgenia Lani, Spyridon Komaitis, Despoina Chatzopoulou, Danai Manolakou, Nikos Pantazis, Georgios A. Zenonos, Constantinos G. Hadjipanayis, George S. Stranjalis, Christos Koutsarnakis

6:51–6:57 pm

**BEST INTERNATIONAL BASIC SCIENCE**

**502 Association of SOX17 Gene Polymorphisms and Intracranial Aneurysm: A Case-Control Study and Meta-analysis**

Museung Park, Yong-Jun Cho, Jin Sue Jeon

6:57–7:03 pm

**503 Clinical Significance of Conversion from Computational Fluid Dynamics to Morphology for Risk Evaluation of Aneurysm Recurrence After Coiling**

Kouichi Misaki, Iku Nambu, Takehiro Uno, Akifumi Yoshikawa, Naoyuki Uchiyama, Mitsutoshi Nakada

7:03–7:09 pm

**504 Application of Intraoperative Electrocoagulation in Precise Bypass Surgery of Adult Moyamoya Disease: A Preliminary Study**

Yu Lei

**THE INTERNATIONAL FUNCTIONAL NEUROSURGERY SYMPOSIUM ORAL PRESENTATIONS**

Room 3002

6:39–6:45 pm

**505 Mesial Temporal Lobe Epilepsy: Role of Reelin Signalling Pathway**

Tulika Gupta, Mandeep Kaur, Navneet Singla, Bishan Radotra, Sunil Kumar Gupta, Daisy Sahni

6:45–6:51 pm

**506 Asymmetric Deep Brain Stimulation Electrodes for Parkinson's Disease: A Pilot Study of Symptom-tailored Stimulation**

Chencheng Zhang, Linbin Wang, Leonardo Almeida, Bomin Sun, Dianyou Li

6:51–6:57 pm

**507 Sex Difference in Language Processing in Patients with Malignant Brain Tumors**

Shun Yao, Einat Liebenthal, Parikshit Juvekar, Adomas Bunevicius, Matthew Vera, Laura Rigolo, Alexandra J. Golby, Yanmei Tie

6:57–7:03 pm

**508 Multi-modal Presurgical Evaluation of Refractory Localization-related Epilepsy Involving Mesial Temporal Lobe Structures**

Rui Feng, Jie Hu, Chengxin Ma, Zhen Fan, Liqin Lang, Bing Sun, Jinsong Wu, Li Pan

7:03 –7:09 pm

**509 Language Localisation in Multilingual Patients – Evidence from Direct Electrical Stimulation: A Systematic Review and Single Institution Case Series**

Colin Teo Kok Ann, Djaina Satoer, Hui Minn Chan, Marco Rossi, Tseng Tsai Yeo, Yi Ting Emily Guo, Ne Hooi Will Loh, Elke De Witte, Kejia Teo



# ORAL ABSTRACT PRESENTATIONS

## TUESDAY, OCTOBER 22

SE

### SUNRISE SCIENCE ORAL PRESENTATIONS SESSION

Room 3016

7:00–7:06 am

#### **320 Does Hospital For-Profit Status Affect Intracranial Hemorrhage Outcomes and Cost of Care?**

Ryan G. Chiu, Blake Murphy, David Rosenberg, Amy Zhu, Ankit I. Mehta

7:06–7:12 am

#### **321 Workplace Violence and Neurosurgical Practice: Insights from the CSNS Workplace Violence Survey**

Tyler Schmidt, Samuel Tomlinson, Kristopher T. Kimmell, Joshua M. Rosenow, Jeremy T. Phelps

7:12–7:18 am

#### **322 Factors and Trends Associated with NIH Funding for Neurosurgeons over 25 years**

Ankush Chandra, Arman Jahangiri, Patrick M. Flanigan, Maxine Arnush, Jonathan W. Rick, Sarah Choi, Alvin Chou, Mitchel S. Berger, Manish K. Aghi

7:18–7:24 am

#### **323 Variation in 90-day Postoperative Costs Among Patients Undergoing Elective Anterior Cervical Discectomy and Fusion: Insights from the OPTUM Labs Data Warehouse (OLDW)**

Panagiotis Kerezoudis, Mohammed A. Alvi, Anshit Goyal, Yagiz U. Yolcu, Stephanie Payne, Lindsey Sangaralingham, Molly Jeffery, Mohamad Bydon

7:24–7:30 am

#### **324 This Is Not Brain Surgery: Increasing Neurosurgical Knowledge and Retention in Medical Students Through Usage of a Video-Based Education Curriculum**

Carl Gustaf Stefan Axelsson, William T. Curry, Michael G. Healy, Emil Petrusa, Deborah M. Rooney, Traci Wolbrink, Roy Phitayakorn

7:30–7:36 am

#### **325 Video Recording Patient Visits to Improve Patient Satisfaction and HCAHPS Scores**

Malika Bhargava, Komal Naeem, Randall W. Porter

7:36–7:42 am

#### **326 Trends in Neurosurgical Fellowship Training in North America over Two Decades 1997-2016**

Ankush Chandra, Michael G. Brandel, John K. Yue, Lauro Avalos, Michael W. McDermott, Mitchel S. Berger, Manish K. Aghi

7:42–7:48 am

#### **327 Surgical Epilepsy Care in a Safety-Net and Private Healthcare System: A Comparative Analysis**

Jordan Lam, Vivek Mehta, Daniel R. Kramer, Dudley Fukunaga, Brian Lee, Jonathan Russin, David Millett, Christianne N. Heck, Susan Shaw, Hui Gong, Michelle Armacost, Laura A. Kalayjian, George Nune, Guadalupe Coralle-Leyva, Sandra Oviedo, Joanne Gibbons, Charles Y. Liu

7:48–7:54 am

#### **328 Factors Associated with Cost of 30-day and 90-day Readmissions Following Anterior Cervical Discectomy and Fusion: Insights from the Nationwide Readmissions Database**

Anshit Goyal, Archis Bhandarkar, Mohammed A. Alvi, Mohamad Bydon

7:54–8:00 am

#### **329 Socioeconomic Impacts of Opioid Dependence on Spinal Decompression and Fusion at Any Level: Analysis of a Nationwide Database**

Andrew J. Caras, William K. Miller, Weikai Qu, Jason L. Schroeder, Azedine Medhkour

8:00–8:06 am

#### **910 Health Literacy Among Surgical Subspecialties: Readability of Online Patient Materials for Surgical Procedures**

Rosemary Behmer-Hansen, Meeki Lad, Justin L. Gold, Raghav Gupta, Somnath Ganapa, Antonios Mammis

8:06–8:12 am

#### **911 Cost Variability for Four Common Neurosurgical Procedures in the United States**

Hammad A. Khan, Konrad Knusel, Joseph E. Tanenbaum, Thomas E. Mroz, Edward C. Benzel, Deborah L. Benzil, Michael P. Steinmetz, Sebastian Salas-Vega

8:12–8:18 am

#### **912 Analysis of Variables Associated with Number of Neurosurgical Residency Interview Invitations using a Survey Database**

Anthony Nguyen, Will Coggins, Elizabeth Nyabuto, Joseph R. McFarland, III, Daniel Branch, Rishi R. Lall

8:18–8:24 pm

#### **913 Reducing Neurosurgery Craniotomy Surgical Site Infections: A Quality Improvement Project**

Clifford Crutcher, Adam Podet, Frank Culicchia

8:24–8:30 am

#### **914 Implementation of an Inpatient Neurosurgical Advanced Practice Nursing Role Reduces 30-Day Re-admissions and Post-operative Wound Infections**

Adam Podet, Kevin D. Morrow, Anthony M. DiGiorgio, Jessica Shields, Taylor Wapshott-Girolamo, Bonnie Koepp, Gabriel C. Tender, Jason D. Wilson



**SUNRISE SCIENCE ORAL PRESENTATIONS SESSION**

Room 2016

7:00–7:06 am

**330 A Novel Preoperative Radiographic Scoring System to Predict Postoperative Outcomes in Patients Undergoing Cervical Disc Replacement Surgery**

Yahya Othman, Todd Albert, Russell Huang, Philip York, Avani Vaishnav, Steven Mcanany, Sravisht Iyer, Catherine Gang, Sheeraz Qureshi

7:06–7:12 am

**331 PROMIS-29 Validity and Conversion Equation to Neck Disability Index (NDI) Using a National Sample of Cervical Spine Surgery Patients**

Inamullah Khan, Jacquelyn S. Pennings, Claudia Davidson, Mohamad Bydon, Anthony L. Asher, Clinton J. Devin, Kristen Archer-Swygert

7:12–7:18 am

**332 Genomic Landscape of Intramedullary Spinal Cord Tumors Suggests Distinct Genetic Origins Compared to Intracranial Histopathologic Counterparts**

Tej D. Azad, Ming Zhang, Rajiv Iyer, Qing Wang, Tomas Garzon-Muvdi, Joanna Wang, Ann Liu, Peter C. Burger, Charles G. Eberhart, Fausto J. Rodriguez, Daniel M. Sciubba, Jean-Paul Wolinsky, Ziya L. Gokaslan, Mari L. Groves, George I. Jallo, Chetan Bettegowda

7:18–7:24 am

**333 Surgical Treatment of Cervical Spondylotic Myelopathy Leads to Functional Improvement in Hand Strength and Dexterity: A Prospective Quantitative Study**

Tyler S. Cole, Kaith K. Almefty, Jakub Godzik, Randall Hlubek, Jay D. Turner

7:24–7:30 am

**334 Neuro-Spinal Scaffold™! Implantation in Patients with Acute Traumatic Thoracic Complete Spinal Cord Injury: Twenty-Four Month Results from the INSPIRE Study**

Kee D. Kim, K. Stuart Lee, Jason J. Chang, Richard M. Toselli

7:30–7:36 am

**335 Does ACR Result in Greater Morbidity than LLIF Alone When Treating Adult Spinal Deformity?**

Adam S. Kanter, Robert Eastlack, Juan S. Uribe, Richard G. Fessler, Khoi D. Than, Stacie Tran, Dean Chou, Kaiming Fu, Paul Park, Michael Y. Wang, David O. Okonkwo, Pierce D. Nunley, Neel Anand, Gregory M. Mundis, Jr., Praveen V. Mummaneni, International Spine Study Group

7:36–7:42 am

**336 Anterior Lumbar Interbody Fusion (ALIF) Versus Oblique Lateral Interbody Fusion (OLIF) at L5-S1: A Comparison of Two Approaches to the Lumbosacral Junction**

Zhuo Xi, Shane Burch, Chih-Chang Chang, Hui-bing Ruan, Charles M. Eichler, Praveen V. Mummaneni, Dean Chou

7:42–7:48 am

**337 Treatment of Adult Scoliosis Fractional Curve with Minimally Invasive Surgery: Anterior Versus Posterior Approach?**

Robert Eastlack, Juan S. Uribe, Richard G. Fessler, Khoi D. Than, Stacie Tran, Kai-Ming G. Fu, Paul Park, Michael Y. Wang, Adam S. Kanter, David O. Okonkwo, Pierce D. Nunley, Neel Anand, Gregory M. Mundis, Jr., Praveen V. Mummaneni, Dean Chou, International Spine Study Group

7:48–7:54 am

**338 The Minimally Invasive Interbody Selection Algorithm (MIISA) for Spinal Deformity**

Praveen V. Mummaneni, Christopher I. Shaffrey, Sr., Robert Eastlack, Juan S. Uribe, Richard G. Fessler, Paul Park, Leslie Robinson, Joshua Rivera, Dean Chou, Kai-Ming G. Fu, Adam S. Kanter, David O. Okonkwo, Pierce D. Nunley, Khoi Duc Than

7:54–8:00 am

**339 Predictors of the Best Outcomes Following Minimally Invasive Surgery for Grade 1 Lumbar Spondylolisthesis**

Andrew Kai-Hong Chan, Erica F. Bisson, Mohamad Bydon, Steven D. Glassman, Kevin T. Foley, Eric A. Potts, Christopher I. Shaffrey, Sr., Mark E. Shaffrey, Domagoj Coric, John J. Knightly, Paul Park, Michael Y. Wang, Kai-Ming G. Fu, Jonathan Slotkin, Anthony L. Asher, Michael S. Virk, Panagiotis Kerezoudis, Mohammed A. Alvi, Jian Guan, Regis W. Haid, Praveen V. Mummaneni

8:00–8:06 am

**915 Anterior Approach versus Posterior Approach in the Treatment of Cervical Spondylotic Myelopathy: A Prospective, Randomized Study**

Nasser M.F. El-Ghandour, Mohamed A.R. Soliman, Ahmed A.M. Ezzat, Amr Ashraf, Mostafa Z. El-Abdeen

8:06–8:12 am

**916 Large Increases in Lumbar Fusions Expected in the United States by 2060**

Sean N. Neifert, Jeffrey Gilligan, Robert J. Rothrock, Jeffrey H. Zimering, John M. Caridi, Eric K. Oermann

8:12–8:18 am

**917 Evaluation of Single Level Cervical Disc Arthroplasty in Advanced Degenerative Disc Disease**

Nathan L. Pratt, Charles A. Sansur, Kenneth M. Crandall, George A. Crabill

8:18–8:24 am

**918 Key Drivers of Patient Satisfaction in the Outpatient Spine Surgery Setting**

Nicholas M. Rabah, Jay M. Levin, Robert Winkelman, Thomas E. Mroz, Michael P. Steinmetz

8:24–8:30 am

**919 The Safety and Efficacy of Riluzole in Enhancing Clinical Outcomes in Patients undergoing Surgery for Cervical Spondylotic Myelopathy: Results of the CSM-Protect Double-blinded, Multi-center Randomized Controlled Trial in 300**

Michael G. Fehlings, Jetan H. Badhiwala, Henry Ahn, Francis Farhadi, Christopher I. Shaffrey, Sr., Ahmad Nassr, Praveen V. Mummaneni, Paul M. Arnold, W. Bradley Jacobs, Darrel S. Brodke, K. Daniel Riew, Michael P. Kelly, James S. Harrop, Alexander R. Vaccaro, Jason D. Wilson, Sangwook Yoon, Daryl R. Fournay, Kee Kim, Carlo Santaguida, Branko Kopjar

7:00–7:06 am

**340 Firearm Injuries Cause Disproportionate Mortality in Pediatric Traumatic Brain Injury**

Saksham Gupta, Blake M. Hauser, Mark M. Zaki, David J. Cote, Saef Izzy, Timothy R. Smith, Ayaz M. Khawaja

7:06–7:12 am

**341 Exome Sequencing Defines the Molecular Pathogenesis of Vein of Galen Malformation**

Adam Kundishora, Xue Zeng, Daniel Duran, August A. Allocco, Jungmin Choi, Sheng Chih Jin, Sierra B. Conine, Carol Nelson-Williams, Jonathan Gaillard, Charuta G. Furey, Andrew T. Timberlake, Mohammad Mansuri, Michelle Sorscher, Jennifer Klein, Qiongshi Lu, Julio D. Montejo, Alberto Vera, Jason K. Karimy, Shreyas Panchagnula, Mark Youngblood, Michael L. DiLuna, Charles C. Matouk, Shrikant Mane, Seth Alper, Andrew F. Ducruet, Joseph M. Zabramski, Beverly Aagaard-Kienitz, Georges Rodesch, Edward R. Smith, Darren Orbach, Alejandro Berenstein, Kaya Bilguvar, Murat Gunel, Richard P. Lifton, Kristopher T. Kahle

7:12–7:18 am

**342 Elbow Flexion in Neonatal Brachial Plexus Palsy: A Meta-Analysis of Graft Versus Transfer**

Muhibullah S. Tora, Nathan Hardcastle, Pavlos Texakalidis, Jeremy Wetzel, Joshua J. Chern

7:18–7:24 am

**343 Prognostic Value of Leucocytosis in Pediatric Traumatic Brain Injury**

Soumya Mukherjee, Gnanamurthy Sivakumar, John Goodden, Atul Tyagi, P.D. Chumas

7:24–7:30 am

**344 A Comparison of Parent and Child Evaluations of Quality of Life in Pediatric Neurosurgery**

Eric Goethe, Melissa LoPresti, Michelle Yifan Zhao, I-Wen Pan, Sandi Lam

7:30–7:36 am

**345 Gene Mutations Related to Pathogenesis and Development of Cerebral Arteriovenous Malformations in Pediatric Populations**

Rebecca Y. Du, Melissa LoPresti, Vijay Ravindra, Ionela Iacobas, Katie Bergstrom, Eric A. Goethe, Sandi Lam

7:36–7:42 am

**346 Traumatic Spinal Injuries Cause Disproportionate Morbidity in Sports-related Pediatric Trauma**

Blake M. Hauser, Saksham Gupta, David J. Cote, Mark M. Zaki, Edward Xu, Ayaz M. Khawaja, Yi Lu, Michael W. Groff, Timothy R. Smith, Hasan A. Zaidi

7:42–7:48 am

**347 Early Outcome of Endoscopic Third Ventriculostomy with or without Choroid pPexus Cauterization and Ventriculoperitoneal Shunt as Primary Treatment of Hydrocephalus in Infants with Myelomeningocele**

Bamidele Oludele Adebayo, Okezie Kanu, Olufemi B. Bankole, Omotayo Ojo

7:48–7:54 am

**348 Complications in Children with Ehlers-Danlos Syndrome Following Spine Surgery: Analysis of the Pediatric National Surgery Quality Improvement Program Database**

Abhijith V. Matur, Aria Nouri, Shenwen Huang, Nora C. Elson, William J. Jeong, Karin S. Bierbrauer, Francesco T. Mangano, Joseph S. Cheng

7:54–8:00 am

**349 Surgical Management of Tumors Involving the Cerebello-Medullary Angle: Anatomical Classification, Technique and Retrospective Analysis of 90 Pediatric Patients**

Jaafar Basma, Paul Klimo, Jr.

8:00–8:06 am

**920 Developmental Pleiotropy of PTEN in Congenital Hydrocephalus and Autism Spectrum Disorder**

Tyrone DeSpenza, Jr., Maryam Zekavat, Stephanie Getz, Sheng C. Jin, Weilai Dong, Carol Nelson-Williams, Duy Phan, Sierra B. Conine, August A. Allocco, Jason K. Karimy, Murat Gunel, Richard P. Lifton, Bryan Luikart, Kristopher T. Kahle

8:06–8:12 am

**921 Damaging Mutations in EphrinB2-EphB4-RASA1 Signaling Underlie Vein of Galen Malformation**

Daniel Duran, Xue Zeng, Ava Hunt, Sheng C. Jin, Sierra B. Conine, August A. Allocco, Benjamin Reeves, Carol Nelson-Williams, Michelle Sorscher, Erin Loring, Jennifer Klein, Michael L. DiLuna, Charles C. Matouk, Seth Alper, Masaki Komiyama, Andrew F. Ducruet, Joseph M. Zabramski, Alan Dardik, Brian P. Walcott, Christopher J. Stapleton, Sean Himel, Beverly Aagaard-Kienitz, Georges Rodesch, Eric M. Jackson, Edward R. Smith, Darren Orbach, Alejandro Berenstein, Kaya Bilguvar, Miikka Vikkula, Murat Gunel, Richard P. Lifton, Kristopher T. Kahle

8:12–8:18 am

**922 Challenges in Management of Pediatric Fossa Tutors: Indian Experience**

Kamlesh S. Bhaisora

8:18–8:24 am

**923 Finite Element Optimization of an Intervertebral Disc Replacement for Treating Scoliosis**

George R. Vithoulkas, Eric R. Taleghani, Rohit S. Rustagi, Alexander A. Singh, Hasan R. Syed

8:24–8:30 am

**924 Management of Infectious Complications in Pediatric ITB; a Meta-analysis**

Mohammed Nuru, Benton Maglinger, Ian S. Mutchnick

## COUNCIL OF STATE NEUROLOGICAL SOCIETIES ORAL PRESENTATIONS

Room 3016

3:27–3:33 pm

### SAMUEL Hassenbusch Young Neurosurgeon Award

#### 159 Simulating Costs for Episode-Based Bundled Payments for Cranial Neurosurgical Procedures

Zachary A. Medress, Beatrice Ugiliweneza, Jonathon J. Parker, Dengzhi Wang, Eric Burton, Shiao Y. Woo, Loren Baker, Maxwell Boakye, Stephen Skirboll

3:33–3:39 pm

#### 160 The Impact of Single-Vendor Procurement of Spinal Implants: An Analysis of Cost Savings and Surgical Quality at an Academic Hospital

Collin Blackburn, Nicolas Thompson, Joseph E. Tanenbaum, Thomas E. Mroz, Michael P. Steinmetz

3:39–3:45 pm

#### 161 Trending Racial and Socioeconomic Inequality in the Surgical Management and Outcome of Traumatic Cervical Spinal Cord Injury With Fracture In the USA from 1998-2009

Alexander Dru, Dan Neal, W. Christopher Fox, Brian L. Hoh, Daniel J. Hoh

3:45–3:51 pm

#### 162 Association Between Interhospital Competition and Hospital Resource Use for Cranial Neurosurgery: Analysis of 513,271 Admissions

Oliver Y. Tang, Krissia M. Rivera-Perla, Steven A. Toms

3:51–3:57 pm

#### 163 Bundle Payment, Health Care Utilization and Outcomes Following Surgery for Anterior, Middle and Posterior Cranial Fossa Skull Base Meningioma: A Market Scan Analysis

Mayur Sharma, Beatrice Ugiliweneza, Maxwell Boakye, Norberto O. Andaluz, Brian J. Williams

3:57–4:03 pm

#### 164 Patient Reported Outcomes Following Surgery for Lumbar Disc Herniation: Comparison of a Universal and Multitier Health Care System

Oliver G.S. Ayling, Tamir T. Ailon, Nicolas Dea, Charles Fisher

4:03–4:09 pm

#### 165 Length of Stay and Disposition of Patients Undergoing Elective Spine Surgery in Maryland: Impact of the Global Budget Revenue Program

Berje H. Shammassian, Andrew Ahn, Debraj Mukherjee

4:09–4:15 pm

#### 166 The Cost-Effectiveness of Epilepsy Surgery and Surgical Evaluation in the United States

Shehryar R. Sheikh, Michael P. Steinmetz, Michael W. Kattan, Mendel Singer, Belinda Udeh, Lara Jehi

## SECTION ON CEREBROVASCULAR SURGERY ORAL PRESENTATIONS

Room 2014

3:27–3:33 pm

#### 167 Mechanical Thrombectomy in Acute Ischemic Stroke: A Meta-Analysis of Stent Retrievers Versus Direct Aspiration Versus a Combined Approach

Pavlos Texakalidis, Stefanos Giannopoulos, Theofilos Karasavvidis, Leonardo Rangel-Castilla, Dennis J. Rivet, John F. Reavey-Cantwell

3:33–3:39 pm

#### 168 Percutaneous Trans-carotid Puncture for Mechanical Thrombectomy in Acute Ischemic Stroke Patients is Safe and Effective: A Large, Single-center Case Series

Branden J. Cord, Anson Wang, Fouad Chouairi, Andrew Koo, Carl Porto, Andrew Silverman, Sreeja Kodali, Sumita Strander, Guido Falcone, Kevin Sheth, Ryan M. Hebert, Lauren Sansing, Joseph Schindler, Nils Petersen, Charles C. Matouk

3:39–3:45 pm

#### 169 A Phase I/II, Prospective Multi-Center Study of the Safety and Preliminary Efficacy of Intravenous Allogeneic Mesenchymal Bone Marrow Cells in Chronic Ischemic Stroke

Michael L. Levy, John Crawford, Nabil Dib, Lev Verkh, Nikolai Tankovich, Steven C. Cramer

3:45–3:51 pm

#### 170 MicroRNA-26b/PTEN Signaling Pathway Mediates Glycine-induced Neuroprotection in SAH Injury

Xingping Qin

3:51–3:57 pm

#### 171 Elucidating a Proteomic Signature for the Detection of Intracerebral Aneurysms

Dominic A. Nistal, Michael L. Martini, Trevor Hardigan, Nicolas Fernandez, Seunghee Kim-Schulze, Rui Song, Natalia Romano-Spica, Julianne Kleitsch, J D. Mocco, Christopher P. Kellner

3:57–4:03 pm

#### 172 Bone Marrow T-cell Sequestration and Lymphopenia Accompanying Ischemic Stroke are Mediated by T-cell S1P1 Loss

Pakawat Chongsathidkiet, Cosette Dechant, Daniel Wilkinson, Haichen Wang, Hanna Kemeny, Xiuyu Cui, Selena Lorrey, Daniel T. Laskowitz, Peter E. Fecci

4:03–4:09 pm

#### 173 Vitamin D: A New Perspective in Treatment of Cerebral Vasospasm After Subarachnoid Hemorrhage

Sepide Kashefiolasi, Matthias Leisegang, Valeska Helfinger, Christoph Schürmann, Beatrice Pflüger-Müller, Voahanginirina Randriamboavonjy, Andrea Estefy-Vasconez, Geert Carmeliet, Klaus Badenhoop, Gudrun Hintereder, Volker Seifert, Katrin Schröder, Juergen Konczalla, Ralf Brandes



4:09–4:15 pm

**174 Optogenetic Stimulation Reduces Neuronal Nitric Oxide Synthase Expression After Stroke**

Arjun V. Pendharkar, Daniel L. Smerin, Lorenzo Gonzales, Eric Wang, Sabrina L. Levy, Stephanie Wang, Shunsuke Ishizaka, Masaki Ito, Michelle Cheng, Gary K. Steinberg

**SECTION ON DISORDERS OF THE SPINE AND PERIPHERAL NERVES ORAL PRESENTATION**

Room 2016

3:29–3:35 pm

**175 Stereotactic Radiation Therapy (SBRT) Versus External Beam (EB) Radiation for Metastatic Spine Disease: Comparing Fracture Rates and Local Control**

Enrique Vargas, Steve Braunstein, Matthew Susko, Praveen V. Mummaneni, Dean Chou

3:35–3:41 pm

**176 Development of Clinical Prognostic Models for Postoperative Survival and Quality of Life in Patients with Surgically Treated Metastatic Epidural Spinal Cord Compression**

Anick Nater, Junior Chuang, Kuan Liu, Nasir A. Quraishi, Dritan Pasku, Jefferson R. Wilson, Michael G. Fehlings

3:41–3:47 pm

**177 The Safety of Per Os Naloxone and its Efficacy in Resolving Postoperative Ileus in Patients Undergoing Spine Surgery**

Karam P. Asmaro, Eric Klomparens, Jacob A. Pawloski, Sameah A. Haider, Hesham M. Zakaria, Mathew Jones, Beverly C. Walters, Jason M. Schwalb

3:47–3:53 pm

**178 Long-term Outcomes of High-dose Single-fraction Radiosurgery for Chordomas of the Spine and Sacrum**

Jenny Jin, John Berry-Candelario, Jr., Y. Josh Yamada, Daniel Higginson, Adam Schmitt, Anne Reiner, Eric Lis, Ori Barzilai, Ilya Laufer, Mark H. Bilsky

3:53–3:59 pm

**179 The Association of Intraoperative Antibiotic and Surgical Site Infection After Lumbar Spine Surgery: Analysis of the Michigan Spine Surgery Improvement Collaborative**

Hesham M. Zakaria, Karam P. Asmaro, Tarek R. Mansour, Rachel J. Hunt, Theresa A. Elder, Michael Bazydlo, Lonni Schultz, David Nerenz, Jason M. Schwalb, Victor W. Chang, Muwaffak Abdulhak

3:59–4:05 pm

**180 The Association Between Chronicity of Preoperative Opioid Usage Between Patient Satisfaction, Return to Work, and Achieving ODI MCID up to 2 Years After Lumbar Fusion: Analysis from the Michigan Spine Surgery Improvement Collaborative (MSSIC)**

Hesham M. Zakaria, Tarek R. Mansour, Edwin Telemi, Karam P. Asmaro, Theresa A. Elder, Michael Bazydlo, Lonni Schultz, David Nerenz, Muwaffak Abdulhak, Jason M. Schwalb, Victor W. Chang

4:05–4:11 pm

**181 Is Obtaining a CT Prior to Offering Anterior Cervical Disc Arthroplasty (ACDA) Necessary? The Results of Surgeons Predicting ACDA Candidacy from MRIs and X-Rays Alone**

Joseph A. Osorio, Griffin R. Baum, Simon Morr, Richard P. Menger, Patrick Reid, K. Daniel Riew

4:11–4:17 pm

**182 Effect of Cage Type on Immediate Post-operative Radiographic Outcomes in Single-level Minimally Invasive Transforaminal Lumbar Interbody Fusion (MI-TLIF)**

Avani Vaishnav, Joshua Wright-Chisem, Michael Steinhaus, Steven Mcanany, Sravisht Iyer, Todd Albert, Catherine Gang, Sheeraz Qureshi

**SECTION ON NEUROTRAUMA AND CRITICAL CARE ORAL PRESENTATIONS**

Room 3022

3:28–3:34 pm

**183 The Effect of Supplementation of Vitamin D in Neurocritical Care Patients with Hypovitaminosis D: A Randomized Controlled Clinical Trial**

Andrea Archambault-Brock, Michael Karsy, Jian Guan, Ilyas Eli, Sarah T. Menacho, Min S. Park

3:34–3:40 pm

**184 Effects of ISO-alpha-acids on the Hematoma Volume, Inflammation and Neurological Functions in ICH Rats and its Potential Mechanism**

Jian-Lan Zhao, Rong Xie, Jin Hu

3:40–3:46 pm

**185 Development of a Clinical Prediction Model for Central Cord Syndrome: An Evaluation of Motor Recovery and the Effectiveness of Early Surgery**

Jetan H. Badhiwala, Christopher D. Witiw, Jefferson R. Wilson, Michael G. Fehlings

3:46–3:52 pm

**186 Same Day Surgical Intervention Dramatically Minimizes Complication Occurrence and Optimizes Peri-operative Outcomes for Central Cord Syndrome**

Cole Bortz, Avery Brown, Haddy Alas, Katherine Pierce, M. Burhan Janjua, Paul Park, Dimitrios C. Nikas, Aaron Hockley, Alexandra Soroceanu, Rafael De la Garza-Ramos, Daniel M. Sciubba, Anthony K. Frempong-Boadu, Dennis Vasquez-Montes, Bassel G. Diebo, Michael Gerling, Peter G. Passias

3:52–3:58 pm

**187 Deviation from Dynamic and Personalized Optimal Blood Pressure Targets is Associated with Worse Functional Outcomes After Aneurysmal Subarachnoid Hemorrhage**

Andrew Silverman, Sreeja Kodali, Sumita Strander, Emily Gilmore, Alexandra Kimmel, Anson Wang, Branden J. Cord, Guido Falcone, Ryan M. Hebert, Charles C. Matouk, Kevin Sheth, Nils Petersen

3:58–4:04 pm

**188 PET Imaging of Neurodegeneration with [18F]AV-1451 PET After Repetitive Traumatic Brain Injury**  
Matthew Mesley, Ross Puffer, Charles Laymon, Brian Lopresti, Kathryn Edelman, Jane Sharpless, Julia Billigen, Tiffany Wilkins, Ava Puccio, Chet Mathis, James Mountz, David O. Okonkwo

4:04–4:10 pm

**189 Delayed Restart of Antithrombotic Therapy and Rates of Adverse Events in Subdural Hematomas**  
Anisse N. Chaker, David Rosenberg, James S. Ryoo, Clayton L. Rosinski, Shashank Patil, Brett Geever, Saavan Patel, Ryan G. Chiu, Nikki Barrington, Andrew Mudreac, Angelica Fuentes, Amy Zhu, Parshva Shah, Ankit I. Mehta

# SECTION ON PAIN ORAL PRESENTATIONS

Room 3024

3:29–3:35 pm

**190 Sex-specific Transcriptomic Differences from Human Dorsal Root Ganglia Associated with Painful Radiculopathy**  
Robert Y. North, Yan Li, Pradipta Ray, Laurence D. Rhines, Claudio E. Tatsui, Ganesh Rao, Yeun H. Kim, Bo Zhang, Greg Dussor, Tae H. Kim, Theodore Price, Patrick M. Dougherty

3:35–3:41 pm

**191 Protocolized High-Dose (HD) and Low-Dose (LD) Spinal Cord Stimulation (SCS) Workflow Results in Meaningful Pain and Opiate Reduction.**  
Sarah E. Hodges, Shervin Rahimpour, Luis A. Antezana, Abena A. Ansah-Yeboah, Rajeev Dharmapurikar, John Hatheway, Michael Warrick, Scott Berlin, Benjamin Seeman, Shivanand P. Lad

3:41–3:47 pm

**192 Internal Neurolysis With and Without Microvascular Decompression for Trigeminal Neuralgia**  
Victor Sabourin, Jacob Mazza, Tomas Garzon-Muvdi, Donald Y. Ye, Anthony Stefanelli, Fadi Al Saiegh, Daniel Tzou, James J. Evans

3:47–3:53 pm

**193 Earlier Radiosurgery Leads to Better Pain Relief and Less Medication Usage for Trigeminal Neuralgia Patients: An International, Multi-center Study**  
Monica Mureb, Danielle Golub, Carolina G. Benjamin, Ben A. Strickland, Gabriel Zada, Eric L. Chang, Ronald E. Warnick, Herwin Speckter, Skyler Eastman, Anthony M. Kaufmann, Caleb E. Feliciano, Carlos Carhini, William Leduc, David Mathieu, Yusuke Hori, Sean J. Nagel, Dusan Urgosik, Roman Liscak, Samir Patel, Yi-Chieh Hung, Jason P. Sheehan, Douglas Kondziolka

3:53–3:59 pm

**194 Effects of External Focused Ultrasound on Inflammatory Markers in Neuropathic Pain Caused by Common Peroneal Nerve Injury**  
Adithya Srikanthan, Teresa Maletta, Abigail Hellman, Vraj Patel, Alicia Clum, Paul Neubauer, Emery Williams, Clif Burdette, Jiang Qian, Julie G. Pilitsis

3:59–4:05 pm

**195 Defining the Therapeutic Window (TW) for Spinal Cord Stimulation (SCS) Using Evoked Compound Action Potential (ECAP) Recordings: Results from the Evoke Study**  
Robert M. Levy

4:05–4:11 pm

**196 Healthcare Resource Utilization Among Patients with Non-Surgical Refractory Low Back Pain in the United States: A Retrospective Analysis of Health Insurance Claims Data**  
Charis Spears, Sarah E. Hodges, Musa Kiyani, Zidanyue Yang, Ryan Edwards, Alexis Musick, Christine Park, Beth Parente, Hui-Jie Lee, Shivanand P. Lad

4:11–4:17 pm

**197 The Neurosurgeons' Armamentarium for the Management of Refractory Post-Herpetic Neuralgia**  
Muhibullah S. Tora, Pavlos Texakalidis, Nicholas M. Boulis

# SECTION ON PEDIATRIC NEUROLOGICAL SURGERY ORAL PRESENTATIONS

Room 3018

3:27–3:33 pm

**198 Developmental Pleiotropy of PTEN in Congenital Hydrocephalus and Autism Spectrum Disorder**  
Tyrone DeSpenza, Jr.

3:33–3:39 pm

**199 Predictors of Posterior Fossa Syndrome: Results from an International Multicenter Cohort Study of Molecularly Characterized Medulloblastoma Patients**  
Rashad Jabarkheel, Nisreen Amayiri, Derek W. Yecies, Yuhao Huang, Sebastian Toescu, Donald Mabbott, Sniya Sudhakar, Prateek Malik, Suzanne Laughlin, Geeta Chacko, Leni Mathew, Paul Fisher, Michael D. Taylor, Stefan Pfister, Kristian Aquilina, Gerald A. Grant, Kshitij Mankad, Kristen Yeom, Vijay Ramaswamy

3:39–3:45 pm

**200 Cost Comparison of Prenatal Myelomeningocele Closure Versus Postnatal Closure for both Mother and Child at 1 year of Life**  
Brice A. Kessler, Carolyn Quinsey, William Goodnight, Scott Elton

3:45–3:51 pm

**201 Intraoperative Injection of Intraventricular Antibiotics Is Associated with a Decreased Incidence of Infection and Revision Surgery in Pediatric Hydrocephalus Patients Undergoing Shunt Placement**  
Nikita Lakomkin, Constantinos G. Hadjipanayis

3:51–3:57 pm

**202 When Does an Incidental Chiari I Malformation Require Surgery? A 10-Year Prospective Study on the Evolution and Natural History**  
Hepzibha Alexander, Deki Tsering, John S. Myseros, Suresh N. Magge, Chima Oluigbo, Carlos E. Sanchez, Robert F. Keating

3:57–4:03 pm

**203 Reduced Fractional Anisotropy of Superior Cerebellar Peduncle Is Associated with Persistent Ataxia in Children Undergoing Resection of Posterior Fossa Tumors**  
Aditya Vedantam, Katie Stormes, Nisha Gadgil, Stephen F. Kralik, Guillermo Aldave, Sandi Lam

4:03–4:09 pm

**204 Opioid Prescribing Patterns for Low Back Pain Among Commercially-Insured Children**

Tej D. Azad, Michael D. Harries, Daniel Vail, Yi J. Zhang, John K. Ratliff

4:09–4:15 pm

**205 Pediatric Anoxic Brain Injury – A Possible Locked-In Syndrome**

Mariam Ishaque, Crystal G. Franklin, Mary D. Woolsey, Peter T. Fox

### SECTION ON STEREOTACTIC AND FUNCTIONAL NEUROSURGERY ORAL PRESENTATIONS

Room 3020

3:27–3:33 pm

**206 Action Observation and Execution Differentially Modulate Basal Ganglia-cortical Activity in Humans**

Mahsa Malekmohammadi, Kathryn Cross, Jeongwoo Choi, Nader Pouratian

3:33–3:39 pm

**207 Resting-state SEEG May Help Localize Epileptogenic Brain Regions**

Sarah Goodale, Hernan F. J. Gonzalez, Graham W. Johnson, Kanupriya Gupta, William Rodriguez, Robert Shults, John D. Rolston, Benoit M. Dawant, Victoria Morgan, Dario J. Englot

3:39–3:45 pm

**208 Direct Targeting of the Ventral Intermediate Nucleus Using High-field Proton Density MR Imaging: Functional Outcomes and Comparison to “Indirect” Targeting**

Francisco A. Ponce, Margaret Lambert

3:45–3:51 pm

**209 Blood-Brain Barrier Opening in Alzheimer’s Disease Using MR-guided Focused Ultrasound**

Ying Meng, Zahra Shirzadi, Bradley MacIntosh, Chris Heyn, Gwen S. Smith, Isabelle Aubert, Clement Hamani, Sandra Black, Kullervo Hynynen, Nir Lipsman

3:51–3:57 pm

**210 Neural Control of Individual Finger Movements Using Intracortical Recordings from a Person with Tetraplegia**

Ahmed Jorge, Dylan Royston, Elizabeth C. Tyler-Kabara, Michael Boninger, Jennifer Collinger

3:57–4:03 pm

**211 Functional Use of Directional Local Field Potentials in Parkinson’s Disease**

Ilknur Telkes, Jennifer Durphy, Octavian Adam, Nataly Raviv, Julie G. Pilitsis

4:03–4:09 pm

**212 Risk Analysis of Hemorrhages in Stereo-electroencephalography Procedures**

Robert A. McGovern, III, Paul Ruggieri, Juan Bulacio, Imad Najm, William E. Bingaman, Jorge A. Gonzalez-Martinez

4:09–4:15 pm

**213 A Novel Computational Approach in MATLAB to Characterize Thermal Damage Estimate in Magnetic Resonance-guided Laser Interstitial Thermal Therapy.**

Allison Liang, Sean Munier, Shabbar F. Danish

### SECTION ON TUMORS ORAL PRESENTATIONS

Room 3014

3:33–3:39 pm

#### JOURNAL OF NEURO-ONCOLOGY AWARD

**214 Decreased Circulating Myeloid Derived Suppressor Cells at First Follow-up Predict Favorable Response to Immunotherapy in a Randomized Trial of Nivolumab and Bevacizumab in Recurrent GBM**

Matthew M. Grabowski, Balint Otvos, Tyler J. Alban, Marcella Diaz, Justin D. Lathia, Gene H. Barnett, Manmeet Ahluwalia

3:39–3:45 pm

**215 Role of CX3CR1 Signaling in Malignant Transformation of Gliomas**

Sungho Lee, Khatri Latha, Ganesh Rao

3:45–3:51 pm

**216 The TRIM26-SOX2 Ubiquitin Signaling Axis Regulates the Maintenance and Tumorigenicity of Glioblastoma Stem-like Cells**

Tatenda Mahlokozera, Mounica Paturu, Daniel Hafez, Diane Mao, Albert H. Kim

3:51–3:57 pm

#### COLUMBIA SOFTBALL PEDIATRIC BRAIN TUMOR AWARD

**217 Recapitulation of Genetic Predisposition to Medulloblastoma in Human Neuroepithelial Stem Cells**

Jignesh Tailor, Miller Huang, Austin Smith, William A. Weiss

3:57–4:03 pm

#### LEKSELL RADIOSURGERY AWARD

**218 Stereotactic Radiosurgery With and Without Checkpoint Inhibition for Patients with Metastatic Non-Small Cell Lung Cancer to the Brain: A Matched Cohort Study**

Matthew Shepard, Zhiyuan Xu, Joseph Donahue, Thomas E. Muttikkal, Diogo Codeiro, Leslie Hansen, Nasser Mohammed, Ryan D. Gentzler, James Lerner, Camilo Fadul, Jason P. Sheehan

4:03–4:09 pm

#### BRAINLAB NEUROSURGERY AWARD

**219 A Brain Penetrating HSP90 Inhibitor NXD30001 Inhibits Glioblastoma as a Monotherapy or in Combination with Radiation**

Hao Chen, Jialiang Wang, Hengli Tian

4:09–4:15 pm

**220 Survival Benefit with Resection of Brain Metastases from Renal Cell Carcinoma in the Setting of Molecular Targeted Therapy and Immune Therapy**

Mark A. Damante, Jr, Kristin Huntoon, Thomas Olencki, Bradley Elder

**CSNS CASE-BASED DISCUSSION ORAL PRESENTATIONS**

Room 3016

4:51–4:57 pm

**432 Safety and Costs Analysis of a “Fast-track Algorithm for Early Hospital Discharge After Brain Tumor Surgery**

Danilo Gomes Quadros, Iuri S. Neville, Francisco M. Urena, Davi J. Fontoura Solla, Wellington S. Paiva, Manoel Teixeira

4:57–5:03

**433 A Safe Transitions Pathway for Post Craniotomy Neurological Surgery Patients: High Value Care that Bypasses the Intensive Care Unit**

Jacob S. Young, Andrew Kai-Hong Chan, Jennifer Viner, Sujatha Sankaran, Alvin Y. Chan, Dominic Amara, Stephen T. Magill, Joseph A. Osorio, Lizbeth Gibson, Peter Sanftner, Mariann Ward, Tracy Ward, Stacy Wong, Manish K. Aghi, Edward F. Chang, Shawn L. Hervey-Jumper, Line G. Jacques, Philip V. Theodosopoulos, Mitchel S. Berger, Michael W. McDermott

5:03–5:09

**434 Reducing Preventable Readmissions in a Neurosurgical Patient Population at an Academic Medical Center**

Shayan Moosa, Lindsay Bowerman, Ellen Smith, Mindy Bryant, Natalie Krovetz, Melissa Pritchett, Nancy Staton, JoAnne Wilson, Carol Wisinski, Patty Bullock, Kearby Chen, Susan Prather, Lisa Archual, Amy Johnston, Mark E. Shaffrey

5:09–5:15

**435 A Novel Protocol for Reducing Intensive Care Utilization after Craniotomy**

Arjun V. Pendharkar, Maryam N. Shahin, Allen L. Ho, Eric S. Sussman, Gordon Li, John K. Ratliff, Melanie Hayden Gephart, Amy Lu

**CEREBROVASCULAR OPERATIVE TECHNIQUES AND CASE-BASED DISCUSSION ORAL PRESENTATIONS**

Room 2014

4:44–4:50 pm

**436 Diverse Use of the WEB Device: A Technical Note on WEB Stenting and WEB Coiling of Complex Aneurysms**

Jorge A. Roa, Mario Zanaty, Sudeepta Dandapat, Edgar Samaniego, Pascal Jabbour, David M. Hasan

4:50–4:56 pm

**438 Microcatheter Shaping for Intracranial Aneurysm Coiling Using Artificial Intelligence Assisted Technique**

Wei Ni

4:56–5:02 pm

**439 Early Lessons Learned from the WEB Device: Feasibility, Technique and Complications – A Real Life Experience**

Nikolaos Mouchtouris, David M. Hasan, Fadi Al Saiegh, Ahmad Sweid, Mario Zanaty, Omaditya Khanna, Nohra Chalouhi, Stavropoula I. Tjoumakaris, M. Reid Gooch, Robert H. Rosenwasser, Pascal Jabbour

**SPINE OPERATIVE TECHNIQUES AND CASE-BASED DISCUSSION ORAL PRESENTATIONS**

Room 2016

4:36–4:42 pm

**BEST INTERNATIONAL OPERATIVE TECHNIQUE**

**440 Convection-enhanced Delivery of Nimustine Hydrochloride for Recurrent Spinal Cord High-grade Glioma**

Toshiki Endo, Ryuta Saito, Teiji Tominaga

4:42–4:48 pm

**441 Complication Profile Associated with S1 Pedicle Subtraction Osteotomy Compared To Other Spinal Levels**

Darryl Lau, Vedat Deviren, Christopher P. Ames

4:48–4:54 pm

**442 4 Year Experience of Robot-Assisted Pedicle Screw Placement: An Australian Prospective Analysis**

Jordan Cory, Mohammed A. Awad, Richard G. Bittar

4:54–5:00 pm

**443 Single Position Lateral Lumbar Fusion Utilizing Robot Guided Screw Placement**

George V. Huffmon III

**NEUROTRAUMA OPERATIVE TECHNIQUES AND CASE-BASED DISCUSSION ORAL PRESENTATIONS**

Room 3022

4:15–4:21 pm

**444 Initial Experience of Spinal Cord Perfusion Pressure Goals in Lieu of Mean Arterial Pressure Goals in Acute Traumatic Spinal Cord Injury at a U.S. Level I Trauma Center: A TRACK-SCI Study**

John K. Yue, Debra P. Hemmerle, Hansen Deng, Ethan A. Winkler, Leigh H. Thomas, Xuan Duong Fernandez, Pavan S. Upadhyayula, Nikolaos Kyritsis, Lisa U. Pascual, Vineeta Singh, Philip R. Weinstein, Jason Talbott, J. Russell Huie, Adam Ferguson, William Whetstone

4:21–4:27 pm

**445 MRI Evidence of Therapeutic Efficacy of Timing of Decompression in AIS Grades A-C Cervical Spinal Cord Injury Patients**

Joshua R. Olexa, Bizhan Aarabi, Kathirkamanathan Shanmuganathan, Noori Akhtardanesh, Charles A. Sansur, Gary T. Schwartzbauer, Maureen Scarboro, Nick Caffes, Jeffrey Oliver, Stephen Carbine, Mori Kanami

4:27–4:33 pm

**446 Surgery Delay Increases Length of Stay in Thoracolumbar Trauma**

Lawrence Zeldin, Sean N. Neifert, Robert J. Rothrock, Ian T. McNeill, Jonathan S. Gal, John M. Caridi



4:33–4:39 pm

**447 Early Versus Late Surgical Decompression for Central Cord Syndrome: A Propensity Score-Matched Analysis**

Jetan H. Badhiwala, Christopher D. Witiw, Jefferson R. Wilson, Michael G. Fehlings

**PAIN OPERATIVE TECHNIQUES AND CASE-BASED DISCUSSION ORAL PRESENTATIONS**

Room 3024

4:36–4:42 pm

**448 Complications of Endoscope-Assisted Microvascular Decompression for Trigeminal Neuralgia- An Evaluation of 300 Consecutive Patients**

Alexandra D. Baker, Melvin Field

4:42–4:48 pm

**449 C1-C4 Unilateral Dorsal Root Entry Zone Rhizotomy (Drez) for Treatment of Refractory Post-Herpetic Occipital Neuralgia.**

Zaid Aljuboori, Joseph S. Neimat

4:48–4:54 pm

**450 Surgical Outcomes After Microvascular Decompression with Internal Neurolysis and Partial Neurectomy for Patients with Trigeminal Neuralgia and Negative Neurovascular Compression**

Amanda Carpenter, James K. Liu

**PEDIATRICS OPERATIVE TECHNIQUES AND CASE-BASED DISCUSSION ORAL PRESENTATIONS**

Room 3018

4:15–4:21 pm

**451 Reduction Cranioplasty Using a Three-dimensional Preoperative Virtual Model for Treatment of Extreme Macrocephaly and Positional Plagiocephaly Secondary to Untreated Hydrocephalus – Case Description and Literature Review**

Wilson R. Teixeira, Alexandre Rainha Campos, Mickael Bartikian, Claudia Faria, Lia Lucas-Neto, Maria M. Santos

4:21–4:27 pm

**452 Moyamoya Disease in Infancy: Application of a Novel Indirect Revascularization Technique for Bihemispheric Cortical Synangiosis**

Danielle DeBacker Dang, John V. Dang, Duaa AbdelHameid, Seth Mansinghani, Leon E. Moores

4:27–4:33 pm

**453 Idiopathic Intrasyringal Hemorrhage: A Case Report and Review of the Liter**

Shawn S. Rai, Carlos R. Goulart, Mark R. Proctor, R. Michael Scott, Katie P. Fehnel

4:33–4:39 pm

**454 Endovascular Super-Selective Intra-arterial Chemotherapy for Retinoblastoma: Systematic Review and Institutional Experience**

Simon Menaker, Samir Sur, Anil Mahavadi, Stephanie H. Chen, Eric C. Peterson, Robert M. Starke

**PAIN OPERATIVE TECHNIQUES AND CASE-BASED DISCUSSION ORAL PRESENTATIONS**

Room 3024

4:54–5:00 pm

**455 Penetrating Offending Vessel, the Most Surgically Demanding Type During Microvascular Decompression Surgery in Hemifacial Spasm**

Seunghoon Lee, Kwan Park

5:00–5:06 pm

**456 Improving Accuracy for Optical Navigation in Asleep DBS Electrode Implantation**

Kim J. Burchiel, Ann Mitchell, Kevin J. Mansfield

5:06–5:12 pm

**457 MRI-guided Stereotactic Laser Ablation of Deep-seated Cerebral Cavernous Malformations**

James A. M. Douglas, III, Alex C. M. Greven, Christopher W. Rich, James G. Malcolm, Robert E. Gross, Jon T. Willie

5:12–5:18 pm

**458 The Role of Tissue Expansion in Deep Brain Stimulation Surgery for Parkinson's Disease**

Nikhil Thakur, Michael Eibach, Shahram Ghanaati, Volker Seifert, Gerhard Marquardt, Johanna Quick

**TUMOR OPERATIVE TECHNIQUES AND CASE-BASED DISCUSSION ORAL PRESENTATIONS**

Room 3014

4:45–4:51 pm

**459 Confocal Assisted Fluorescence Resection of Low Grade Gliomas**

Cleopatra Charalampaki, Juergen Schlegel

4:51–4:57 pm

**460 Intraoperative Near-infrared Fluorescence Imaging with Second-window Indocyanine-green Offers Accurate and Real-time Correction for Brain Shift and Anatomic Inconsistencies in Frameless Neuronavigation**

Steve Sungwon Cho, BS, Ashwin G. Ramayya, Clare W. Teng, Steven Brem, Sunil Singhal, John Y.K. Lee

4:57–5:03 pm

**461 Laser Interstitial Thermal Therapy to the Posterior Fossa: Challenges and Nuances**

Jeffrey I. Traylor, Rajan Patel, Matthew Muir, Ahmed Habib, Dhiego Chaves de Almeida Bastos, Ganesh Rao, Sujit S. Prabhu

**INTERACTIVE MULTIMEDIA RESEARCH ORAL PRESENTATIONS**

Podium 1, Level 2 Lobby

5:45–5:48 pm

**600 A Comparison of Minimally-Invasive Transforaminal Lumbar Interbody Fusion and Decompression Alone for Degenerative Lumbar Spondylolisthesis**

Andrew Kai-Hong Chan, M.D., Erica F. Bisson, Mohamad Bydon, Steven D. Glassman, Kevin T. Foley, Christopher I. Shaffrey, Sr., Eric A. Potts, Mark E. Shaffrey, Domagoj Coric, John J. Knightly, Paul Park, Michael Y. Wang, Kai-Ming G. Fu, Jonathan Slotkin, Anthony L. Asher, Michael S. Virk, Panagiotis Kerezoudis, Mohammed A. Alvi, Jian Guan, Regis W. Haid, Praveen V. Mummaneni

5:48–5:51 pm

**601 Intra-operative 3D Navigation Versus Fluoroscopy: A Comparison of Time Demand, Radiation Exposure and Outcomes in Minimally Invasive Transforaminal Lumbar Interbody Fusion (MI-TLIF)**

Avani Vaishnav, Steven Mcanany, Sravisht Iyer, Todd Albert, Catherine Gang, Sheeraz Qureshi

5:51–5:54 pm

**602 Increased Axial Facet Angle Correlates with Poor Percutaneous Pedicle Screw Placement**

Guang-Ting Cong, James Dowdell, Avani Vaishnav, Steven Mcanany, Sravisht Iyer, Todd Albert, Catherine Gang, Sheeraz Qureshi

5:54–5:57 pm

**603 Anterior Column Reconstruction Versus Pedicle Subtraction Osteotomy for Severe Sagittal Plane Deformity: Early Clinical and Radiographic Outcomes Using a Hyperlordotic Expandable Lateral Interbody Device**

Lara Walsh Massie, Mohamed Macki, Hesham M. Zakaria, Michelle Gilmore, Azam Basheer, Victor W. Chang, Frank La Marca

5:57–6:00 pm

**604 Characterizing the Risk and Outcome Profiles of Lumbar Fusion Procedures in Patients with Opioid Use Disorders: A Step Towards Improving Enhanced Recovery Protocols for a Unique Patient Population**

Michael L. Martini, Dominic A. Nistal, Brian C. Deutsch, Jeffrey Gilligan, Robert J. Rothrock, Sean N. Neifert, John M. Caridi

6:00–6:03 pm

**605 Anterior Cervical Arthrodesis with Polyetheretherketone Spacers: What is the Role of the Grafting Material?**

Jeffrey Pollock, Donald A. Ross, Jung U. Yoo, Ningcheng P. Li

6:03–6:06 pm

**606 Reoperations Following Lumbar Discectomy are Associated with Worse Clinical Outcomes and Greater Socioeconomic Burden 3 Years after the Primary Procedure**

Claudius Thomé, Ali Araghi, Jason Inzana, Jonathan Stieber, Joshua M. Ammerman

6:06–6:09 pm

**607 DEXA Versus CT: Comparison of Bone Mineral Density Measurements in Predicting Postoperative Spinal Fusion Outcomes**

Awais Vance, Alexander Mazal, Salah G. Aoun, Najib El Tecle, Matthew Thomas Davies, Tarek Youssef El Ahmadi, Kevin C. Morrill, Carlos A. Bagley, Mazin Al Tamimi

6:09–6:12 pm

**608 Perioperative Complications in Obese Patients Undergoing Anterior Lumbar Interbody Fusion: Results from 938 Patients**

Michael Safaee, Alexander Tenorio, Dominic Amara, Lillian Lai, Annette Molinaro, Serena Hu, Bobby Tay, Shane Burch, Sigurd Berven, Vedat Deviren, Sanjay S. Dhall, Dean Chou, Praveen V. Mummaneni, Charles M. Eichler, Christopher P. Ames, Aaron J. Clark

6:12–6:15 pm

**609 Predictors of Patient Satisfaction Following One- or Two-Level Anterior Cervical Discectomy and Fusion: Insights from the Quality Outcomes Database**

Panagiotis Kerezoudis, Anthony L. Asher, Clinton J. Devin, Mohammed A. Alvi, Inamullah Khan, Hui Nian, Ahilan Sivaganesan, Frank E. Harell, Kristin Archer, Mohamad Bydon

6:15–6:18 pm

**610 Neuroanesthesia Guidelines for Optimizing Transcranial Motor Evoked Potentials Neuromonitoring During Deformity and Complex Spinal Surgery: A Delphi Consensus Study**

Corey T. Walker, Han Jo Kim, Paul Park, Lawrence Lenke, Justin S. Smith, Daniel M. Sciubba, Michael Y. Wang, Christopher I. Shaffrey, Sr., Vedat Deviren, Praveen V. Mummaneni, Khoi Duc Than, Robert Eastlack, Gregory M. Mundis, Jr., Adam S. Kanter, David O. Okonkwo, John H. Shin, Tyler R. Koski, Steven D. Glassman, Alan H. Daniels, Jay D. Turner, Juan S. Uribe

6:18–6:21 pm

**611 Impact of Dominant Symptom on 12-Month Patient Reported Outcomes for Patients Undergoing Lumbar Spine Surgery: A Quality Outcomes Database Analysis**

Clinton J. Devin, Mohamad Bydon, Panagiotis Kerezoudis, Mohammed A. Alvi, Anshit Goyal, Inamullah Khan, Yagiz U. Yolcu, Anthony L. Asher

6:21–6:24 pm

**612 Predictors of Non-Routine Discharge Among Patients Undergoing Surgery for Grade I Spondylolisthesis : Insights from the Quality Outcomes Database (QOD)**

Mohamad Bydon, Praveen V. Mummaneni, Panagiotis Kerezoudis, Andrew Kai-Hong Chan, Steven D. Glassman, Kevin T. Foley, Jonathan R. Slotkin, Eric A. Potts, Mark E. Shaffrey, Christopher I. Shaffrey, Sr., Domagoj Coric, John J. Knightly, Paul Park, Kai-Ming G. Fu, Clinton J. Devin, Anthony L. Asher, Erica F. Bisson

6:24–6:27 pm

**613 Does Positioning of Cervical Disc Arthroplasty Implant Affect Postoperative Outcome?**

Yahya Othman, Todd Albert, Russell Huang, Philip York, Avani Vaishnav, Steven Mcanany, Sravisht Iyer, Catherine Gang, Sheeraz Qureshi

6:27–6:30 pm

**614 Implementation of an Enhanced Recovery Pathway in Complex Spine Surgery Patients in a Multidisciplinary Center**

Kristen M. Hall, Jessica R. Moreno, Luke Dosselman, Carlos A. Bagley

6:30–6:33 pm

**615 SCOUT IDE Investigation: One-year Clinical Findings for a Conforming Porous Polymeric Lumbar Interbody Fusion Device**

Yi Lu, Kyle Wu, Martin H. Krag, Stephane Lavoie, Mohamad Bydon, Pierce D. Nunley, John H. Chi

6:33–6:36 pm

**616 Effect of Myelopathy on Outcomes After Cervical Disc Replacement: A study of a Local Patient Cohort and a Large National Cohort**

Sheeraz Qureshi, Andre Samuel, Steven Mcanany, Sravisht Iyer, Todd Albert, Catherine Gang

6:36–6:39 pm

**617 Radiographic Accuracy of Percutaneous Pedicle Screw Placement in Fluoroscopic Versus CT Navigation-guided Lumbar Spine Instrumentation**

Guang-Ting Cong, Avani Vaishnav, Joseph Barbera, Hiroshi Kumagai, James Dowdell, Catherine Gang, Sheeraz Qureshi

6:39–6:42 pm

**618 The Impact of NSAID Use after Lumbar Fusion Surgery on Fusion Rate and Complications: A Meta-Analysis**

Yahya Othman, Avani Vaishnav, Steven Mcanany, Sravisht Iyer, Todd Albert, Catherine Gang, Sheeraz Qureshi

6:42–6:45 pm

**619 Do We Need Standing Scoliosis Films for One or Two-Level Lumbar Fusions?**

Caroline Davidson, Gabriel Claudiu Tender

6:45–6:48 pm

**620 Surgical Outcomes of Dysphagia Provoked by Diffuse Idiopathic Skeletal Hyperostosis in Cervical Spine**

Young Soo Chung, Ho Yeol Zhang, Yoon Ha, Jeong Yoon Park

6:48–6:51 pm

**621 Outcomes and Risks with Age in Spondylolisthesis: A Comparison of the Elderly from the Quality Outcomes Database**

Michael Karsy, Andrew Kai-Hong Chan, Michael S. Virk, Praveen V. Mummaneni, Mohamad Bydon, Steven D. Glassman, Kevin T. Foley, Eric A. Potts, Christopher I. Shaffrey, Sr., Mark E. Shaffrey, Domagoj Coric, Anthony L. Asher, John J. Knightly, Paul Park, Kai-Ming G. Fu, Jonathan Slotkin, Regis W. Haid, Michael Y. Wang, Erica F. Bisson

6:51–6:54 pm

**622 Multimodal Analgesia in Lumbar Fusion Surgery: Impact Amidst the Opioid Epidemic**

Yi Lu, Erica Bertonecini

6:54–6:57 pm

**623 Incidence and Clinical Risk of Cement Extravasation in Adult Patients Undergoing Prophylactic Vertebroplasty During Surgical Spine Reconstruction**

Michael Bohl, Jean-Christophe A. Leveque, Rajiv Sethi

6:57–7:00 pm

**624 Factors Associated with 12-month Return to Work Following One-level Posterior Lumbar Fusion for Grade 1 Degenerative Spondylolisthesis: An Analysis of the Quality Outcomes Database**

Mohamad Bydon, Praveen V. Mummaneni, Panagiotis Kerezoudis, Andrew Kai-Hong Chan, Steven D. Glassman, Kevin T. Foley, Jonathan R. Slotkin, Eric A. Potts, Mark E. Shaffrey, Christopher I. Shaffrey, Sr., Domagoj Coric, John J. Knightly, Paul Park, Kai-Ming G. Fu, Clinton J. Devin, Anthony L. Asher, Erica F. Bisson

7:00–7:03 pm

**625 Prevalence of Cervical Stenosis and Myelopathy in Patients with Idiopathic Normal Pressure Hydrocephalus**

Ryan M. Naylor, Karina Lenartowicz, Jonathan Graff-Radford, Jeremy Cutsforth-Gregory, Benjamin D. Elder

7:03–7:06 pm

**626 The Association Between PHQ-2 Screening and Patient Satisfaction and Return to Work up to 2 Years after Lumbar Fusion: Analysis from the Michigan Spine Surgery Improvement Collaborative (MSSIC)**

Hesham M. Zakaria, Tarek R. Mansour, Edwin Telemi, Rachel J. Hunt, Karam P. Asmaro, Mohamed Macki, Michael Bazydlo, Lonni Schultz, David Nerenz, Muwaffak Abdulhak, Jason M. Schwalb, Victor W. Chang

7:06–7:09 pm

**627 Postoperative Stereotactic Radiosurgery for Spinal Metastases: Clinical Outcomes, Failures, and Analysis of Local Control**

Muhammed Hadzipasic, Laura Van Beaver, Caroline M. Ayinon, Robert Koffie, Brian Winey, Thomas Botticello, Ganesh Shankar, Joseph H. Schwab, Kevin S. Oh, John H. Shin

7:09–7:12 pm

**628 Assessing the Impact of Epidural Analgesia Early Pain Management and Functional Outcomes Following Deformity Surgery: A Retrospective Review**

Emmanuel Adeyemo, Umaru Barrie, Madelina Nguyen, Mahmoud Elguindy, Luke Dosselman, Kristen M. Hall, Jessica R. Moreno, Carlos A. Bagley

7:12–7:15 pm

**629 Differences in 30- and 90-day Readmission Rates After Surgical Treatment for Lumbar Degenerative Disc Disease in Elderly Patients (≥65 years): A National Readmission Database Study**

Aladine A. Elsamadicy, Andrew B. Koo, Megan Lee, Adam Kundishora, Joaquin Q. Camara-Quintana, Tariq Qureshi, Luis Kolb, Maxwell S.H. Laurans, Khalid M. Abbed

**INTERACTIVE MULTIMEDIA RESEARCH ORAL PRESENTATIONS**

Podium 2, Level 2 Lobby

5:45–5:48 pm

**630 Detection of Glioma and Prognostic Subtypes by Non-invasive Circulating Cell-free DNA Methylation Markers**

Ian Yu Lee, Thais Sabedot, Tathiane Malta, James Snyder, Michael Wells, Ana DeCarvalho, Abir Mukherjee, Dhananjay Chitale, Karam P. Asmaro, Adam M. Robin, Mark L. Rosenblum, Tom Mikkelsen, Jack P. Rock, Laila Poisson, Tobias Walbert, Steven N. Kalkanis, Anavaleria Castro, Houtan Noushmehr

5:48–5:51 pm

**631 Cerebrospinal Fluid Biomarkers of Brain Metastasis**

Stephanie Cheok, Anna Arnal-Estape, Azeet Narayan, Maheen Zakaria, Sarah Goldberg, Abhijit Patel, Don Nguyen, Veronica Chiang

5:51–5:54 pm

**BEST INTERNATIONAL CLINICAL RESEARCH****632 The Efficacy of Pure Navigation-system Guided Biopsy with 5-ALA Induced Photodynamic Diagnosis for Malignant Brain Tumors**

Naokado Ikeda, Shinji Kawabata, Yoshihide Katayama, Motomasa Furuse, Ryokichi Yagi, Naosuke Nonoguchi, Ryo Hiramatsu, Toshihiko Kuroiwa, Masahiko Wanibuchi

5:54–5:57 pm

**633 Passive Distribution of Indocyanine-Green via the Enhanced Permeability and Retention Effect Demonstrates Similar Tumor Sensitivity and Specificity Compared to Tumor-Targeting 5-Aminolevulinic Acid in Rodent Allograft and Human Brain Tumors**

Steve Sungwon Cho, Saad Sheikh, Joseph F. Georges, Clare W. Teng, Jay F. Dorsey, Sunil Singhal, John Y.K. Lee

5:57–6:00 pm

**634 Near Real-time Intraoperative Brain Tumor Diagnosis Using Stimulated Raman Histology and Deep Neural Networks**

Todd C. Hollon, Balaji Pandian, Siri Sahib Singh Khalsa, Randy D'Amico, Michael B. Sisti, Jeffrey N. Bruce, Karin M. Muraszko, B. Gregory Thompson, Christian Freudiger, Shawn L. Hervey-Jumper, Guy M. McKhann, II, Sandra Camelo-Piragua, Peter D. Canol

6:00–6:03 pm

**635 Laser Therapy Enhances Blood-Brain Barrier and Blood-Tumor Barrier Permeability in a Mouse Model of Glioblastoma**

Afshin Salehi, Mounica Paturu, Matthew Caine, Robyn Klein, Albert H. Kim

6:03–6:06 pm

**636 Genome Wide DNA Methylation Landscape Reveals Glioblastoma Mediated Epigenetic Modification in Tumor Infiltrating CD4+ T-cells.**

Sreenivasulu Chintala, Kaleigh Fetcko, Mario Henriquez, Sheng Liu, Jun Wan, Xiaoling Xuei, Yunlong Liu, Adam T. Leibold, Atique Ahmed, Mahua Dey

6:06–6:09 pm

**637 Enhanced B7-H4 Expression in Gliomas with Low PD-L1 Expression Identifies Cold Tumors**

Di Chen, Gaopeng Li, Chunxia Ji, Qiqi Lu, Ying Qi, Chao Tang, Ji Xiong, Jian Hu, Dave S.B. Hoon, Yan Zhang, Yu Yao, Liangfu Zhou

6:09–6:12 pm

**638 Identification of Tumor Specific Lymphocytes Cells in a Murine Glioma Model**

David Shin, Catherine Flores, Bayli Divita, Brandon Fernandez, Tyler Wildes, Adam Grippin, Kyle Dyson, Duane Mitchell

6:15–6:18 pm

**640 A Patient-derived Glioblastoma Organoid Model Maintains Intertumoral and Intratumoral Heterogeneity for Therapeutic Testing**

Ryan Salinas, Daniel Zhang, Fadi Jacob, Phuong Nguyen, Saad Sheikh, Stefan Prokop, Jay F. Dorsey, MacLean Nasrallah, Steven Brem, Donald M. O'Rourke, Guo-li Ming, Hongjun Song

6:18–6:21 pm

**641 Local Delivery of the PARP-inhibitor Olaparib from a Biodegradable Paste Potentiates Radiotherapy and Prolongs Survival**

Riccardo Serra, Stuart J. Smith, Jonathan Rowlinson, Noah L. Gorelick, Gareth J. Veal, Kevin Shakesheff, Richard Grundy, Henry Brem, Ruman Rahman, Betty Tyler

6:21–6:24 pm

**642 NRG Oncology CC001 Neurocognitive Final Analysis: A Phase III Trial of Hippocampal Avoidance (HA) in Addition to Whole-brain Radiotherapy (WBRT) Plus Memantine to Preserve Neurocognitive Function (NCF) in Patients with Brain Metastases (BM)**

Jeffrey S. Wefel, Stephanie Pugh, Vinai Gondi, Paul D. Brown, Wolfgang Tome, Terri S. Armstrong, Deborah Bruner, Joseph Bovi, Cliff Robinson, Deepak Khuntia, David Grosshans, Andre Konski, David Roberge, Vijayananda Kundapur, Kiran Devisetty, Sunjay Shah, Kenneth Usuki, Bethany Anderson, Minesh P. Mehta, Lisa Kachnic

6:24–6:27 pm

**643 Intracranial Response of Brain Metastases to Osimertinib With or without Upfront Stereotactic Radiosurgery in TKI-Naïve Non-small Cell Lung Cancer Patients**

Michael Chuwei Jin, Elisa K. Liu, Charles W. Macaulay, Amanda Gian, Siyu Shi, Julie Koenig, Gordon Li, Scott G. Soltys, Erqi Pollom L

6:27–6:30 pm

**644 Melatonin Disrupts Glioblastoma Metabolism and Enhances Temozolomide Cytotoxic Effects**

Beatriz Irene Fernandez Gil, Carla A. Vazquez-Ramos, Paula Schiapparelli, Rachel Sarabia-Estrada, Germaine Escames, Alfredo Quinones-Hinoja

6:30–6:33 pm

**645 Stereotactic Radiosurgery Versus Stereotactic Radiotherapy in the Management of Intracranial Meningiomas: A Systematic Review and Meta-analysis**

Nida Fatima, Antonio Meola, Erqi Pollom, Scott G. Soltys, Steven D. Chang

6:33–6:36 pm

**646 Outcome Analysis Among Meningioma Genomic Subgroups Identifies Decreased Recurrence Free Survival in PI3K Activated Tumors**

Mark W. Youngblood, Amar Sheth, Amy Zhao, Julio D. Montejo, Jr., Daniel Duran, Chang Li, Evgeniya Tyrtova, Koray Ozduman, Danielle F. Miyagishima, Julien Boetto, Matthieu Peyre, Sacit Bulent Omay, Michel Kalamarides, Zeynep E. Omay, Murat Gunel, Jennifer A. Moliterno

6:36–6:39 pm

**647 Outcomes of Single-institution Retrospective Case Series on Observation Alone Following Atypical Meningioma Resection**

Lauren Stone, Hugh D. Moulding, Nimisha Deb, Charles T. Lee

6:39–6:42 pm

**648 Tumor Control Rates in Patients Undergoing Stereotactic Radiosurgery for Cystic Vestibular Schwannomas: A Systematic Review and Meta-analysis**

Kevin Ding, Edwin Ng, Prasanth Romiyo, Dillon Dejam, Courtney Duong, Matthew Z. Sun, Quinton Gopen, Isaac Yang

6:42–6:45 pm

**The International Neurooncology Fellowship at The University of Miami – My Experience**

Alexis A. Morell



6:45–6:48 pm

**649 Trim71 Links an Ancient MicroRNA Pathway to Neural Stem Cell Development and Human Congenital Hydrocephalus**

Duy Phan, Daniel Foster, Bettina Jux, Evelyn Lake, Todd Constable, Waldemar Kolanus, Frank Slack, Kristopher Thomas Kahle

6:48–6:51 pm

**650 Cerebrospinal Fluid Access Devices in Pediatric Diffuse Midline Glioma Patients: Literature Review and Evaluation of Institutional Practices**

Daphne Li, Wendy Stellpflug, Amanda Muhs Saratsis

6:51–6:54 pm

**651 Patterns of Care and Age Specific Impact of Resection Extent and Adjuvant Radiotherapy in Pediatric Pineoblastoma**

Michael Chuwei Jin, Laura M. Prolo, Adela Wu, Tej D. Azad, Siyu Shi, Adrian Rodrigues, Scott G. Soltys, Erqi Pollom, Gordon Li, Susan Hiniker, Gerald A. Grant

6:54–6:57 pm

**652 Multimodality Language Mapping Using Cortical Stimulation in Pediatric Patients with Epilepsy**

Sneha Sharma, Carrie R. Muh, Sandra Serafini, Naomi D. Chou, Tracy G. Spears, Sarah E. Hodges, Gregory B. Cogan, Jordan Komisarow, Gerald A. Grant

6:57–7:00 pm

**653 Split Cord Malformation – Spectrum of Associated Anomalies.**

Natarajan Muthukumar

7:00–7:03 pm

**654 Endoscopic Third Ventriculostomy Versus Shunt for Pediatric Hydrocephalus: A Systematic Literature Review and Meta-analysis**

Pavlos Texakalidis, Muhibullah S. Tora, Jeremy Wetzel, Joshua J. Chern

7:03–7:06 pm

**655 Automated Evaluation of Intracranial Vessel Morphology in Normal Versus Pediatric Moyamoya Disease**

Jennifer L. Quon, Lily H. Kim, Pauline Mouches, Rashad Jabarkheel, Yi Zhang, Gary K. Steinberg, Gerald A. Grant, Michael S. B. Edwards, Kristen Yeom, Nils Forkert

7:06–7:09 pm

**656 Global and Intertuberal Epileptic Networks in Tuberous Sclerosis Based on Stereoelectroencephalographic (sEEG) Findings: A Quantitative EEG Analysis in Pediatric Subjects and Surgical Implications**

Hepzibha Alexander, Rathinaswamy B. Govindan, Coleman T. Garrett, Tayyba Anwar, Islam Fayed, Robert F. Keating, William Gaillard, Chima Oluigbo

7:09–7:12 pm

**657 Characteristics and Outcomes of Pediatric Glioblastoma in the Post-Temozolomide Era**

Ankush Chandra, Taemin Oh, Harsh Wadhwa, Sumedh Subodh Shah, Nalin Gupta, Michael W. McDermott, Mitchel S. Berger, Manish K. Aghi

7:12–7:15 pm

**658 Clinical and Imaging Outcomes After Combined Direct and Indirect Bypass for Pediatric Moyamoya Disease: A Single Center Retrospective Series**

Ramin A. Morshed, Daniel Murph, Jasmin Dao, Kathleen Colao, Lauro Avalos, Steven Hetts, Adib A. Abia, Christine Fox, Michael T. Lawton, Nalin Gupta

**INTERACTIVE MULTIMEDIA RESEARCH ORAL PRESENTATIONS**

Podium 3, Level 2 Lobby

5:45–5:48 pm

**659 Unruptured Intracranial Aneurysm Initial Treatment and Follow-up Cost Analysis: Pipeline Flow Diverters Versus Coiling**

Herschel Wilde, Spencer Twitchell, Michael Karsy, Philipp Taussky, Ramesh Grandhi

5:51–5:54 pm

**661 Healthcare Resource Utilization of Complications of Intracerebral Hemorrhage**

Lefko T. Charalambous, Syed M. Adil, Zidanyue Yang, Christine Park, Sarah E. Hodges, Laura Zitella Verbick, Aaron McCabe, Beth Parente, Hui-Jie Lee, Shivanand P. Lad

5:54–5:57 pm

**662 Treatment Trends and Outcome of Aneurysmal Subarachnoid Hemorrhage by Hospital Volume**

Victor Lopez-Rivera, Songmi Lee, Peng R. Chen, Spiros L. Blackburn, David Rosenbaum-Halevi, Arvind Bambhroliya, Farhaan Vahidy, Sean Savitz, Sunil Sheth

5:57–6:00 pm

**663 Persistent Hydrocephalus and Activated Microglia Drive the Spatial Memory Decline after Intraventricular Hemorrhage in Rodents**

Kimia Kamal, Tamar Binyamin, Janet A. Keiter, Audrey R. Vergara, Ali Izadi, Katelynn Ondek, Robert Berman, Frank Sharp, Gene G. Gurkoff, Ben Waldau

6:00–6:03 pm

**664 What Size Cerebral Aneurysms Rupture? A Systematic Review and Meta-analysis of Literature**

Maxim Mokin, Muhammad Waqas, Andrew Gong, Felix Chin, Hamid Rai, Kunal Vakharia, Hamidreza Rajabzadeh Oghaz, Kenneth V. Snyder, Jason Davies, Elad I. Levy, Hui Meng, Adnan H. Siddiqui

6:03–6:06 pm

**665 Location of Intracerebral Hemorrhage Affects Outcome after Minimally Invasive Endoscopic Hematoma Evacuation**

Rui Song, Dominic A. Nistal, Jacopo Scaggiante, Alexander G. Chartrain, Natalia Romano Spica, Julianne Kleitsch, John Liang, J D. Mocco, Christopher P. Kellner

6:09–6:12 pm

**667 Repeat Flow Diversion for Previously Failed Flow Diversion in a Multicenter Cohort**

Mohamed M. Salem, Ahmad Sweid, Anna L. Kuhn, Adam A. Dmytriw, Muhammad Waqas, Nimer Adeeb, Peter Kan, Ajit S. Puri, Tom R. Marotta, Elad I. Levy, Justin M. Moore, Christopher S. Ogilvy, Pascal Jabbour, Ajith J. Thomas

6:12–6:15 pm

**668 Stent-assisted Coiling of Cerebral Aneurysms: A Multi-center Analysis**

Maxim Mokin, Christopher T. Primiani, Keaton Piper, David Fiorella, Ansaar Rai, Kirill Orlov, Dmitry Kisilitsin, Anton Gorbatykh, J D. Mocco, Reade DeLeacy, Joyce Lee, Alejandro M. Spiotta, Raymond D. Turner, IV, Imran Chaudry, Aquilla S. Turk

6:15–6:18 pm

**669 Management of Tandem Cervical Internal Carotid Artery Stenosis and Large Vessel Occlusion During Acute Stroke: A Single Institution's Initial Experience**

Nicolas W. Villelli, Andrew DeNardo, John Scott, Daniel Sahlein, Troy D. Payner, Jesse J. Savage, Mitesh Vipin Shah, Charles Glen Kulwin

6:18–6:21 pm

**670 Implications of Achieving TIC1 2b Versus TIC1 3 Reperfusion in Patients with Ischemic Stroke: A Cost-Effectiveness Analysis**

Xiao Wu, Dheeraj Gandhi, Charles C. Matouk, Joseph Schindler, Danny Hughes, Howard Forman, Pina C. Sanelli, Ajay Malhotra

6:21–6:24 pm

**671 Neurosurgical Management in Left Ventricular Assist Device (LVAD) Patients with Intracerebral Hemorrhage (ICH)**

Kyle Mueller, Matthew R. D'Antuono, David Zhao, Jeffrey C. Mai, Edward F. Aulisi, Daniel Felbaum, Michael Hockstein, Rocco Armonda

6:24–6:27 pm

**672 Surgical Outcomes in Brainstem AVM: A Systematic Review and Meta-analysis**

Anadjeet Singh Khahera, Oludotun Ogunsola, Justin Sim, Alison Clarke, E. Sander Connolly, Jr.

6:27–6:30 pm

**673 Managing Anterior Communicating Artery Aneurysms – Are We Doing it Right?**

Lauren Harris, Ciaran S. Hill, Matthew Elliot, Teresa Fitzpatrick, Alejandro Feria, Anthony Ghosh, Raghu Vindlacheruvu

6:30–6:33 pm

**674 Abdominal Aortic Aneurysm Is an Independent Risk Factor for Subarachnoid Hemorrhage**

D. Andrew Wilkinson, Jeffrey L. Nadel, Neeraj Chaudhary, Joseph J. Gemmete, Byron G. Thompson, Jr., Aditya S. Pandey

6:33–6:36 pm

**675 Preliminary Experience with Proximal Flow Reversal During Intracranial Balloon Angioplasty and Stenting for Symptomatic, Severe Intracranial Stenosis**

Branden J. Cord, Corrado Santarosa, Nanthiya Sujjantararat, Adam Kundishora, Guido Falcone, Kevin Sheth, Lauren Sansing, Joseph Schindler, Nils Petersen, Charles C. Matouk

6:36–6:39 pm

**676 Vasa Vasorum Formation Is Associated with Rupture of Intracranial Aneurysms**

Haruka Miyata, Hirokazu Koseki, Kampei Shimizu, Yu Abekura, Mieko Oka, Tomohiro Aoki, Kazuhiko Nozaki

6:39–6:42 pm

**677 Somatic PDGFRB Activating Variants in Fusiform Cerebral Aneurysms**

Joshua W. Osbun, Yigit Karasozen, Carolina Parada, Tina Busald, Philip Tatman, Luis Gonzalez-Cuyar, Christopher Hale, Diana Alcantra, Mark O'Driscoll, William Dobyns, Mitzi Murray, Louis J. Kim, Peter Byers, Michael Dorschner, Manuel Ferreira

6:42–6:45 pm

**678 Optical Coherence Tomography Imaging in Acute Ischemic Stroke: Preliminary Animal and Human Results**

Christopher R. Pasarikovski, Leo da Costa, Joel Ramjist, Yuta Dobashi, Victor Xiao Dong Yang

6:45–6:48 pm

**679 Toward Optimal VTE Prophylaxis in Neurosurgery**

H. Westley Phillips, TJ Florence, Nicholas Macaluso, Diana Babayan, Nader Pouratian, Won Kim

6:48–6:51 pm

**680 Acute Brain Injury Is Associated with Prolonged Suppression of Cerebral Blood Flow Oscillations**

Ryan M. Jamiolkowski, Wesley Baker, W. Andrew Kofke, Ramani Balu

6:51–6:54 pm

**681 Higher Volume Predicts Improved Outcomes for Severe Pediatric Traumatic Brain Injury Patients at Level 1 and 2 Trauma Centers**

Anna Kimata, Oliver Young Tang, Wael Asaad

6:54–6:57 pm

**682 Effect of ACS Level 1 - Trauma Center Designation on Management of Adult Severe TBI Patients**

Matthew Helton, Austin Porter, Kevin Thomas, Jeffrey C. Henson, Mason Sifford, Hayden Scott, Analiz Rodriguez, Kevin Sexton

6:57–7:00 pm

**683 Methylene Blue Attenuates Significant Shifts in the Gut Microbiome following Traumatic Brain Injury in Rodents**

Matthew McIntyre, David M. Burmeister, Shannon Scroggins, Michael O' Boyle, Zhao Lai, Martin Schwacha, Lora Watts, Susannah Nicholson.

7:00–7:03 pm

**684 Self-reported Knowledge Levels of Critical Care Nurses in Managing Neuroemergencies: A Survey Based Study**

Karan Amlani, Sonia Nelson, Elka Riley, Zachary L. Hickman, Christopher P. Kellner, Nirit Weiss, Fawaz Almufti, Golda Bohaene, Joshua B. Bederson, J D. Mocco, Neha Dangayach

7:03–7:06 pm

**685 Factors Associated with Worsened Neurologic Outcomes in Traumatic Subarachnoid Hemorrhage**

Risheng Xu, Yuanxuan Xia, Chau D. Vo, Wuyang Yang, Jason A. Liew, Ted Alban, James Feghali, Justin M. Caplan, Rafael J. Tamargo, Judy Huang

7:06–7:09 pm

**686 The Protective Role of Heme Oxygenase-1 (HO-1) in Chronic Subdural Hematoma**

Hui-Tzung Luh

7:09–7:12 pm

**687 Incidence and Risk Factors for Developing Post Traumatic Hydrocephalus, Analysis of a Prospective Cohort of 402 Patients**

Ezequiel Goldschmidt, Federico Angriman, Ruchira Menka Jha, Benjamin Zusman, Ava Puccio, David O. Okonkwo

7:12–7:15 pm

**688 The Utility of Thromboelastography for Predicting the Risk of Posttraumatic Cerebral Infarction in Traumatic Brain Injury**

Hao Chen, Hengli Tian

**INTERACTIVE MULTIMEDIA RESEARCH PRESENTATION  
ORAL PRESENTATIONS**

Podium 4, Level 2 Lobby

5:45–5:48 pm

**689 Is Biological Effective Dose (BED) Predictive of Outcomes after Radiosurgery for Cerebral Arteriovenous Malformations?**

Cody L. Nesvick, Christopher S. Graffeo, Michael J. Link, Bruce E. Pollock

5:48–5:51 pm

**690 Pre-operative Epilepsy Network Distribution Correlates with Seizure Recurrence Following Epilepsy Surgery**

Long Di, Elliot G. Neal, Stephanie Maciver, Fernando L. Vale

5:51–5:54 pm

**691 Skull Density Ratio and Treatment Outcomes in Essential Tremor Patients Treated with Transcranial MR-guided Focused Ultrasound Thalamotomy**

Abdul-Kareem Ahmed, Jiachen Zhuo, Howard M. Eisenberg, Timothy R. Miller, Rao Gullapalli, Dheeraj Gandhi

5:54–5:57 pm

**692 Pallidal Thermoablation Unleashes Gamma Oscillations in the Motor Cortex in Parkinson's Disease**

Doris D. Wang, Coralie de Hemptinne, Svjetlana Miocinovic, Witney Chen, Jill L. Ostrem, Philip A. Starr

5:57–6:00 pm

**693 Glomus Jugulare: Is Gamma Knife Radiosurgery the Ideal Treatment?**

Jaskaran Singh, Manmohan Singh

6:00–6:03 pm

**694 Combination Targeting of Subthalamic Nucleus and Ventral Intermediate Thalamic Nucleus in Deep Brain Stimulation for Tremor-dominant Parkinson's Disease: Experience and Outcomes**

Islam Fayed, Kelsey Diva Cobourn, Gnel Pivazyan, Fernando Pagan, Steven Lo, Yasar Torres-Yaghi, Allen S. Mandir, Christopher G. Kalhorn

6:03–6:06 pm

**695 Audiovisual Speech Enhancement via Cross-modal Suppression of Auditory Association Cortex by Visual Speech**

Patrick J. Karas, John F. Magnotti, Zhengjia Wang, Brian A. Metzger, Daniel Yoshor, Michael S. Beauchamp

6:06–6:09 pm

**696 Use of Functional MRI to Assess How Motor Phenotypes of Parkinson's Disease Respond to DBS**

Marisa D. DiMarzio, Radhika Madhavan, Suresh Joel, Ileana Hancu, Eric Fiveland, Julia Prusik, Michael Gillogly, Tanweer Rashid, Jeffrey Ashe, Ilknur Telkes, Paul Feustel, Damian Shin, Jennifer Murphy, Roy S. Hwang, Era Hanspal, Julie G. Pilitsis

6:09–6:12 pm

**697 The Positive Allosteric Modulator of Alpha-2/3-Containing GABA A Receptors, KRM-II-81, Is Active in Pharmacoresistant Models of Epilepsy and in Human Epileptic Tissue**

Jodi L. Smith, Xingie Ping, Xiaoming Jin, Lalit K. Golani, Guanguan Li, Farjana Rashid, Rajwana Jahan, James M. Cook, Jeffrey M. Witkin

6:12–6:15 pm

**698 Interneuron Transplantation Creates New Network States and Rescues Social Behavior Deficits in a Mouse Model of Autism**

Derek Southwell, Helia Seifikar, Ruchi Malik, Karen Lavi, Daniel Vogt, John Rubenstein, Vikaas Sohal

6:15–6:18 pm

**699 The Durability of Pain Relief Following Endoscope-assisted MVD for Trigeminal Neuralgia**

Alexandra D Baker, Melvin Field

6:24–6:27 pm

**702 Management of Non-Surgical Refractory Low Back Pain in the United States: A Retrospective Analysis**

Charis Spears, Sarah E. Hodges, Musa Kiyani, Zidanyue Yang, Beth Parente, Hui-Jie Lee, Shivanand P. Lad

6:27–6:30 pm

**703 Central Neuropathic Pain And Complex Regional Pain Syndrome Following Brachial Plexus Injury Treated Successfully with Dorsal Root Entry Zone Lesioning**

Erin McCormack, Mansour H. Mathkour, Lora Wallis Kahn, Reda Tolba, Maged Guirguis, Gassan Chaiban, Daniel Denis

6:30–6:33 pm

**704 Clinical Diagnosis Scale for Pain Lumbar of Facet Origin: Systematic Review of Literature and Pilot Study**

Juan C. Gomez Vega, Juan C. Acevedo Gonzalez

6:36–6:39 pm

**706 The Impact of Pre-Operative Opioids on Outcomes in Craniotomy Patients**

Varun Shah, Nguyen Hoang, Brandon Rodgers, David L. Dornbos III, Ryan Eaton, Dante Pezzutti, Erin Hoover, Helen Duenas, Santino Cua, Shahid Mehdi Nimjee

6:39–6:42 pm

**707 20 Years of Opioids Prescriptions in Spine Patients: The Experience of Two Academic Hospitals in Massachusetts**

Elisabetta Mezzalana, Paola Prieto Calvachi, Brittany M. Stopa, Jordan Muse, Ahmad Kareem Almekkawi, Hassan Zaidi, Linda S. Aglio, Timothy R. Smith, William B. Gormley

6:42–6:45 pm

**708 Sex Disparities in Outpatient Management of Post-laminectomy Syndrome**

Amy Zhu, Ryan Guan Chiu, Jeffery Zhao, Ankit Indravadan Mehta

6:45–6:48 pm

**709 Late Week Surgery Is Associated with Longer Length of Stay in Patients Undergoing Laminectomy for Degenerative Lumbar Stenosis**

Robert Winkelman, Vikram Chakravarthy, Matthew M. Grabowski, Ghaith Habboub, Sebastian Salas-Vega, Thomas E. Mroz

6:48–6:51 pm

**710 Disparities in Rates of Fusions in Single-Level Lumbar Disc Pathologies**

Soobin Kim, James S. Ryoo, Philip B. Ostrov, Abhinav K Reddy, Ankit Indravadan Mehta

6:51–6:54 pm

**711 Global Burden of Neurosurgical Disease**

Alex Jacob, Christopher Carr, Cassidy Werner, Aaron S. Dumont

6:54–6:57 pm

**712 Postoperative Admission of Adult Craniotomy Patients to Neuroscience Floor Unit Reduces Cost and Length of Stay**

Matthew Z. Sun, Diana Babayan, Jia-Shu Chen, Maxwell Wang, Priyanka Naik, Kara Reitz, Won Kim

6:57–7:00 pm

**713 Socioeconomic Barriers Affecting Neurologic Recovery Facing the Aneurysmal Subarachnoid Population**

Ben A. Strickland, Kristine Ravina, Alexander G. Chartrain, Robert Rennert, Arun P. Amar, Jonathan Russin, Steven L. Giannotta

7:00–7:03 pm

**714 Analysis of Neurosurgery Resident Operative Experience: Training Tomorrow's Neurosurgeon**

Shahjehan Ahmad, Bledi C. Brahima

7:03–7:06 pm

**715 The Neurosurgeon-Scientists NIH Funding Trends**

Karim ReFaey, Shashwat Tripathi, William D. Freeman, Hugo Guerrero-Cazares, James Meschia, Leonard Petrucelli, Fredric B. Meyer, Alfredo Quinones-Hinojosa

7:06–7:09 pm

**716 A Single-Institution's Experience with the CMS Non-Cervical Spine Fusion Bundle Payments**

Abraham Schlauderaff, Neel T. Patel, G. Timothy Reiter

7:09–7:12 pm

**717 Neurosurgery Elective for Preclinical Medical Students With and Without a Home Neurosurgery Program**

Jonathan Dallas, Nishit Mummareddy, Aaron M. Yengo-Kahn, Robert J. Dambrino, IV, Alexander M. Lopez, Lola Blackwell Chambless, Richard Berkman, Rohan V. Chitale, Christopher M. Bonfield, Regina S. Offodile, John C. Wellons, III, Reid C. Thompson, Scott L. Zuckerman

7:12–7:15 pm

**718 Causes of Hospital Readmissions Within Seven Days from the Neurosurgical Service of a Quaternary Referral Hospital**

Enyinna L. Nwachuku

# CNS Wellness Afternoon

Tuesday 1:45–2:45 pm



Meet Dr. Gary Simonds, author of “The Thriving Physician: How to Avoid Burnout by Choosing Resilience Throughout Your Medical Career”



Voices of Neurosurgery: The Unforgettable Moments



CNS sweatpants giveaway (limited quantity)



Create Your Own Smoothie on the Blender Bike



# ORAL ABSTRACT PRESENTATIONS

## WEDNESDAY, OCTOBER 23

PA

### SUNRISE SCIENCE ORAL PRESENTATIONS SESSION

Room 3024

7:00–7:06 am

**350 Evoked Compound Action Potentials to Guide Lead Placement: A Neuromonitoring Technique Case Series**  
Steven M. Falowski

7:06–7:12 am

**351 Development and Validation of a Clinical Prediction Score for Poor Postoperative Pain Control Following Elective Spine Surgery**  
Michael M.H. Yang, Jay Riva-Cambrin, Jonathan Cunningham, Nathalie Jette, Tolulope T. Sajobi, Steven Casha

7:12–7:18 am

**352 Pre-operative Radiological Finding at the Lumbar Spinal Level is a Novel Predictive Factor for Post-operative Outcome After Spinal Cord Stimulation in Patients with Failed Back Surgery Syndrome**  
Yusuke Hori, Andre Machado, Sean J. Nagel

7:18–7:24 am

**353 Spontaneous Intracranial Hypotension and the Durability of Epidural Blood Patch**  
Ali Hazama, Lori John, Alexander E. Braley, Lawrence S. Chin, Satish Krishnamurthy

7:24–7:30 am

**354 Stim Salvage: Case Series Reporting on the Effectiveness of SCS Salvage**  
Patrick Paullus, Erika A. Petersen

7:30–7:36 am

**355 Spinal Cord Stimulation with Non-linear Burst Stimulation Design Improves Psychosocial Function Through the Medial Spinothalamic Tract**  
Steven M. Falowski

7:36–7:42 am

**356 Impact of Predominant Arm Pain Versus Neck Pain on 12-Month Outcomes Following Elective Cervical Spine Surgery: Analysis from the Quality Outcomes Database (QOD)**  
Clinton J. Devin, Mohamad Bydon, Mohammed A. Alvi, Anshit Goyal, Panagiotis Kerezoudis, Inamullah Khan, Yagiz U. Yolcu, Anthony L. Asher

7:42–7:48 am

**357 Factors Contributing Spinal Cord Stimulator Explantation**  
Francisco A. Ponce, Dakota Graham, Margaret Lambert, Zaman Mirzadeh

7:48–7:54 am

**358 Utility of a Mobile Clinical Decision Support Application in Patients Undergoing Spinal Cord Stimulation**  
Shervin Rahimpour, Sarah E. Hodges, Luis A. Antezana, Abena A. Ansah-Yeboah, Rajeev Dharmapurikar, John Hatheway, Michael Warrick, Scott Berlin, Benjamin Seeman, Shivanand P. Lad

7:54–8:00 am

**359 Direct Anterior Insular Cortex Stimulation Increases Heat Pain Threshold: A Case Report**  
Chang-Chia Liu, Shayan Moosa, Mark Quigg, W. Jeffrey Elias

8:00–8:06 am

**925 Risk Factors for Wound-related Complications after Microvascular Decompression: A Case Control Study**  
Elizabeth N. Alford, Gustavo Chagoya, Galal Elsayed, Joshua Bernstock, Nicole Bentley, Andrew K. Romeo, Barton L. Guthrie

8:06–8:12 am

**926 CT Guided Percutaneous Glycerol Rhizotomy for Trigeminal Neuralgia - A Standardized Protocol to Reduce Radiation Dose and Procedure Time**  
Bradley T. Schmidt, Conrad Pun, Scott Hetzel, Wendell B. Lake, Daniel K. Resnick

8:12–8:18 am

**927 A Retrospective Analysis of High Opioid use Patients undergoing a Preoperative Pain Program Prior to Spine Surgery**  
Karl Wittnebel, Lindsey Ross, Jeanne Black, Keith Siegel, Terrence T. Kim, Sang D. Kim, Eli M. Baron, Tiffany G. Perry, Alexander Tuchman, Mark Vrahas, J. Patrick Johnson

8:18–8:24 am

**928 A Multidisciplinary Spinal Fusion Pathway to Discharge: Improved Standardization of Care Reduces Hospital Length of Stay, Enhances Pain Control and Optimizes Disposition after Lumbar Spine Surgery**  
Corey T. Walker, Virginia Prendergast, Jakub Godzik, Alex Whiting, Juan S. Uribe, Jay D. Turner, Laura A. Snyder

8:24–8:30 am

**929 Minimally Invasive Versus Open Surgical Treatment of Thoracolumbar Metastatic Epidural Spinal Cord Compression (MESCC): Meta-analysis and Systematic Review**  
Ali R. Tafreshi, Elwood Siagian, Guofang Shen, Wei-Xing Shi

(SF)

**SUNRISE SCIENCE ORAL PRESENTATIONS SESSION**

Room 3020

7:00–7:06 am

**360 Rates of Post Procedure Hemorrhage in Brain Tumor Patients on Therapeutic Anticoagulation Undergoing Gamma Knife Radiosurgery**

Carlos R. Goulart, Michelle Dewitt, Gaddum D. Reddy

7:06–7:12 am

**361 Real-World Outcomes Using a Novel Directional Lead From a Deep Brain Stimulation Registry for Parkinson's Disease**

Jan Vesper, Roshini Jain, Alex Wang, Heleen Scholtes, Michael T. Barbe, Steffen Paschen, Andrea Kuhn, Jens Volkmann, Monika Potter-Nerger, Günther Deuschl

7:12–7:18 am

**362 Neuroanatomical Correlates of Response to Focused Ultrasound Thalamotomy in Essential Tremor**

Robert Gramer, Stanley Xiangyu Li, Gavin Elias, Alexandre Boutet, Jurgen Germann, Michael Schwartz, Alfonso Fasano, Andres M. Lozano

7:18–7:24 am

**363 The Predictive Value of Interictal Scalp EEG Findings in Aiding the Detection of Malformations of Cortical Development in Temporal Lobe Epilepsy**

Jeffrey W. Fuchs, Nathan A. Shlobin, Benjamin Hopkins, Zehra Husain, Michael Cloney, Evgeniya Tyrtova, Pue Farooque, Jessica W. Templer, S. Kathleen Bandt

7:24–7:30 am

**364 Clinically weighted Probabilistic Tractography Mapping of Therapeutic Thalamic Deep Brain Stimulation for Essential Tremor**

Evangelia Tsolaki, Alon Kashanian, Nader Pouratian

7:30–7:36 am

**365 Interstitial Laser Capsulotomy for Refractory Obsessive-Compulsive Disorder – Lesion Size and Energy Deposition Determine Outcome**

Peter C. Warnke, Anil Mahavadi, Jon Grant

7:36–7:42 am

**366 A Feedforward Mechanism for Epileptogenesis Regulated by Lactate Dehydrogenase A**

Marcelle Altshuler, Alexander Ksendzovsky, Muznbanu Bachani, Stuart Walbridge, Sara Inati, Islam Fayed, John D. Heiss, Jaideep Kapur, Kareem A. Zaghoul

7:48–7:54 am

**368 Evaluation of Predictive Models of Postoperative Seizure Freedom in Patients with Medically-refractory Epilepsy**

Alireza Mansouri, Jerry C. Ku, Shervin Taslimi, James M. Drake, Abhaya Vivek Kulkarni, James T. Rutka, Taufik Valiante

7:54–8:00 am

**369 Cortical Basal Ganglia Network Interactions During Sequence Learning in Parkinson's Disease**

Doris D. Wang, Coralie de Hemptinne, Roee Gilron, Philip A. Starr

8:00–8:06 am

**930 Prefrontal Cortex Regulation of Nigral DA and Non-DA Neurons: An in Vivo Optogenetics Study in Rats**

Ali R. Tafreshi, Elwood Siagian, Guofang Shen, Wei-Xing Shi

8:06–8:12 am

**931 Multi-modal Presurgical Evaluation of Refractory Localization-related Epilepsy involving Mesial Temporal Lobe Structures**

Rui Feng, Jie Hu, Zhen Fan, Liqin Lang, Li Pan

8:12–8:18 am

**932 Post-operative MRI Is Associated with Increased Radiographic Hemorrhage Detection after Stereotactic Encephalography Depth Electrode Placement**

Victor Sabourin, Anthony Stefanelli, Fadi Al Saiegh, Caio M. Matias, Ashwini D. Sharan, Chengyuan Wu

8:18–8:24 am

**933 Laser Interstitial Thermal Therapy for Epilepsy with Periventricular Nodular Heterotopia**

Alex Whiting, Justin Bingaman, Joshua Catapano, Benjamin B. Whiting, Jakub Godzik, Corey T. Walker, Kris A. Smith

8:24–8:30 am

**934 Does Bilingualism Prognosticate a Favorable Outcome after Awake Surgery?**

Karim ReFaey, Sanjeet S. Grewal, Shashwat Tripathi, Adip G. Bhargav, Erik H. Middlebrooks, David S. Sabsevitz, Adela Wu, Kaisorn L. Chaichana, Alfredo Quinones-Hinojosa

**CRANIAL AFTERNOON ABSTRACT ORAL PRESENTATIONS**

Room 2020

1:45–1:51 pm

**800 Pregnancy after Cerebral Bypass for Moyamoya Disease**

Ephraim W. Church, Rabia Qaiser, Theresa E. Bell-Stephens, Eric Chow, Summer Han, Yasser Y. El-Sayed, Gary K. Steinberg

1:51–1:57 pm

**801 Multiplex Profiling of Secreted Factors in the Cerebrospinal Fluid of Moyamoya Disease Patients**

Kumar Abhinav, Alex G. Lee, Arjun Vivek Pendharkar, Yael Rosenberg-Hasson, Haruto Uchino, Michelle Cheng, Gary K. Steinberg

1:57–2:03 pm

**802 Cerebral Aqueduct CSF Stroke Volume Hydrodynamics in Chronic Communicating Hydrocephalus: Exploration of the Initial and Late Phases in an Animal Model**

Tito G.M. Vivas-Buitrago, Ignacio Jusue Torres, Gabriel D. Pinilla-Monsalve, Armelle Lokossou, Jiadi Xu, Hugo Guerrero Cazares, Susumu Mori, Alfredo Quinones-Hinoja, Olivier Baledent, Daniele Rigamonti

2:09–2:15 pm

**804 Seizure Presentation in Patients with Brain Arteriovenous Malformations Treated with Stereotactic Radiosurgery: A Multicenter Study**

Ching-Jen Chen, Leah Shabo, Dale Ding, Natasha Ironside, Douglas Kondziolka, L. Dade Lunsford, Jason P. Sheehan

2:15–2:21 pm

**805 Technical Note: Endoscopic Evacuation of Intraventricular Hemorrhage During Minimally Invasive Endoscopic Intracerebral Hemorrhage Evacuation**

Jacque J. Lara-Reyna, Rui Song, Dominic A Nistal, Neha S. Dangayach, J D. Mocco, Christopher Paul Kellner

2:21–2:27 pm

**806 Dynamic Structural Modeling Revealed that Nilotinib Inhibits Smoothed Signaling**

Kirti Kandhwal Chahal, Jie Li, Irina Kufareva, Donald Durden, Robert Wechsler Reya, Ruben Abagyan, Clark C. Chen

2:27–2:33 pm

**807 Functional Characterization of Brain Tumor-initiating Cells: Implications for Preclinical Models and Drug Development**

Cesar A. Garcia, Adip Guruprasad Bhargav, Sujan K. Mondal, Karim ReFaey, Natanael Zarco, Paula Schiapparelli, Rachel Sarabia-Estrada, Hugo Guerrero-Cazares, Alfredo Quiñones-Hinojosa

2:33–2:39 pm

**808 Preoperative MRI-based Predictive Modeling of Brain Tumor Laser Ablation**

Anil Mahavadi, Walter J. Jermakowicz, Iahn Cajigas, Lia Dan, Santiago Guerra, Ghulam Farooq, Ashish H. Shah, Michael E. Ivan, Jonathan R. Jagid, Ricardo J. Komotar

2:39–2:45 pm

**809 Decorin Expression Is Associated with Diffusion MR Phenotypes in Glioblastoma**

Kunal S. Patel, Catalina Raymond, Jingwen Yao, Joseph Tsung, Linda M. Liao, Richard Everson, Timothy F. Cloughesy, Benjamin Ellingson

2:45–2:51 pm

**810 Captopril as an Adjuvant to Temozolomide Prolongs Survival in a Rat Intracranial Gliosarcoma Model via Downregulation of Matrix Metalloproteinase-2**

Leon Pinheiro, Alexander Perdomo-Pantoja, Joshua Casaos, Iddo Paldor, Veronica Vigilar, Antonella Mangraviti, Yuan Wang, Henry Brem, Betty Tyler

2:51–2:57 pm

**811 Possibilities of Photodynamic Therapy in the Complex Treatment of Malignant Gliomas**

Artemii Y Rynda

2:57–3:03 pm

**812 The Luciferase Expressing Glioma-261 Murine Models Elicit an Immune-mediated Anti-tumor Response**

Victoria E. Sanchez, John Lynes, Stuart Walbridge, Xiang Wang, Nancy A. Edwards, Anthony Nwankwo, Gifty Dominah, Arnold Obungu, Nicholas Adamstein, Pradeep Dagur, Tianxia Wu, Dragan Maric, John D. Heiss, Edjah K. Nduom

3:03–3:09 pm

**813 Trends in Management of Cerebrospinal Fluid Leaks Among Pediatric Head Trauma Patients with Skull Base Fractures**

Anthony O. Asemota, Eric B. Schneider, Gary L. Gallia

3:09–3:15 pm

**814 Volume and Midline Shift as Pre-operative CT Imaging Predictors of Postoperative Chronic Subdural Hematoma Recurrence: Retrospective Review of 345 Patients with 412 Operative Subdural Sides**

Laila Malani Mohammad, William H. McKay, Christine Meadows, Jacqueline O'Neill, Howard Yonas, Andrew P. Carlson

**DISORDERS OF THE SPINE AND PERIPHERAL NERVES  
ORAL ABSTRACT PRESENTATIONS**

Room 2016

1:45–1:51 pm

**815 Independent Patient Risk Factors Associated with Increased Length of Hospital Stay, Unplanned Return to OR and 30-Day Readmission Rates After Posterior Cervical Fusion for Cervical Spondylotic Myelopathy**

Aladine A. Elsamadicy, Fouad Chouairi, Megan Lee, Andrew B. Koo, Adam Kundishora, Joaquin Q. Camara-Quintana, Luis Kolb, Maxwell S.H. Laurans, Khalid M. Abbed

1:51–1:57 pm

**816 Combined Nucleus Pulposus Augmentation and Annulus Fibrosus Repair Prevents Intervertebral Disc Degeneration After Discectomy**

Sertac Kirnaz, Stephen Sloan, Christoph Wipplinger, Franziska Anna Schmidt, Roger Hartl, Lawrence J. Bonassar

1:57–2:03 pm

**817 The Impact of Obstructive Sleep Apnea on Clinical, Perioperative, and Cost Outcomes in Patients who Underwent Posterior Cervical Discectomy and Fusion: A Single Center Retrospective Analysis from 2008-2016**

Alejandro Carrasquilla, Dominic A. Nistal, John M. Caridi

2:03–2:09 pm

**818 Intrathecal Riluzole for the Treatment of Patients with Amyotrophic Lateral Sclerosis**

Nicholas M. Boulis

2:09–2:15 pm

**819 Body Mass Index Greater than 35 is Associated with Increased Major and Radiographic Complications after Minimally Invasive Adult Spinal Deformity Surgery**

Khoi D. Than, Stacie Tran, Dean Chou, Kai-Ming G. Fu, Paul Park, Richard G. Fessler, Michael Y. Wang, Adam S. Kanter, David O. Okonkwo, Pierce D. Nunley, Neel Anand, Juan S. Uribe, Robert Eastlack, Gregory M. Mundis, Jr., Praveen V. Mummaneni

2:15–2:21 pm

**820 Complications in Minimally Invasive Versus Open Surgery for Intermediate to High-Grade Spondylolisthesis: A 10-year Retrospective, Multicenter Experience**

Asad Mehmood Lak, Abdullah M. Abunimer, Amina Rahimi, Ian Tafel, Hasan Aqdas Zaidi

2:21–2:27 pm

**821 Does a Fracture Liaison Service Program Minimize Recurrent Fragility Fractures in the Elderly with Osteoporotic Vertebral Compression Fractures?**

Tarik Wasfie, Avery M. Jackson, III

2:27–2:33 pm

**822 Comparative Effectiveness of Adjustable Lordotic Expandable Versus Static Lateral Lumbar Interbody Fusion Devices: Two-Year Clinical and Radiographic Outcomes**

Yan M. Li, Richard F. Frisch, Zheng Huang, James Towner, Yan Icy Li, Jessica Riggelman, Charles Ledonio

2:33–2:39 pm

**823 Comparing Radiographic Parameters for Single-level L5-S1 Interbody Fusion: Anterior Lumbar (ALIF) Versus Transforaminal Lumbar Interbody Fusion (TLIF)**

Caleb S. Edwards, Andrew Kai-Hong Chan, Dean Chou, Praveen V. Mummaneni

2:39–2:45 pm

**824 Safety of Outpatient Anterior Cervical Discectomy and Fusion: A Systematic Review and Meta-analysis**

Ketan Yerneni, John F. Burke, K. Daniel Riew, Vincent C. Traynelis, Lee A. Tan

2:45–2:51 pm

**825 Choosing Minimally Invasive Versus Open Surgery in the Treatment of Adult Spinal Deformity (ASD): Analysis of a Prospective, Non-randomized Multi-center Study**

Paul Park, Khoi D. Than, Pierce D. Nunley, Robert Eastlack, Juan S. Uribe, Michael Y. Wang, Stacie Tran, Richard G. Fessler, David O. Okonkwo, Adam S. Kanter, Neel Anand, Dean Chou, Kai-Ming G. Fu, Gregory M. Mundis, Jr.

2:51–2:57 pm

**826 Fusion and Opioid-sparing with the Use of Ketorolac in Posterior Thoracolumbar Spinal Fusions: A Prospective Double-blinded Randomized Placebo-Controlled Trial**

Evan J. Lytle, Chad F. Claus, Doris Tong, Diana Sigler, Dominick Lago, Matthew Bahoura, Amarpal Dosanjh, Michael H. Lawless, II, Dejan Slavnic, Jacob Jasinski, Robert W. McCabe, Karl Kado, Prashant Sudhir Kelkar, Clifford Michael Houseman, Peter L. Bono, Boyd F. Richards, Teck Mun Soo

2:57–3:03 pm

**827 Predictive Model for Length of Stay Among Patients Undergoing Surgery for Grade I Spondylolisthesis: Analysis from the Quality Outcomes Database**

Praveen V. Mummaneni, Mohamad Bydon, John J. Knightly, Anshit Goyal, Mohammed A. Alvi, Andrew Kai-Hong Chan, Jian Guan, Steven D. Glassman, Kevin T. Foley, Jonathan Slotkin, Eric A. Potts, Mark E. Shaffrey, Christopher I. Shaffrey, Sr., Regis W. Haid, Kai-Ming G. Fu, Michael Y. Wang, Paul Park, Anthony L. Asher, Erica F. Bisson

3:03–3:09 pm

**828 Geographic Differences in Intraoperative Neuromonitoring During Minimally Invasive Lateral Spine Surgery**

Sheeraz Qureshi, Luke Ricci, Avani Vaishnav, Steven Mcanany, Sravisht Iyer, Todd Albert, Catherine Gang

3:09–3:15 pm

**829 Acute Exacerbation of Symptoms After Lumbar Decompression Surgery: An Analysis of Readmissions and Reoperations in 81,365 patients**

Andre Samuel, Avani Vaishnav, Steven Mcanany, Sravisht Iyer, Todd Albert, Catherine Gang, Sheeraz Qureshi

**NEUROTRAUMA AND CRITICAL CARE ORAL ABSTRACT PRESENTATIONS**

Room 2022

1:45–1:51 pm

**830 Sports-Related Cervical Spine Fracture and Spinal Cord Injury: A Review of Nationwide Pediatric Trends**

Haddy Alas, Avery Brown, Katherine Pierce, Cole Bortz, Michael Moses, Dennis Vasquez-Montes, Bassel G. Diebo, Carl Paulino, Aaron James Buckland, Michael Gerling, Peter G. Passias

1:51–1:57 pm

**831 Micro RNA Profiles of Traumatic Brain Injury Isolated from Plasma Extracellular Vesicles**

Ross Puffer, Luz Cumba-Garcia, Benjamin T. Himes, David O. Okonkwo, Ian F. Parney

1:57–2:03 pm

**832 Meta-Analysis of Functional Outcomes in 5508 Patients Sustaining a Gunshot Wound to the Head**

Georgios Maragkos, Efsthios Papavassiliou, Martina Stippler, Aristotelis Filippidis

2:03–2:09 pm

**833 Pulmonary Embolism in Neurocritical Care – Introduction of a Novel Grading System for Risk Stratification: The Frankfurt AMBOS Score**

Daniel Dubinski

2:09–2:15 pm

**834 Detection of Persisting Concussion Effects on Measures of Neuromechanical Responsiveness**

Chad J. Prusmack

2:15–2:21 pm

**835 Clinical Course of Intracranial Bleeding in Patients Anticoagulated with Factor Xa Inhibitors without the Use of Specific Reversal Agents**

Emmalin Nelton, Georgios Maragkos, Sven Richter, Aristotelis Filippidis, Martina Stippler

2:21–2:27 pm

**836 Lower Mortality and Morbidity with LMWH for VTE Prophylaxis in Spine Trauma**

Emily K. Chapman, Sean N. Neifert, Robert J. Rothrock, Frank Yuk, Ian T. McNeill, Jonathan J. Rasouli, Jonathan S. Gal, John M. Caridi

2:27–2:33 pm

**837 Anatomic Factors Affecting Size of Suboccipital Decompression**

Courtney Pendleton, Lohit Velagapudi, Jack Jallo

2:33–2:39 pm

**838 Potential of Human Neural Stem Cell Transplantation to Treat Acute Subdural Hematoma**

Lee Onn Chieng, Shoji Yokobori, Markus Spurlock, Shyam Gajavelli, Tom Hazel, Karl Johe, M. Ross Bullock



2:39–2:45 pm

**839 The Accuracy of Glasgow Coma Score Documentation in a Trauma Database: Implications for Patient Care and Performance Metrics**

Anthony M. DiGiorgio, Blake E. Wittenberg, Brooke Kennamer, Clifford Crutcher, Adam Podet, Jason D. Wilson, Clarence S. Greene, Jr., Gabriel C. Tender, Frank Culicchia, John Hunt

2:45–2:51 pm

**840 Radiological Parameters Predicting Clinical Outcome After Decompressive Hemicraniectomy in Malignant Ischemic Stroke**

Nida Fatima

2:51–2:57 pm

**841 Multivariate Analysis of Acute Magnetic Resonance Imaging Predicts Neurological Improvements in Patients with Cervical Spinal Cord Injury After Early Surgical Decompression**

Tomoo Inoue, Toshiki Endo, Shinsuke Suzuki, Hiroshi Uenohara, Teiji Tominaga

2:57–3:03 pm

**842 Minimally Invasive Endoscopy Versus Craniotomy for Acute Subdural Hematomas: A Retrospective Matched Cohort Study**

Enzo Fortuny, Nicolas K. Khattar, Kevin John, Esther Bak, Shawn W. Adams, Kimberly S. Meyer, Emily P. Sieg, Robert F. James, Dale Ding

3:03–3:09 pm

**843 Monotherapy Aspirin in Minor Traumatic Head Bleeds does not Worsen Outcome**

Nasya Mendoza-Elias, Sandi Mackey, Lisa Jasak, Michael Rosenblatt, Subu N. Magge, Robert G. Whitmore, Zoher Ghogawala

3:09–3:15 pm

**844 Mobile Digital Pupillometry for Rapid Triage of Patients with Severe Traumatic Brain Injury**

Lynn B. McGrath, Jr., Jessica C. Eaton, Anthony Law, Alex Mariakakis, Shwetak Patel, Michael R. Levitt

**LATE-BREAKING ABSTRACT SESSION**

Room 3024

1:45–1:51 pm

**935 Repurposing rhDNase to Improve Neurological Outcomes after Traumatic Brain Injury**

Ayobami L. Ward, Molly Braun, Kumar Vaibhav, Krishnan M. Dhandapani

1:51–1:57 pm

**936 Subdural Drain Versus Subdural Evacuating Port System for the Treatment of Non-acute Subdural Hematomas**

N. Scott Litofsky, Michael J. Ortiz Torres, Patrick Belton, Matthew Burton, Ruben Ngnitewe

1:57–2:03 pm

**937 Mortality Prediction Model for Traumatic Intracranial Hemorrhage: A National Trauma Data Bank Study**

Esther Wu, Siddharth Marthi, Wael Asaad

2:03–2:09 pm

**938 Neurophysiologic Composition of Fascicles Utilized for Oberlin Transfer: The Rare Presence of the FCU Fascicle**

Brandon W. Smith, Nicholas Chulski, Kate Wan-Chu Chang, Ann Little, Lynda J.S. Yang

2:09–2:15 pm

**939 Regional Variance in Disability and Quality of Life Outcomes following Surgery for Grade I Degenerative Lumbar Spondylolisthesis: A Quality Outcomes Database Analysis**

Brandon Sherrod, Andrew K.H. Chan, Mohamad Bydon, Steven D. Glassman, Kevin T. Foley, Eric A. Potts, Christopher I. Shaffrey, Sr., Domagoj Coric, John J. Knightly, Paul Park, Michael Y. Wang, Kai-Ming G. Fu, Jonathan Slotkin, Anthony L. Asher, Michael S. Virk, Panagiotis Kerezoudis, Silky Chotai, Regis W. Haid, Jr., Praveen V. Mummaneni, Erica F. Bisson

2:15–2:21 pm

**940 Repair of Brachial Plexus Injury using Direct Neurotization of the Spinal Accessory Nerve to the Superior Trunk of the Brachial Plexus: A Case Series**

Sean Himel, Paul R. Clark, J. Mason Shiflett

2:21–2:27 pm

**941 Anterior (ALIF), Oblique (OLIF), and Transforaminal (TLIF) Lumbar Interbody Fusions: A Comparison of Perioperative Morbidity**

Caleb S. Edwards, Praveen V. Mummaneni, Anthony M. DiGiorgio, Darryl Lau, Dean Chou

2:27–2:33 pm

**942 The Incidence of Adjacent Segment Degeneration after Lumbar Spine Surgery with Transpedicular Stabilization System and PEEK Rods**

Luis J.L. Ulloa, Socorro Figueroa Rivera

2:33–2:39 pm

**943 Medial Branch Block versus Vertebroplasty for 1-Level Osteoporotic Vertebral Compression Fracture: 2-Year Retrospective Study**

Hyoung Joon Chun

2:39–2:45 pm

**944 Anterior Lumbar Interbody Fusion Reduces Thecal Sac Compression in the Setting of Degenerative Spondylolisthesis**

Hammad A. Khan, Nathan J. Stumpf, Kelsey A. Isbester, Samuel C. Overley, Shaleen Vira, Michael P. Steinmetz, Thomas E. Mroz

2:45–2:51 pm

**945 Ultra-early DVT Prophylaxis in Intracerebral Hemorrhage**

Dimitri Laurent, Olgerd Bardhi, Paul Kubilis, Brian M. Corliss, Stephanie Adamczack, Ndi Geh, Katharina Busl, W. Christopher Fox

2:51–2:57 pm

**946 Phase 2 Clinical Trial of Encephaloduroarteriosynangiosis (EDAS) Revascularization for Symptomatic Intracranial Atherosclerosis (ERSIAS)**

Nestor R. Gonzalez, Hao Jiang, Patrick Lyden, Shlee Song, Konrad Schlick, Oana Dumitrascu, Lucas Restrepo, Neal Rao, Jason Hinman, David S. Liebeskind, Michael J. Alexander, Wouter I. Schievink, Juan F. Toscano, Raymond Liou, Steven Piantadosi, Miguel Quintero-Consuegra, Jeffrey L. Saver

2:57–3:03 pm

**947 Traumatic Subarachnoid Hemorrhage as a Risk Factor for Mortality in Moderate and Severe Traumatic Brain Injury Patients. Hospital Central de Maracay, 2015-2016**

Sasha J. Antunez, Ivis J. Graterol, Iran J. Briceño

3:03–3:09 pm

**948 High Molecular Weight Amyloid- $\beta$  Oligomers Level in Cerebrospinal Fluid Distinguish Idiopathic Normal Pressure Hydrocephalus from Other Neurodegenerative Diseases**

Kaito Kawamura, Madoka Nakajima, Masakazu Miyajima, Chihiro Akiba, Chihiro Kamohara, Jyo Kanpyo, Wei Meng, Ikuko Ogino, Hajime Arai

3:09–3:15 pm

**949 Fiber Tract Anatomy of the Hypothalamus**

Pelin Kuzucu, Pinar Çeltikçi, Emrah Çeltikçi, Ahmet Memduh Kaymaz, Ahmet Akbas, Serhat S. Baydin, M. Sakir Eksi, Necmettin Pamir, Abuzer Güngör



CNS

Foundation

Improving worldwide health together,  
through philanthropy.

Your donation. Your impact.

[www.Foundation.CNS.org](http://www.Foundation.CNS.org)

**THANK YOU**  
INDUSTRY AMBASSADOR

**stryker<sup>®</sup>**

FOR YOUR  
VALUABLE SUPPORT!



# INTERACTIVE MULTIMEDIA RESEARCH PRESENTATION SESSION: POSTER PRESENTATIONS

## TUESDAY, OCTOBER 22

5:45-7:15 pm  
Level 2 Lobby

### SECTION ON CEREBROVASCULAR SURGERY POSTERS

#### 1000 Intra-aneurysmal Signal Dropout on 3D Time-of-flight MRA is Strongly Associated with Wall Enhancement in Unruptured Cerebral Aneurysms: A Novel Biomarker of Aneurysm Instability

Corrado Santarosa, Branden John Cord, Andrew Koo, Aladine A. Elsamadicy, Xiao Wu, Seyedmehdi Payabvash, Kevin Sheth, Nils Petersen, Guido Falcone, Ajay Malhotra, Charles C. Matouk

#### 1001 FMS-like Tyrosine Kinase 3 Ligand (FLT3L) Downregulation in Peripheral Blood Serves as a Biomarker for the Presence of Unruptured Intracranial Aneurysms

Dominic A. Nistal, Michael L. Martini, Trevor Hardigan, Nicolas Fernandez, Seunghye Kim-Schulze, Rui Song, J D. Mocco, Christopher P. Kellner

#### 1002 Genome-wide Association Meta-analysis of Over 30,000 Subjects Reveals Novel Intracranial Aneurysm Risk Genes

Tanyeri Barak, Katsuhito Yasuno, Murat Gunel

#### 1003 Transcirculation Approach in the Endovascular Treatment of Acute Ischemic Stroke, Aneurysms, Dural Arteriovenous Fistulas and Arteriovenous Malformations: A Multicenter Study

Jorge A. Roa, Guilherme Dabus, Alberto Maud, Mario Martinez-Galdamez, Diego Paez-Granda, Vladimir Kalousek, Roger Barranco Pons, Ashkan Mowla, Viktor Szeder, Pascal Jabbour, Santiago Ortega-Gutierrez, David M. Hasan, Edgar Samaniego

#### 1004 Revascularization Versus Clipping in High Hunt & Hess Grade Aneurysmal Subarachnoid Hemorrhage Unamenable to Endovascular Treatment

Jordan Lam, Krista Lamorie-Foote, Shivani Rangwala, Kristine Ravina, Jonathan Russin

#### 1005 Predicting Perioperative Coagulopathy Via Machine Learning in Patients Requiring Emergency Neurosurgical Operations

Yirui Sun, Jinli Yu, Pengfei Fu, Hong Huang, Junyan Chen, Ying Mao

#### 1006 The Risk Factors and Outcomes of Patients with Intra-Operative Aneurysm Rupture During Surgical Clipping

Ryan P. Palsma

#### 1007 Evaluation of Disease Severity and Treatment Intensity as Cost Drivers for Ruptured Intracranial Aneurysms

Herschel Wilde, Spencer Twitchell, Jared C. Reese, Michael Karsy, Jian Guan, Ilyas Eli, Philipp Taussky, Ramesh Grandhi, Richard Schmidt, William T. Couldwell

#### 1008 Pharmacogenetic and Clinical Warfarin Dosing Algorithm Assessments with Predictive Bleeding Risk Stratification

Nicholas Dietz, Elliot Antman

#### 1009 Role of Antiplatelet and Statin Therapy in Patients with Cerebral Cavernous Malformations

Santiago Gomez-Paz, Mohamed M. Salem, Georgios Maragkos, Luis C. Ascanio, Alejandro Enriquez-Marulanda, Kimberly Kicielski, Justin M. Moore, Ajith J. Thomas, Christopher S. Ogilvy

#### 1010 Dandy's Vein Sacrifice and the Analysis of its Safety Profile in Neurosurgical Procedures

Vinayak Narayan, Amey Savardekar, Lekshmi P. Sateesh, Anil Nanda

#### 1011 A Nationwide Analysis of Unplanned 30- and 90-day Readmissions After Elective Cerebral Aneurysm Clipping: Causes, Predictors, and Trends

Haydn Hoffman, Matthew Protas, Lawrence S. Chin

#### 1012 A Nationwide Analysis of 30- and 90-day Readmissions After Elective Endovascular Embolization of Cerebral Aneurysms: Causes, Predictors, and Trends

Haydn Hoffman, Matthew Protas, Lawrence S. Chin

#### 1013 Laser Interstitial Thermal Therapy for Cerebral Vascular Pathologies

Christopher S. Hong, Branden J. Cord, Charles C. Matouk, Veronica Chiang

#### 1014 Elevated Serum Fibrinogen Degradation Products on Admission Predicts Recurrence of Chronic Subdural Hematoma

Yusuke Hori, Toru Fukuhara

#### 1015 Flow Diversion for the Treatment of Partially Thrombosed Aneurysms: A Multicenter Case Series

Mohamed M. Salem, Paul M. Foreman, Christoph J. Griessenauer, Adam A. Dmytriw, Nicola Limbucci, Anna L. Kuhn, Ajit S. Puri, Kimberly P. Kicielski, Alejandro Bugarini, Clemens M. Schirmer, Christopher S. Ogilvy, Ajith J. Thomas

#### 1016 Evaluation of a Pharmacy-mediated Antiplatelet Management Protocol in Stent-assisted Coiling of Cerebral Aneurysms

Mirja Wirtz, Clemens M. Schirmer, Oded Goren, Shamsheer Dalal, Gregory Weiner, Paul M. Foreman, Christoph Johannes Griessenauer

#### 1017 A Single Center Medical Quality Evaluation and Factor Analysis of One-staged Hybrid Operation in the Treatment of Brain Arteriovenous Malformations

Mingze Wang, Yong Cao, Shuo Wang, Jizong Zhao



**1018 Occlusion Rates of Different Modalities in the Endovascular Treatment of Basilar Tip Aneurysms**

Ritam Ghosh, Nikolaos Mouchtouris, Ahmad Sweid, Fadi Al Saiegh, Nohra Chalouhi, M. Reid Gooch, Robert H. Rosenwasser, Pascal Jabbour, Stavropoula I. Tjoumakaris

**1019 Rebleeding Drives Poor Outcome in Aneurysmal Subarachnoid Hemorrhage Independent of Delayed Cerebral Ischemia: A Propensity Score Matched Cohort Study**

Victor M. Lu, Christopher Salvatore Graffeo, Avital Perry, Lucas P. Carlstrom, Leonardo Rangel-Castilla, Giuseppe Lanzino, Waleed Brinjikji, Eelco F.M. Wijdicks, Alejandro A. Rabinstein

**1020 The Impact of Current Generation Anticonvulsant Prophylaxis on Seizure Incidence and Clinical Outcome After Primary Intracerebral Hemorrhage**

Neel T. Patel, Carlton W. Christie, Lekhaj C. Daggubati, Erik B. Lehman, Kevin M. Cockroft

**1021 Treatment of Cerebral Aneurysms in the Post-ISAT Era: Trends and Outcomes**

Evan Luther, David J. McCarthy, Marie-Christine Brunet, Samir Sur, Dileep R. Yavagal, Eric C. Peterson, Robert M. Starke

**1022 Quantitative Versus Qualitative Assessment of Aneurysm Wall Enhancement on Magnetic Resonance Vessel Wall Imaging**

Corrado Santarosa, Branden J. Cord, Andrew Koo, Aladine A. Elsamadicy, Xiao Wu, Seyedmehdi Payabvash, Kevin Sheth, Nils Petersen, Guido Falcone, Ajay Malhotra, Charles C. Matouk

**1023 Predictors of Complications, Functional Outcome, and Mortality in a Large Cohort Treated with Flow Diversion**

Ahmad Sweid, Nabeel Herial, Stavropoula I. Tjoumakaris, Sage Rahm, Michael Gooch, Robert H. Rosenwasser, Pascal Jabbour

**1024 Flow Diversion for Small Caliber Vessel Aneurysms, Efficacy, Safety, and Functional Outcome**

Ahmad Sweid, Robert M. Starke, Nabeel Herial, Robert H. Rosenwasser, Michael Gooch, Stavropoula I. Tjoumakaris, Pascal Jabbour

**1025 Radiosurgical Management of Brainstem Arteriovenous Malformations: Treatment Outcomes and Predictors of Outcome**

Anadjeet S. Khahera, Oludotun Ogunsola, Justin Sim, Alison Clarke, E. Sander Connolly, Jr.

**1028 Virtual Reality as an Immersive 3D Visualization Technique to Improve Surgeon Understanding of Aneurysm Anatomy**

Talia L. Weiss, Christine D. Young, Kevin M. Brennan, Cristian Luciano, Laura Stone-McGuire, Fernanda Herrera, Ali Alaraj

**1029 Patients Taking an Antithrombotic Medication Less Frequently Present with Ruptured Aneurysms**

Peyton L. Nisson, Michael Gaub, Ali Tayebi-Meybodi, Timothy Secomb, Garrett K. Berger, Denise Roe, Michael T. Lawton

**1030 Outcomes in Elderly Aneurysmal Subarachnoid Hemorrhage Patients in the Barrow Ruptured Aneurysm Trial (BRAT)**

Joshua Catapano, Michael J. Lang, Michael T. Lawton

**1031 Variations in the Subventricular Zone Population Overtime in Adult Chronic Communicating Hydrocephalus: Animal Model**

Tito G.M. Vivas-Buitrago, Emily Norton, Andres Ramos, Ignacio J. Torres, Pamela Saavedra, Hugo Guerrero-Cazares, Alfredo Quinones-Hinoja, Daniele Rigamonti

**1032 Valve Opening Pressure Settings in Relation to The Lumbar Puncture Opening Pressure in Patients with INPH: A Delta Value Correlation to Over-drainage**

Tito G.M. Vivas-Buitrago, Johan Heemskerk, Juan P. Herrera, Ricardo Domingo, Sanjeet S. Grewal, Ronald Reimer, Robert E. Wharen, Neil R. Graff-Radford

**1033 Causes of Unfavorable Outcome in Good Grade Patients with Aneurysmal Subarachnoid Hemorrhage: Opportunities for Improvement?**

Matthew E. Eagles, Madeleine P. de Lotbiniere-Basset, Oliver Ayling, Michael K. Tso, R. Loch Macdonald

**1034 Simultaneous Kissing Stent Deployment for Endovascular Treatment of Wide-necked Intracranial Aneurysms: A Case Series of 14 Patients**

Kenichi Sato, Miki Fujimura, Teiji Tominaga

**1035 The Fragility Index in Cerebrovascular Randomized Controlled Trials: Analysis of Robustness and Proposal of a Classification System**

Nimer Adeeb

**1036 Urinary Incontinence and Gait Dysfunction in Intraventricular Hemorrhage: The Role of Acute and Long-Term Cerebral Spinal Fluid Diversion**

Tyler P. Behymer, Simone U. Venema, Padmini Sekar, Charles J. Moomaw, Ashby C. Turner, Vaibhav Vagal, Elisheva Coleman, Russell Sawyer, Robert Stanton, Matthew Flaherty, Christopher D. Andereson, Alessandro Biffi, Jonathan Rosand, Daniel Woo, Charles J. Prestigiacomo

**1037 The Effect of Mechanical Thrombectomy and TICI Score on the Incidence of Decompressive Hemicraniectomy in Ischemic Stroke Patients**

Fadi Al Saiegh, Nikolaos Mouchtouris, Karim Hafazalla, Nohra Chalouhi, Victor Sabourin, Evan M. Fitchett, Pascal Jabbour, Stavropoula I. Tjoumakaris, M. Reid Gooch, Robert H. Rosenwasser, Fred Rincon

**1038 Descending Branch of the Lateral Circumflex Femoral Artery: A Favorable Interposition Graft for Extracranial-to-Intracranial Bypass**

Kristine Ravina, Ben A. Strickland, Robert Rennert, Erik M. Wolfswinkel, Joseph Carey, Jonathan Russin

**1040** Maturing Institutional Experience with the Transradial Approach for Diagnostic Cerebral Arteriography: Overcoming the Learning Curve  
Benjamin M. Zussman, Daniel Tonetti, Jeremy G. Stone, Bradley A. Gross, Ashutosh Jadhav, Tudor Jovin, Brian T. Jankowitz

**1041** The Impact of Leptomeningeal Collaterals in Acute Ischemic Stroke: A Systematic Review and Meta-analysis  
Nida Fatima

**1042** Arterial Spin Labeling MR Imaging at Short Post-labeling Delay Reflects CBF/CBV Verified by 15O-PET in Cerebrovascular Steno-occlusive Disease  
Hiroshi Itagaki, Yasuaki Kokubo, Yukihiko Sonoda

**1043** Radial Artery Catheterization for Neuroendovascular Procedures: Clinical Outcomes and Patient Satisfaction Measures  
Omaditya Khanna, Ahmad Sweid, Nikolaos Mouchtouris, Geoffrey Stricsek, M. Reid Gooch, Stavropoula I. Tjoumakaris, Robert H. Rosenwasser, Pascal Jabbour

**1044** Downregulation of Signaling Components in the NO-PKG Pathway After Subarachnoid Hemorrhage: Why Current Therapeutics are Ineffective at Treating Cerebral Vasospasm?  
Peter J. Morone, Colleen M. Brophy, Reid C. Thompson, Mark Does, Daniel Colvin, Joyce Cheung-Flynn

**1045** Intra-arterial ICG Fluorescence Video-angiography: A Feasible Method for Intraoperative Neurosurgical Purposes?  
Markus Holling, Benjamin Risse, Christof Duhme, Gregory Arnone, Helena M. Yoder, Walter Stummer, Fady T. Charbel

**1046** Transradial Approach is Safe and Effective for Anterior and Posterior Circulation Mechanical Thrombectomy  
Stephan Munich, Kunal Vakharia, Matthew J. McPheeters, Muhammad Waqas, Michael K. Tso, Kenneth Vincent Snyder, Elad I. Levy, Adnan H. Siddiqui, Jason Davies

**1048** Multimodal Laser Angioscopy: A New Imaging Platform to Shine a Light on Structural and Biological Markers of Carotid Plaque Vulnerability  
Luis E. Savastano, Reddy Adhitya, Eric Seibel, David Gordon, Thomas Wang, Jie Xu, Jifeng Zhang, Byron Gregory Thompson, Jr., Aditya S. Pandey

**1049** tPA Use During Mechanical Thrombectomy: Success and Complication Rates  
Risheng Xu, Jason A. Liew, Sasicha Manupitpatpong, Paul Choi, Sharon Pang, Sophie Roh, Yuanxuan Xia, Justin M. Caplan, Monica Pearl, Philippe Gailloud, Cameron G. McDougall, Ferdinand Hui

**1051** Risk Factors for Restenosis Following Carotid Revascularization: A Meta-analysis of Hazard Ratios  
Pavlos Texakalidis, Andreas Tzoumas, Stefanos Giannopoulos, Pascal Jabbour, Leonardo Rangel-Castilla, Theofilos Machinis, Dennis J. Rivet, John F. Reavey-Cantwell

**1052** Strokenomics - Bending the Cost Curve in Stroke Care  
Stephan Munich, Kunal Vakharia, Adnan H. Siddiqui, Kenneth V. Snyder, Jason Davies, Elad I. Levy

**1054** Mechanical Thrombectomy is Safe and Effective in Treating Acute Ischemic Stroke of Distal Intracranial Vessels  
Jeffery R. Head, Ahmad Sweid, Stavropoula I. Tjoumakaris, Vivian Xu, Kavya Shivashankar, Tyler Alexander, Nabeel Herial, David M. Hasan, Maureen Deprince, Robert H. Rosenwasser, Pascal Jabbour

**1055** Exceeding Personalized Blood Pressure Targets After Endovascular Stroke Therapy Is Associated with Hemorrhagic Transformation and Worse Functional Outcome  
Nils Petersen, Andrew Silverman, Anson Wang, Sumita Strander, Sreeja Kodali, Lauren Sansing, Joseph Schindler, Brandon J. Cord, Ryan M. Hebert, Charles C. Matouk, Kevin Sheth

**1056** Outcomes in Patients with Moyamoya Syndrome and Sickle Cell Disease: A Systematic Review  
Sarah Newman, Jason H. Boulter, James G. Malcolm, Gustavo Pradilla

**1057** CT Perfusion in Pediatric Moya Moya Disease: Establishing Normative Data and Utility in Surgical Planning  
Vijay Ravindra, Sara Hartnett, Melissa LoPresti, Jeffrey M. Treiber, Steven Kralik, Sandi Lam

**1058** Antiplatelet Therapy and Operative Risk of Decompressive Craniectomy for Ischemic Stroke  
Ryan T. Kellogg, Thomas Larrew, Alejandro Spiotta, Jonathan Leary, Orgest Lajthia

**1059** Higher Number of Mechanical Thrombectomy Passes does not Significantly Lower TICI Score or Neurologic Outcome  
Risheng Xu, Jason A. Liew, Paul Choi, Sharon Pang, Sasicha Manupitpatpong, Sophie Roh, Yuanxuan Xia, Justin M. Caplan, Monica Pearl, Philippe Gailloud, Cameron G. McDougall, Ferdinand Hui

**1061** From Stroke Onset to Reperfusion: How Much Time Can Interventionalists Save?  
Risheng Xu, Yuanxuan Xia, Jason A. Liew, Paul Choi, Sharon Pang, Sophie Roh, Sasicha Manupitpatpong, Justin M. Caplan, Monica Pearl, Philippe Gailloud, Cameron G. McDougall, Ferdinand Hui

**1062** Revascularization Surgery Outcomes in a North American Cohort of Moyamoya Disease vs Moyamoya Syndrome  
Anadjeet S. Khahera, Justin Sim, Evangeline Reyes-Pastorella, Brandon Christophe, E. Sander Connolly, Jr.

## SECTION ON PAIN POSTERS

**1064 Systematic Anatomical Study of the Adamkiewicz Artery and the Accessory Thoracic and Lumbar Hairpin Turn Spinal Cord Branches.**

Krishnakant Khandelwal, Jorge E. Alvernia, Gustavo G. Luzardo, Eddie Perkins

**1065 The Yang-Gopen Scale for Superior Semicircular Canal Dehiscences**

Prasanth Romiyo, Kevin Ding, Dillon Dejam, Edwin Ng, Shelby L. Willis, Courtney Duong, Tyler Miao, Taranjit Kaur, Alyssa Franks, H. Westley Phillips, Quinton Gopen, Isaac Yang

**1066 Comparison of Traditional Middle Cranial Fossa Craniotomy Versus Minimally Invasive Keyhole Approach for Repair of Superior Semicircular Canal Dehiscence**

Matthew Z. Sun, Dillon Dejam, Courtney Duong, Shelby L. Willis, Quinton Gopen, Isaac Yang

**1067 Feasibility of Lavender Aromatherapy in an Awake Craniotomy Environment**

Kailah Cathey, Nancy Conway, Diane Ames, Nichole Gunyon, Nancy Chung, Maharaj Singh, Amin B. Kassam, Richard A. Rovin

**1068 Could DBS Lead Impedance Trends Provide Objective Data on Cyst Resolution**

Heather Pinckard-Dover, Patrick Paullus, Rohit Dhall, Erika A. Petersen

## SECTION ON PEDIATRIC NEUROLOGICAL SURGERY POSTERS

**1070 Pediatric Intracranial Arteriovenous Malformations and Epilepsy: A Case Series and Review of the Literature**

Melissa LoPresti, Rebecca Y. Du, Marc Prablek, Eric A. Goethe, Sandi Lam

**1071 Rates of In-Hospital Failure for Endoscopic Third Ventriculostomy (ETV) Compared to Shunting in Post-Hemorrhagic Hydrocephalus of Prematurity (PHHP)**

Evan Luther, David J. McCarthy, Toba Niazi

**1072 Analysis of Pediatric Craniopharyngioma Admissions in the United States and the Effect of Surgical Approaches on Outcomes Utilizing the Kids Inpatient Database (KID)**

Mohammed A. Fouda, Coleman Riordan, David Zurakowski, Liliana Goumnerova

**1073 Therapeutic Choices for Ventricular Collapse after Ventriculo-peritoneal Shunting for Pseudotumor Cerebri**

Riccardo Serra, Giorgia A. Simboli, Smruti Mahapatra, Noah L. Gorelick, Lacie Manthripragada, Mark G. Luciano

**1074 Radiological Evidence of a Brain-wide System for Solute Distribution in a Canine Model**

Riccardo Serra, Noah L. Gorelick, Wataru Ishida, Alexander Perdomo-Pantoja, Smruti Mahapatra, Ari M. Blitz, Betty Tyler, Amir Manbachi, Mark G. Luciano

**1075 Scoliosis in Loeys-Dietz Syndrome: A Case Series and Clinical Update**

Abdul B. Khan, Melissa LoPresti, Rajan Patel, Rory R. Mayer, Shaine A. Morris, Sandi Lam, Vijay Ravindra

**1076 Characterization of Unplanned 90-day Readmission After Pediatric Brain Tumor Resection: Readmission Rates, Reasons, and Destination**

Michelle Connor, Neal H. Nathan, Li Ding, William J. Mack, Mark D. Krieger, Frank Attenello, III

**1077 Wireless, Noninvasive Thermal Sensors for the Continuous Monitoring of Ventricular Shunt Function in Pediatric and Adult Patients**

Amit Ayer, Siddharth R. Krishnan, Gurvinder Kaur, Nikhil Murthy, Matthew Ordon, Constantine L. Karras, Zachary A. Abecassis, Joshua M. Rosenow, Matthew C. Tate, Tord D. Alden, Matthew B. Potts, John A. Rogers

**1078 Hydrocephalus and Spina Bifida in Toddlers: 3-month Experience in Angola at the Neurosurgical and Hydrocephalus Treatment Center**

Wilson R. Teixeira, Egon E. L. Neto, Sergio Livraghi, Mayanda Inocente

**1079 Long-term Parenchyma Changes in Extreme Hydrocephalus after Ventriculoperitoneal Shunting**

Jesús Q. Beltrán, Carlos A. Mendoza-García, David Trejo, Jose de Jesus Gutierrez-Cabrera, Elizabeth Ogando-Rivas

**1080 Epidemiology of Surgical Traumatic Brain Injury in Patients Younger than 16 Years at a Single Trauma Center in a Low/Middle-income Country Urban Center**

Nastassja Cury-Sales, Raphael Bertani, Barbara Pilon, Raphael Machado, Luiz F. Ribeiro, Flavia Abreu, Daniela Von Zuben, Priscila Mendes, Ruy Monteiro

**1081 Results of Posterior Fossa Decompression for Patients with Both Chiari I Malformation and Hydrocephalus**

Joyce Koueik, Ryan DeSanti, Bermans Iskandar

**1082 Laparoscopic Repositioning of Peritoneal Catheter for Treatment of Selected Ventriculoperitoneal Shunt-Associated Abdominal Pseudocysts**

Brett A. Whittemore, Dale Swift

**1083 Long-term Sequelae of Intervention for Pediatric Intracranial Arteriovenous Malformations: A Metadata Analysis of Functional Outcomes**

Victor M. Lu, Waseem Wahood, Lorenzo Rinaldo, Edward S. Ahn, David J. Daniels

**1084 Evaluation of Brain Fetal Development Based on the Analysis of Cortical Convolution Pattern in Perinatal Autopsies**

Paula A. Barajas, William M. Riveros, Julio C. Mantilla

## SECTION ON PERIPHERAL NERVE POSTERS

**1085 Combined Radial to Axillary and Spinal Accessory (SA) to Suprascapular Nerve (SSN) Transfers Confer Superior Shoulder Abduction Compared to Single SA to SSN Transfer**

Pavlos Texakalidis, Muhibullah S. Tora, Jason J. Lamanna, Jeremy Wetzel, Nicholas M. Boulis

**1086 Surgically Correctable Compressive Neuropathy Overlies Generalized Axonal Disease in Neurofibromatosis 2**

Rogelio Medina, Tanya Lehy, Dominic Maggio, Gautam U. Mehta, Joseph P. Antonios, Gregoire Chatain, Gretchen Scott, Sarah Benzo, Christina Hayes, Zhengping Zhuang, John D. Heiss, Prashant Chittiboina

**1087 The Masseteric-facial Nerve Anastomosis for Facial Paralysis: Report of 57 Cases**

Xuesong Liu

## COUNCIL OF STATE NEUROSURGICAL SOCIETIES POSTERS

**1088 Investigation of Surgical Variation in Elective Anterior Cervical Decompression and Fusion (ACDF) and the Effect on Hospital Cost**

Ken M. Porche, Sasha Vaziri, Omar Awan, Alan A. Stein, W. Christopher Fox

**1089 Association Between Discharge Destination and Length of Hospitalization Following Microvascular Decompression Surgery**

Amanallah Montazeripouragha, Anthony M. Kaufmann

**1090 Effect of Socioeconomic Status in Patients Undergoing Anterior Lumbar Interbody Fusion**

Annie E. Arrighi-Allisan, Sean N. Neifert, Ruben D. Vega Perez, Jonathan J. Rasouli, Jonathan S. Gal, Robert J. Rothrock, John M. Caridi

**1091 Whole Exome Analysis Across 16,242 Patients Identifies an Association Between the Genes PYM1, PPP1R3D, and ABCA7 and Development of Phenotypic Spinal Osteoarthritis**

Ryan A. Grant, Yanfei Zhang, Manu Shivakumar, Vida Abedi, Jonathan Slotkin, Ming Ta M. Lee

**1092 Socioeconomic Impact of Low-Grade Glioma Survivorship from a Patient Perspective**

Sameah A. Haider, Karam P. Asmaro, Steven N. Kalkanis, Ian Yu Lee, Michael Bazydlo, David Nerenz, James Snyder, Tobias Walbert

**1094 Demographics and Outcomes of Spine Surgery in Octogenarians and Nonagenarians: A Comparison of the National Inpatient Sample, MarketScan and National Surgical Quality Improvement Program (NSQIP) Databases**

Mayur Sharma, Siddharth Bhargava, Nicholas Dietz, Joseph Dettori, Beatrice Ugiliweneza, Miriam Nuno, Maxwell Boakye, Daniel Drazin

**1095 Patients with Medicaid Insurance Coverage Have Worse Outcomes Following Surgery for Spondylolisthesis When Compared to Those With Private Insurance and Medicare**

Andrew K. Chan, Erica F. Bisson, John J. Knightly, Mohamad Bydon, Steven D. Glassman, Kevin T. Foley, Christopher I. Shaffrey, Sr., Eric A. Potts, Mark E. Shaffrey, Domagoj Coric, Paul Park, Michael Y. Wang, Kai-Ming G. Fu, Jonathan Slotkin, Anthony L. Asher, Michael S. Virk, Panagiotis Kerezoudis, Mohammed A. Alvi, Jian Guan, Regis W. Haid, Jr., Praveen V. Mummaneni

**1096 An Analysis of the Predictive Value of the LACE Index and HOSPITAL Score for a Neurosurgical Population**

Joseph R. Linzey, Rachel Foshee, Sudharsan Srinivasan, Gic-Owens Fiestan, James M. Mossner, Kyle Sheehan, Aditya S. Pandey

**1097 A Prospective Follow-up Analysis of the Effect of Surgical Start Time on Surgical and Medical Complications in Neurological Surgeries**

Joseph R. Linzey, Rachel Foshee, Gic-Owens Fiestan, Sudharsan Srinivasan, James M. Mossner, James F. Burke, Aditya S. Pandey

**1098 In Pursuit of Balance: The UPMC Neurosurgery Wellness Initiative**

William J. Ares

**1099 Neurosurgery Interviews: The Impact of Inappropriate Questions**

Natalie Limoges, Scott L. Zuckerman, Lola Blackwell Chambless, Deborah L. Benzil, Jonathan Borden, Susan R. Durham

**1100 Gender Differences in Medical Student Perceptions of a Career in Neurosurgery**

Katherine E. Callahan, Jonathan H. Borden, Alyssa Heisser, Kyle Leonard, Shayan A. McGee, Cara Rathmell, Ryan P. Jewell, Susan R. Durham

**1101 Differences in Clinical Outcomes and Health Care Utilization Between Octogenarians and Nonagenarians Following Decompression for Lumbar Spinal Stenosis. A Market Scan Analysis**

Mayur Sharma, Nicholas Dietz, Beatrice Ugiliweneza, Dengzhi Wang, Doniel Drazin, Maxwell Boakye

**1102 Resilience and Recovery from Burnout for Neurosurgery Residents: A 39-Year Single Institution Experience**

Katherine A. Yu Dunn, Oliver Y. Tang, James S. Yoon, Peter Nakaji, Volker K. H. Sonntag, Michael T. Lawton

**1104 Socioeconomic Status is Predictive of Postoperative Length of Stay in Posterior Cervical Decompression and Fusion**

Ruben D. Vega Perez, Annie E. Arrighi-Allisan, Sean N. Neifert, Frank Yuk, Jonathan S. Gal, Trevor Hardigan, John M. Caridi



**1105 Together We Are Strong: A Resource-Conscious Approach to Addressing the Current Neurosurgical Knowledge Gap Amongst US Medical School Graduates**

Carl G. S. Axelsson, William T. Curry, Michael G. Healy, Emil Petrusa, Deborah M. Rooney, Traci Wolbrink, Roy Phitayakorn

**1107 Comparative Nationwide Trends in Carotid Endarterectomy and Carotid Artery Stenting in the Post-CREST era (2010-2015)**

Tyler S. Cole, Luis M. Tumialan, Joshua Catapano, Jakub Godzik, Jacob F. Baranoski, Michael T. Lawton, Andrew F. Ducruet

**1108 Increasing Cost Efficiency in Adult Spinal Deformity Surgery: Identifying Predictors of Lower Total Costs**

Peter G. Passias, Avery Brown, Renaud Lafage, Virginie Lafage, Christopher P. Ames, Douglas C. Burton, Daniel M. Sciubba, M. Burhan Janjua, Aaron Hockley, Pawel P. Jankowski, Jeffrey L. Gum, Robert A. Hart, Richard A. Hostin, Jr., Khaled Kebaish, Brian J. Neuman, Shay Bess, Breton G. Line, Christopher I. Shaffrey, Sr., Justin S. Smith; Frank Schwab, Eric Klineberg, ISSG International Spine Study Group

**1109 Potential Healthcare Cost Savings in Patients with Traumatic Subarachnoid Hemorrhage**

Risheng Xu, Chau D. Vo, Yuanxuan Xia, Jason A Liew, Wuyang Yang, Ted Alban, James Feghali, Justin M. Caplan, Rafael Jesus Tamargo, Judy Huang

**1110 Perioperative Surgical Home for Normal Pressure Hydrocephalus**

George Hanna, Jefferson Chen, Ryan Field

**1111 The Use of Hospital Consumer Assessment of Healthcare Services (H-CAHPS) and the Press-Ganey Medical Practice Survey's in Dictating Neurosurgical Practices**

Michael J. Gigliotti, Gordon Mao, Derrick A. Dupre

**1114 Decreasing Hospital Length of Stay in Patients with Intracerebral Hemorrhage After Minimally Invasive Evacuation: Role of Family Presence at the Bedside**

Natalia Romano Spica, Dominic A. Nistal, Julianne Kleitsch, Trevor Hardigan, Rui Song, Jamie Rumsey, Alexandra S. Reynolds, John Liang, Cappi C. Lay, J D. Mocco, Christopher P. Kellner, Neha S. Dangayach

**1115 Neurosurgery Training Camp for Sub-internship Preparation: Increased Geographical Diversity and Hands-on Skills Training in the Second Annual Course**

Graham M. Winston, Iyan Younus, Mahmoud ElJalby, Sergio W. Guadix, Ryan E. Radwanski, Joel J. Q Nario, Jimmy Xia, Michael Rothbaum, Jeffrey P. Greenfield, Susan C. Pannullo

**SECTION ON DISORDERS OF THE SPINE AND PERIPHERAL NERVES POSTERS**

**1116 Biomechanics of Open or MIS deformity Correction-Comparison of Stability and Rod Strain Between Anterior Column Realignment and Pedicle Subtraction Osteotomy**

Jakub Godzik, Bernardo De Andrada Pereira, Anna Newcomb, Jennifer Lehrman, Gregory M. Mundis, Jr., Randall Hlubek, Juan S. Uribe, Brian P. Kelly, Jay D. Turner

**1117 Comparison of Clinical and Operative Outcomes Between Anterior to Psoas and Transpsoas Lumbar Interbody Fusion: A Systematic Review and a Meta-analysis**

Atiq U. R. Bhatti, Waseem Wahood, Mohammed A. Alvi, Anshit Goyal, Mohamad Bydon

**1118 The "July Effect" Revisited: July Surgeries at Residency Training Programs are Associated with Equivalent Outcomes Following Lumbar Spendylolistheis Surgery**

Winward Choy, Andrew K. Chan, Erica F. Bisson, Mohamad Bydon, Steven D. Glassman, Kevin T. Foley, Christopher I. Shaffrey, Sr., Eric A. Potts, Mark E. Shaffrey, Domagoj Coric, John J. Knightly, Paul Park, Michael Y. Wang, Kai-Ming G. Fu, Jonathan R. Slotkin, Anthony L. Asher, Michael S. Virk, Panagiotis Kerezoudis, Mohammed A. Alvi, Jian Guan, Regis W. Haid, Jr., Praveen V. Mummaneni

**1119 Determining the True Cost to Deliver Minimally Invasive ACDF Across the Full Episode of Care**

Daniel Bu, Samuel C. Overley, Aakash Keswani, Todd Albert, Steven Mcanany, Sheeraz Qureshi

**1120 Microdiscectomy Time of Day Does Not Significantly Impact Risks or Costs**

Samuel Z. Maron, Sean N. Neifert, Jonathan S. Gal, Robert J. Rothrock, Jonathan J. Rasouli, John M. Caridi

**1121 A Novel Preoperative MRI Based Lumbar Muscle Health Calculation to Predict Patient Reported Health-Related Quality of Life Scores**

Sohrab Virk, Joshua Wright-Chisem, Avani Vaishnav, Jung K. Mok, Steven Mcanany, Sravish Iyer, Todd Albert, Catherine Gang, Sheeraz Qureshi

**1122 Same-day Discharge Versus Inpatient Lumbar Fusion: A Matched Cohort Comparison of Four Surgical Approaches**

Avani Vaishnav, Eric Feuchtbaum, Evan Sheha, Andre Samuel, Steven Mcanany, Todd Albert, Catherine Gang, Sheeraz Qureshi

**1123 Validity of the Surgical Invasiveness Index in Minimally Invasive Spine Surgery**

Avani Vaishnav, Jung K. Mok, Steven Mcanany, Sravish Iyer, Todd Albert, Catherine Gang, Sheeraz Qureshi

**1124 Effects of Static and Expandable Interbody Cages on Restoration of Lordosis in Single-level Minimally Invasive Transforaminal Lumbar Interbody Fusion**

Sertac Kirnaz, Christoph Wipplinger, Franziska A. Schmidt, Roger Hartl

**1125 Does the Actual Lordosis Gain Following Use of Interbody Grafts in Fusion Operations Match the Expected Gain Based on the Lordosis of Graft Itself?**

Yahya Othman, Jonathan Elysee, Renaud Lafage, Virginie Lafage, Avani Vaishnav, Steven Mcanany, Sravisht Iyer, Todd Albert, Catherine Gang, Sheeraz Qureshi

**1126 Radiographic and Clinical Adjacent Segment Pathology Following Cervical Total Disc Replacement or Anterior Cervical Discectomy and Fusion Through 7-Year Follow-up**

David A. Cavanaugh, Pierce D. Nunley, Eubulus J. Kerr, Philip A. Utter, Peter Campbell, Rishi K. Wadhwa, Kelly Frank, Kyle Marshall, Marcus B. Stone

**1128 Laterally Placed Expandable Interbody Spacers with Adjustable Lordosis Improve Radiographic and Clinical Outcomes: A One-Year Follow-up Study**

Yan M. Li, Zheng Huang, James Towner, Yan I. Li, Jessica Riggelman, Charles Ledonio

**1129 Laterally Placed Expandable Interbody Spacers with Adjustable Lordosis Improved Radiographic and Clinical Outcomes: A 2-Year Follow-up Study**

Yan M. Li, Zheng Huang, James Towner, Yan I. Li, Jessica Riggelman, Charles Ledonio

**1130 Clinical Outcomes Following Minimally Invasive Sacroiliac Joint Fusion with Decortication: The EVoluSlon Clinical Trial**

Ali Araghi

**1131 Treatment Outcomes Following Endovascular and Microsurgical Treatment of Sacral Dural Arteriovenous Fistulas**

Neethu Gopal, George K. Vilanilam, David Miller, Benjamin L. Brown, Prasanna Vibhute, Giuseppe Lanzino, Bernard R. Bendok, Vivek Gupta, Rabih G. Tawak

**1132 Return to Activities and Discontinuation of Narcotics after Minimally Invasive Lumbar Spine Surgery**

Jung K. Mok, Avani Vaishnav, Steven Mcanany, Sravisht Iyer, Todd Albert, Catherine Gang, Sheeraz Qureshi

**1133 Morphometric Radiographic Analysis of Lumbar Spondylolisthesis Patients Treated with Minimally Invasive Transforaminal Lumbar Interbody Fusion**

Mick J. Perez-Cruet, Lee O. Chieng, Aaron Rapp, Wissam M. Elfallal, Alisha Booms, Esam A. Elkhatib

**1134 Robotic-assistance can be Utilized to Perform Single Position Surgery for Lateral Lumbar Interbody Placement and Posterior Instrumentation**

Joseph A. Osorio, Griffin R. Baum, Simon Morr, Martin H. Pham, Ronald A. Lehman

**1135 Pre-operative Muscle Health Impacts the Time it Takes to Reach Minimally Clinically Important Differences in Health Related Quality of Life Scores for One Level Lumbar Fusions**

Sohrab Virk, Avani Vaishnav, Joshua Wright-Chisem, Jung K. Mok, Yahya Othman, Steven Mcanany, Sravisht Iyer, Todd Albert, Catherine Gang, Sheeraz Qureshi

**1136 Comparison of In-Hospital Outcomes for Open and MIS Lumbar Fusion Within an Enhanced Recovery after Spine Surgery Program**

G. Damian Brusko, Stephen S. Burks, Julie A. Heger, John P. G. Kolcun, Glen R. Manzano, Allan D. Levi, Michael Y. Wang

**1137 How Does Minimally Invasive Lumbar Decompression Surgery Impact Lumbar Muscle Health?**

Sohrab Virk, Jung K. Mok, Joshua Wright-Chisem, Avani Vaishnav, Steven Mcanany, Sravisht Iyer, Todd Albert, Catherine Gang, Sheeraz Qureshi

**1138 Impact of Pre-operative Pain Scores on Post-operative Outcomes in Patients Undergoing Lumbar m Microdiscectomy**

Sohrab Virk, Avani Vaishnav, Jung K. Mok, Steven Mcanany, Sravisht Iyer, Todd Albert, Catherine Gang, Sheeraz Qureshi

**1139 Immediate Impact on Foraminal Dimensions and Sagittal Alignment: A Comparison of Minimally Invasive TLIF Using an Expandable Interbody Cage Versus Traditional Lateral Lumbar Interbody Fusion**

Jeremy Steinberger, Sohrab Virk, Avani Vaishnav, Yahya Othman, Hiroshi Kumagai, Steven Mcanany, Sravisht Iyer, Todd Albert, Catherine Gang, Sheeraz Qureshi

**1140 Correlation Between ODI, PROMIS and SF-12 in Minimally Invasive Lumbar Spinal Surgery**

Avani Vaishnav, Steven Mcanany, Sravisht Iyer, Todd Albert, Catherine Gang, Sheeraz Qureshi

**1141 Factors Associated with Achieving a Clinically Significant Improvement in Patients Undergoing Minimally Invasive Lumbar Decompression Surgery**

Sheeraz Qureshi, Avani Vaishnav

**1143 PROMIS Physical Function is More Relevant for Lumbar Spinal Disorders than for Cervical Spinal Disorders**

Avani Vaishnav, Steven Mcanany, Sravisht Iyer, Todd Albert, Catherine Gang, Sheeraz Qureshi

**1144 Indirect Decompression Failure after Lateral Lumbar Interbody Fusion: Reported Failures and Predictive Factors, Systematic Review**

Christoph Wipplinger, Sertac Kirnaz, Franziska A. Schmidt, Rodrigo Navarro-Ramirez, Roger Hartl

**1145 Return to Activities and Discontinuation of Opioid Consumption following Anterior Cervical Surgery: Trends and Associated Factors**

Avani Vaishnav, Steven Mcanany, Sravisht Iyer, Todd Albert, Catherine Gang, Sheeraz Qureshi

**1146 Comparative Finite Element Modeling Study of Cervical Total Disc Replacement (CTDR) and Anterior Cervical Discectomy and Fusion (ACDF)**

Hoon Choi, Yuvaraj Purushothaman, Jamie Baisden, Narayan Yoganandan

**1147 Recombinant Human Bone Morphogenic Protein-2 Use in Adult Spinal Deformity Outcomes and Health Care Utilization: A Retrospective Comparative Analysis**

Nicholas Dietz, Mayur Sharma, Doniel Drazin, Maxwell Boakye

**1149 Can Dual Headed Pedicle Screws Simplify Use of Dual Rods and Without Sacrificing Biomechanical Stability?**

Jakub Godzik, Bernado De Andrada Pereira, Anna Newcomb, Jennifer Lehrman, Brian P. Kelly, Jay D. Turner

**1150 Cervical Spondyloptosis Successfully Treated with Only Posterior Short Segment Fusion Using Cervical Pedicle Screw Fixation**

Minwoo Kim, Subum Lee, Jinhoon Park

**1151 A Meta-analysis Comparing Stand-alone Anterior Cervical Discectomy and Fusion to Cervical Disc Arthroplasty for the Treatment of Spine Disease**

Julian L. Gendreau, Lily H. Kim, Payton N. Prins, Marissa D'Souza, Paymon Rezaii, Arjun V. Pendharkar, Eric S. Sussman, Allen L. Ho, Atman Desai

**1152 Predicting a Diagnosis of Cervical Spondylotic Myelopathy from MRI Data**

Ifije Ohiorhenuan, Joshua Bakhsheshian, Ian A. Buchanan, Jeffrey C. Wang, John C. Liu

**1153 Effects of Silk Solution Against Laminectomy-induced Dural Adhesion Formation and Inflammation in a Rat Model**

Yong-Jun Cho, Museung Park, Suk Hyung Kang

**1154 Later Surgery Time Increases Cost and Length of Stay in Posterolateral Lumbar Fusion (PLF) Patients**

Samuel Z. Maron, Sean N. Neifert, Jonathan S. Gal, Robert J. Rothrock, Jonathan J. Rasouli, John M. Caridi

**1156 Changes in Cervical Sagittal Vertical Axis (cSVA) After Asymmetric Open-door Laminoplasty using Metallic Mini-plates with Minimum 2-year Follow Up**

Hui Bing Ruan, Praveen V. Mummaneni, Ratnesh Mehra, Minghao Wang, Dean Chou

**1157 Assessing Risk for Anterior Lumbar Interbody Fusion (ALIF): A Three Variable Versus Complex Risk Model**

Robert J. Rothrock, Sean N. Neifert, Samuel Z. Maron, Frank Yuk, Jonathan S. Gal, John M. Caridi

**1159 The Minimum Clinically Important Difference in Patient Reported Outcomes for Cervical Spondylotic Myelopathy: An Analysis from the Canadian Spine Outcomes and Research Network (CSORN)**

Jetan H. Badhiwala, Jefferson R. Wilson, Bradley Jacobs, Michael G. Johnson, Christopher Bailey, Sean D. Christie, Raphael Charest-Morin, Jerome Paquet, Andrew Nataraj, David W. Cadotte, Neil Manson, Hamilton Hall, Kenneth Thomas, Y. Raja Rampersaud, Greg McIntosh, Charles Fisher, Nicolas Dea

**1160 The Use of Autologous Free Vascularized Fibula Grafts for Reconstruction the Mobile Spine following Tumor Resection: Surgical Technique and Outcomes**

Michiel E. R. Bongers, Paul Ogink, Katrina Chu, Anuj Patel, Brett D. Rosenthal, John H. Shin, Sang-Gil Lee, Francis Hornicek, Joseph H. Schwab

**1161 Neurological Recovery in Hand Function after Surgical Decompression in Patients with Cervical Spondylotic Myelopathy**

Monica Paliwal, Alexander Barry, Benjamin Hopkins, Yasin Dhafer, Zachary A. Smith

**1162 Radiological Parameters Predict 1-year Oswestry Disability Index (ODI-Score) Following Single Level Transforaminal Lumbar Interbody Fusion for Degenerative Spondylolisthesis**

Inamullah Khan, Patrick D. Kelly, Ahilan Sivaganesan, Steve H. Monk, Deke M. Blum, Clinton J. Devin, Kristen Archer-Swygert, Scott L. Parker

**1163 Retrospective Assessment of the Use of Liposomal Bupivacaine in Lumbar Fusions in Immediate Post-operative Hospital Care**

Gennadiy A. Katsevman, Andrew A. Allison, Wei Fang, Jennifer Confer, Shahed Elhamdani, Alastair T. Hoyt, Jeffrey M. Garavaglia, Robert Marsh

**1164 Can We Predict Postoperative Sagittal Lumbar Alignment from Intraoperative Prone-Positioned Radiographs?**

Joseph A. Osorio, Griffin R. Baum, Simon Morr, Lawrence Lenke

**1165 Evaluation of the Clinical Utility and Cost-efficacy of Complete Craniospinal Axis Imaging in Newly Diagnosed Intradural Spinal Tumors**

Michael Safaee, Winward Choy, Joseph A. Osorio, Darryl Lau, Christopher P. Ames

**1166 Training to Be a Neurosurgeon: Development of the Surgical Autonomy Program (SAP)**

Michael M. Haglund, Andrew B. Cutler, Alexander Suarez, Rajeev Dharmapurikar, Shivanand P. Lad

**1167 A Feasibility Study of Real-time Resident Intraoperative Performance with the Surgical Autonomy Program (SAP)**

Michael M. Haglund, Andrew B. Cutler, Alexander Suarez, Rajeev Dharmapurikar, Shivanand P. Lad

**1169 Enhanced Recovery after Surgery (ERAS) Reduces Postoperative Opioid Use in Diabetic Patients Undergoing Spinal Surgery**

Tracy M. Flanders, Disha S. Joshi, Eileen Maloney Wilensky, Rachel Pessoa, Kristin Rupich, Michael Kallan, Ali Kemal Ozturk, Neil R. Malhotra, Paul J. Marcotte, M. Sean Grady, William C. Welch, Zarina S. Ali

**1170 Association of Preoperative Hyperglycemic Control Using HbA1c Level and Risk of Perioperative Complication in Spine Surgery**

Tomoko Tanaka, Matthew Burton, Patrick Belton, Michael J. Gardner, Henok G. Woldu, N. Scott Litofsky

**1171 Hypoxic Preconditioning of Adipose-Derived Mesenchymal Stem Cells for Enhancing Posterolateral Lumbar Fusion in a Murine Model**

Alexander Perdomo-Pantoja, Christina Holmes, Ethan Cottrill, Wataru Ishida, Sheng-fu Larry Lo, Timothy F. Witham

**1172 Incidence of Postoperative Deformity and Other Complications Following Intradural Spinal Tumor Resection: An Analysis of 417 Patients**

Thomas Gianaris, Catherine Peterson, Christopher Schneble, Cyrus King, Eric Michael Horn

**1173 Predictors and Impact of Prolonged Intubation Following Posterior Lumbar Fusion (PLF)**

Ian T. McNeill, Halima Tabani, Sean N. Neifert, Jinseong Kim, Jonathan S. Gal, Trevor Hardigan, John M. Caridi

**1174 Cervical Spine Steroid Injections for Delay of Surgery for Cervical Spondylotic Myelopathy**

Andre Samuel, Steven Mcanany, Sravisht Iyer, Todd Albert, Catherine Gang, Sheeraz Qureshi

**1175 Mesenchymal Stem Cells (MSCs) Treated Ex Vivo with Bone Morphogenetic Protein-2 and Spinal Fusion: A Comparison of Adipose- and Bone Marrow-Derived MSCs in a Rat Posterolateral Lumbar Fusion Model**

Alexander Perdomo-Pantoja, Christina Holmes, Ethan Cottrill, Wataru Ishida, Sheng-fu L. Lo, Timothy F. Witham

**1176 The Incidence of Cage Subsidence in Minimally Invasive Transforaminal Lumbar Interbody Fusion with Expandable Cage and Its Impact on Clinical Outcomes**

Yahya Othman, Avani Vaishnav, Steven Mcanany, Sravisht Iyer, Todd Albert, Catherine Gang, Sheeraz Qureshi

**1177 Association Between Age and Short-Term Patient Reported Pain Scores After Complex Spinal Fusion for Adult Deformity Correction: Is Perception of Pain Different?**

Aladine A. Elsamadicy, Megan Lee, Andrew B. Koo, Adam Kundishora, Joaquin Q. Camara-Quintana, Tariq Qureshi, Luis Kolb, Maxwell S.H. Laurans, Khalid M. Abbed, Isaac O. Karikari

**1178 Enhanced Recovery After Surgery (ERAS) Pathway for Adult Spinal Deformity Surgery: Retrospective Review and Proposed Algorithm**

John F. Burke, Vivek Sudhakar, Aaron J. Clark, Christopher P. Ames

**1179 No Differences in Risk of Adverse Events with Shorter Length of Stay After Scoliosis Correction Surgery**

Frank Yuk, Sean N. Neifert, Jinseong Kim, Robert J. Rothrock, Jonathan S. Gal, Ian T. McNeill, John M. Caridi

**1180 Increased Length of Stay After Anterior Cervical Discectomy and Fusion Predicts Rates of Readmission**

Frank Yuk, Sean N. Neifert, Jinseong Kim, Robert J. Rothrock, Ian T. McNeill, Jonathan S. Gal, John M. Caridi

**1181 A Computed Tomography (CT) Analysis of Foraminal Change After Anterior (ALIF), Extreme Lateral (LLIF), and Oblique Lateral Lumbar Interbody Fusion (OLIF)**

Hui Bing Ruan, Praveen V. Mummaneni, Ratnesh Mehra, Ping Guo Duan, Zhuo Xi, Shane Burch, Aaron J. Clark, Vedat Deviren, Sigurd Berven, Dean Chou

**1182 Safety and Efficacy of Skipping C7 Instrumentation in Posterior Cervicothoracic Fusion**

Matthew K. Tobin, Cristian Gragnaniello, Shivani Rangwala, Felicia Sun, Daniel Birk, Sergey Neckrysh

**1183 Does Roussouly Type Affect Revision Surgery Rates for Proximal Junctional Kyphosis (PJK) and Adjacent Segment Degeneration (ASD) After Fusion for Adult Scoliosis?**

Hui Bing Ruan, Praveen V. Mummaneni, Ratnesh Mehra, Shane Burch, Bobby Tay, Aaron J. Clark, Christopher P. Ames, Vedat Deviren, Sigurd Berven, Dean Chou

**1184 Thirty- and 90-Day Readmissions after Decompression and Stabilization Surgery for Spine Metastases: A National Trend Analysis**

Aladine A. Elsamadicy, Andrew B. Koo, Megan Lee, Adam Kundishora, Joaquin Q. Camara-Quintana, Tariq Qureshi, Luis Kolb, Maxwell S.H. Laurans, Khalid M. Abbed

**1185 Significance of the Post-operative Syringomyelia**

Renée R. Cruickshank, Preci L. Hamilton, Carl A. R. Bruce

**1186 An Analysis of Survivorship in Patients Who Undergo Surgical Treatment of Spinal Metastases Using the Florida State Inpatient Database.**

Amar S. Shah, Owoicho Adogwa, Matt Keller, Margaret Olsen, Michael P. Kelly

**1187 Defining Treatment Pathways in Opiate-naïve Patients with Newly Diagnosed Low Back Pain Receiving Surgery**

Michael Chuwei Jin, Allen L. Ho, Tej D. Azad, Daniel Vail, Austin Y. Feng, Gordon Li, Anand Veeravagu, John K. Ratliff

**1188 Analysis of Demographics and Outcomes for Patients with Metastatic Spine Tumors at a Single Institution**

Louisa Onyewadume, Vikram Chakravarthy, Tiffany Ejikeme, Vineeth Saada, Robert Winkelman, Vincent J. Alentado, Thomas Mroz, Michael P. Steinmetz, Ajit A. Krishnane

**1191 Three Variable Model Offers Similar Predictive Value to a Complex Risk Model for Adult Spinal Deformity Correction**

Robert J. Rothrock, Sean N. Neifert, Samuel Z. Maron, Frank Yuk, Jonathan S. Gal, John M. Caridi

**1193 Later Start Times Impact Adolescent Idiopathic Scoliosis Surgery Outcomes**

Michael L. Martini, Sean N. Neifert, Samuel Z. Maron, Jonathan S. Gal, Jonathan J. Rasouli, Robert J. Rothrock, John M. Caridi



**1194 The Impact of Time of Day on Outcomes for Anterior Lumbar Interbody Fusions**

Michael L. Martini, Sean N. Neifert, Samuel Z. Maron, Jonathan S. Gal, Ian T. McNeill, Annie E. Arrighi-Allisan, Jonathan J. Rasouli, John M. Caridi

**1196 Correlations Among PROMIS-29 Domains Before and After Cervical Spine Surgery**

Inamullah Khan, Jacquelyn S. Pennings, Claudia Davidson, Mohamad Bydon, Anthony L. Asher, Clinton J. Devin, Kristen Archer-Swygert

**1197 Prevalence of Anemia and its Relationship with Neurological Status in Patients Undergoing Surgery for Degenerative Cervical Myelopathy and Radiculopathy: A Retrospective Study of 2 Spine Centers**

Aria Nouri, Abhijith V. Matur, Zach Pennington, Nora C. Elson, Sakibul Huq, A. Karim Ahmed, Kishan Patel, William J. Jeong, Rani Nasser, Enrico Tessitore, Daniel M. Sciubba, Joseph S. Cheng

**1198 Surgical Navigation Using Light Field Rendering and Computer-mediated Reality: Proof of Concept in Spinal Instrumentation**

James Youngquist, Joshua Smith, David Colmenares, Dhevan Gangadharan, Samuel R. Browd, Michael R. Levitt

**1199 Vertebral Body Repositioning Corpectomy: A Technique for Harvesting a Local Structural Autograft**

Haydn Hoffman, Carlos R. Goulart, Michael A. Galgano

**1200 Anatomical Trajectory Screw Fixation at Upper Instrumented Vertebra is a Substantial Risk Factor for Proximal Junctional Kyphosis**

Jong-myung Jung, Seung-Jae Hyun, Ki-Jeong Kim, Tae-Ahn Jahng, Hyun-Jib Kim

**1201 Effect of Simulation Training on Resident Proficiency in Spinal Instrumentation Placement of Thoracolumbar Pedicle Screws Using Computer-Assisted Navigation**

Andrew M. Gardeck, Xuan Pu, Qiuyu Yang, David W. Polly, Jr., Kristen E. Jones

**1203 Spinal Deformity Surgery: Outcomes Independent of Time of Surgery**

William Shuman, Sean N. Neifert, Samuel Z. Maron, Jonathan S. Gal, Robert J. Rothrock, Ian T. McNeill, John M. Caridi

**1205 Benefits of Medical Optimization before Thoracolumbar Three-Column Osteotomies: An Analysis of 618 Patients**

Andre Samuel, Noor Maza, Francis Lovecchio, Avani Vaishnav, Steven Mcanany, Sravisht Iyer, Todd Albert, Catherine Gang, Sheeraz Qureshi

**1206 Surgical Outcomes of Patients with Metastatic Spine Disease Receiving Stereotactic Radiation Therapy (SBRT): Comparing Complication Rates in Patients Without Prior Radiation Versus Patients with Prior Radiation**

Enrique Vargas, Steve Braunstein, Matthew Susko, Praveen V. Mummaneni, Dean Chou

**1207 Association of Body Mass Index and Perioperative Outcomes in Surgery for Metastatic Spinal Tumors**

Yamaan S. Saadeh, Jibran A Fateh, Timothy J. Yee, Michael J. Strong, Paul Park

**1208 Vertebral Artery Sacrifice in Surgery for Cervical Spine Tumors: Factors Affecting Clinical Decision Making**

Erick M. Westbroek, Zachary Pennington, Matthew Goodwin, Philippe Gaillood, Daniel M. Sciubba

**1209 A Pilot Study of the ManageMySurgery (MMS) Mobile App for Patient Engagement and Outcomes Collection in Patients Undergoing Spine Surgery**

Sarah E. Hodges, Luis A. Antezana, Shervin Rahimpour, Abena A. Ansah-Yeboah, Rajeev Dharmapurikar, Peter M. Grossi, Isaac O. Karikari, Oren N. Gottfried, Muhammad M. Abd-El-Barr, Michael M. Haglund, Shivanand P. Lad

**1210 Vascularized Bone Formation by Freshly-isolated Mesenchymal Stem Cells in a Rat Posterolateral Lumbar Fusion Model**

Alexander Perdomo-Pantoja, Lexi Rindone, Ethan Cottrill, Wataru Ishida, Maritza Taylor, Colson Tomberlin, Sheng-fu L. Lo, Warren Grayson, Christina Holmes, Timothy F. Witham

**SECTION ON STEREOTACTIC AND FUNCTIONAL NEUROSURGERY POSTERS****1213 Characterization of Adult Human Multipotent Neural Cells Derived from Temporal Lobe Epilepsy with Focal Cortical Dysplasia**

Seunghoon Lee, Hyun Nam, Seung-Chyul Hong

**1214 A Novel Model for Human Cortical Connectivity Using Ex Vivo Retrograde Transport**

Alexander Ksendzovsky, Stuart Walbridge, Lei Liu, Partha Mitra, Kareem A. Zaghloul

**1215 Theta Band High Definition Transcranial Alternating Current Stimulation, but Not Transcranial Direct Current Stimulation, Improves Associative Memory Performance**

Stefan T. Lang, Liu Shi Gan, Tazrina Alrazi, Oury Monchi

**1216 Functional Heterogeneity of Single Unit Dopamine Neuron Activity in the Midbrain Ventral Tegmental Area Revealed by Virtual Reality**

Athar N. Malik, HyungGoo R. Kim, Naoshige Uchida

**1217 Whole Exome Sequencing (WES) Analysis of Genes Potentially Involved in the Pathogenesis of Normal Pressure Hydrocephalus (NPH)**

Diem Kieu Thi Tran, Cat-Thi Ly, Judy Pham, Cassie S. Poole, Melanie Oakes, Jefferson Chen

**1218 Differential Association Between Implantation Hemisphere and Speech Side Effects with STN and VIM Deep Brain Stimulation**

Sarah Black, Andrew K. Romeo, Galal Elsayed, Harrison Walker, Barton L. Guthrie

**1219 Safety of Responsive Neurostimulation (RNS) in Pediatric Patients with Medically Refractory Epilepsy**

Fedor Panov, Sara Ganaha, Jennifer Haskell, Madeline Fields, Matie La Vega Talbott, Steven Wolf, Patricia McGoldrick, Lara Marcuse, Saadi Ghatan

**1220 Structural Connectivity Analysis of the Human Claustrum in Epilepsy Using Machine Learning**

Anil Mahavadi, Regine Goh, Hannah Weiss, Alireza Borghei, Spencer Brown, Kerry Steed, Pierre Besson, Kathleen Bandt

**1221 Outcomes of Gamma Knife Stereotactic Radiosurgery for Choroid Plexus Papilloma: An International Multicenter Study**

Andrew M. Faramand, Hideyuki Kano, Ajay Niranjana, Ahmed Atik, Cheng-Chia Lee, Huai-Che Yang, Nasser Mohammed, Roman Liscak, Jaromir Hansuka, Manjul Tripathi, Douglas Kondziolka, Jason P. Sheehan, David Mathieu, John Flickinger, L. Dade Lunsford

**1222 Analysis of Surgical Outcomes Comparing Osteoplastic and Traditional Bone Flap Techniques in Patients Undergoing Invasive Electroencephalography for Epilepsy Surgery, a Retrospective Review**

David I. Bass, R. Michael Meyer, Robert T. Buckley, Brady Lawrence, Courtne Paschall, Jeffrey G. Ojemann, Andrew Lin Ko

**1223 Twelve-month Outcomes in the Tumor Population From the Multi-center Prospective Laser Ablation "LAANTERN" Registry**

Eric C. Leuthardt, Stephen B. Tatter, Ganesh Rao, Sujit S. Prabhu, Clark C. Chen, David Piccioni, Peter E. Fecci, Brian Toyota, Joseph S. Neimat, Veronica Chiang, Alireza M. Mohammadi, Kris A. Smith, Kevin D. Judy, Andrew E. Sloan, James E. Baumgartner, Zulma S. Tovar-Spinoza, Constantinos G. Hadjipanayis, Albert H. Kim

**1224 A Retrospective Review of the Outcomes and Utility of Percutaneous Radiofrequency Rhizotomy for Trigeminal Neuralgia Using Anatomic Landmark Guidance in Continuously Sedated Patients**

Lauren Stone, Steven M. Falowski

**1225 Apraxia of Speech in Neurosurgical Resection**

John P. Andrews, Nathan Cahn, Benjamin Speidel, Edward F. Chang

**1226 Open Label Surgical Trials: Have We Learned From Our Mistakes?**

Ron L. Alterman, Georgios Maragkos

**1227 Effect of Patient Characteristics on Deep Brain Stimulation Outcomes for Disorders of Consciousness: A Systematic Review and Bivariate Analysis**

G. Damian Brusko, Anshit Goyal, Iahn Cajigas, Jonathan R. Jagid

**1228 Flat Maps for Comparing Cortical Surface Covered by Electrocorticography and Stereo-EEG**

Jarod L. Roland, Matthew D. Smyth

**1229 Primary Motor Cortex High-gamma and Beta Band Changes in Response to Tactile Stimuli in Humans**

Daniel R. Kramer, Michael F. Barbaro, Angad S. Gogia, Morgan Lee, Terrance Peng, Roberto M. del Campo-Vera, Kuanghsu Chen, Rinu Sebastian, Charles Y. Liu, Spencer Kellis, Brian Lee

**1230 Chemogenetic Circuit Specific Neuromodulation in Parkinson's Disease**

Neel T. Patel, Khoi Le, Vishakh Iyer, Siven Chinniah, Adeline Aswine, Ashley Zenerovitz, Erum Jaffrey, Thyagarajan Subramanian, Kala Venkiteswaran

**1231 Electrical Fields Direct Retina Ganglion Cell Axon Growth**

Darrin J. Lee, Daniel Shvarts, Nancy Zepeda, Gianluca Lazzi, Min Zhao, Kimberly K. Gokoffski

**1232 Surgical Outcomes in Patients with Multi-focal Ictal Onset: Resection Plus RNS**

Diem Kieu Thi Tran, Demi Tran, Lilit Mnatsakanyan, Jack Lin, Sumeet Vadera

**1233 Intraoperative Assessment of LFP and SUA for Electrode Positioning in the STN**

Musa Ozturk, Ashwin Viswanathan, Joohi Jimenez-Shahed, Sameer A. Sheth, Nuri F. Ince

**1234 A Prospective Evaluation of Epilepsy Related Quality of Life and Stigma After Surgery at Beijing Children's Hospital**

Warren W. Boling, Margaret Means, Wendy Shih

**1235 Image-Guided Focused Ultrasound for Surgical Treatment of Refractory Psychiatric Disorders**

Karim Mithani

**1236 Identifying the Epileptic Engram - Hippocampal CA1 Pyramidal Neurons Remain Active During Epileptogenesis**

Stephen C. Harward, II, Thiri Lin, Jim O. McNamara

**1237 Ictal and Post-ictal Impairments in Consciousness in an Awake-Behaving Limbic Seizure Model**

Abhijeet Gummadavelli, Derek Goshay, Lim-Anna Sieu, Hal Blumenfeld

**1238 Design and Implementation of a Quality Improvement Registry for Deep Brain Stimulation in Parkinson's Disease**

James McInerney, Jason M. Schwalb, Pierre- François D'Haese, James Kirk, Michelle York, Arthur Berg, Ludy Shih, Joohi Jimenez-Shahed

**1239 Structural Connectivity of the Lateral Habenula to the Basal Ganglia and Cortical Foci of the Human Reward System**

Bledi C. Brahimaj, Alireza Borghei, Sepehr Sani

**1240 Habenular Stimulation for Refractory Schizophrenia: A Case Report**

Chencheng Zhang, Yingying Zhang, Hongjiang Wei, Hengfen Gong, Guozhen Lin, Dianyou Li, Bomin Sun

## SECTION ON NEUROTRAUMA AND CRITICAL CARE POSTERS

### 1241 Substance use on Admission Toxicology Screen is Associated with Injury Factors and Outcome After CT-negative Traumatic Brain Injury in U.S. Level I Trauma Centers: A Multicenter Cohort Study

John K. Yue, Ryan R. L. Phelps, Ethan A. Winkler, Hansen Deng, Mary J. Vassar, David M. Schnyer, Ava Puccio, Hester F. Lingsma, Esther Yuh, Pratik Mukherjee, Alex B. Valadka, David O. Okonkwo, Geoffrey T. Manley

### SHERRY APPLE RESIDENT TRAVEL SCHOLARSHIP

#### 1242 Avoiding Antiplatelet Reversal in Non-Operative Intracranial Hemorrhages: Effects on Length of Stay in Guideline-Based Practice

Courtney Pendleton, Christine L. Hammer, David Nauheim, Onur R. Yoruk, Jack Jallo, Syed O. Shah

#### 1243 90-Day Mortality in Patients Undergoing Decompressive Hemicraniectomy: Differences in Fixed Versus Non-Fixed Positioning

Courtney Pendleton, Lohit Velagapudi, Jack Jallo

#### 1244 Late Cranioplasty is Associated with Decreased Complications in Traumatic Brain Injury: A 274 Patient Case Series

Muhibullah S. Tora, James G. Malcolm, Zayan Mahmooth, Amit Pujari, Tyler Steed, Rima Sestokas Rindler, Nicholas M. Boulis, Faiz U. Ahmad

#### 1245 Impact of Platelet Transfusion on CT Scan Injury Progression in Geriatric TBI Patients on Premorbid Aspirin Therapy

Joshua S. Bauer, David O. Okonkwo, Enyinna L. Nwachuku, David M. Panczykowski, Benjamin Zusman, Ava Puccio, Phillip Parry

#### 1246 Promoting PTEN Ubiquitination Attenuates Microthrombus Formation after Traumatic Brain Injury

Hao Chen, Hengli Tian

#### 1247 Smoking as a Risk Factor for Post-craniotomy 30-day Mortality

Bryson C. Lochte, Kate T. Carroll, Brian R. Hirshman, Tyler Lanman, Jason N. Compton, Alexander J. Schupper, Bob S. Carter, Clark C. Chen

#### 1249 Thirty- and 90-day Readmission Rates After Treatment of Traumatic Subdural Hematoma: A National Trend Analysis

Aladine A. Elsamadicy, Andrew B. Koo, Nanthiya Sujjantarat, Branden J. Cord, Corrado Santarosa, Ryan M. Hebert, Farhad F. Bahrassa, Ajay Malhotra, Charles C. Matouk

#### 1250 Ventilator Associated Pneumonia in a Cohort of Moderate and Severe TBI Patients

Tolga H. Sursal, Christian Bowers, Patrice Anderson, Chad D. Cole

#### 1251 Costs and Predictors of 30-day Readmissions After Craniotomy for Traumatic Brain Injury: A Nationwide Analysis

Haydn Hoffman, Taylor Furst, Lawrence S. Chin

#### 1252 Effect of Alcohol on Glasgow Coma Scale in Severe Traumatic Brain Injury

Nelofar Kureshi, David B. Clarke

#### 1253 Evaluation of the Association Bone Flap Size with Bone Necrosis Following Autologous Cranioplasty: A Radiographic Study

William Johnson, Mariam Ishaque, Thomas T. Patterson, John V. Lacci, Ramesh Grandhi

#### 1254 Does Pre-hospital Ambulance Transport Time Affect Discharge Disposition for TBI?

Saksham Gupta, Blake M. Hauser, Timothy R. Smith, Ayaz M. Khawaja

#### 1255 Estimating Prognosis for Traumatic Brain Injury Patients in a Low Resource Setting: How Do Providers Compare to the CRASH Risk Calculator?

Cyrus Elahi, Theresa Williamson, Charis Spears, Sarah Williams, Josephine Najjuma, Anthony Fuller, Catherine Staton, Joao Ricardo Nickenig Vissoci, David Kitya, Michael M. Haglund

#### 1256 Factors Associated with Bleed Expansion in Traumatic Subarachnoid Hemorrhage

Risheng Xu, Yuanxuan Xia, Chau D. Vo, Wuyang Yang, Jason A. Liew, Ted Alban, James Feghali, Justin M. Caplan, Rafael J. Tamargo, Judy Huang

#### 1257 Anticoagulation/Antiplatelet Reversal Associated with Worsened Outcomes in Traumatic Subarachnoid Hemorrhage

Risheng Xu, Yuanxuan Xia, Chau D. Vo, Wuyang Yang, Jason A. Liew, Ted Alban, James Feghali, Justin M. Caplan, Rafael J. Tamargo, Judy Huang

#### 1258 Patients Requiring Repeat Surgery After Decompressive Craniectomy for Traumatic Intracranial Hemorrhage: Outcome and Predictors

Matthews Lan, Robert J. Dambrino, IV, Andrew Youssef, Aaron M. Yengo-Kahn, Michael C. Dewan, Jesse Ehrenfeld, Christopher M. Bonfield, Scott L. Zuckerman

#### 1260 Effect of P-Glycoprotein Inhibiting Drugs on the Need for Surgery in Adults with Hydrocephalus

Carina Hernandez, Praise N. Austin, Carlos M. Alvarez, David Lehmann, Satish Krishnamurthy

#### 1261 Delayed Custom Synthetic Implant Cranioplasty for Host National Patients: Retrospective Case Series

Patrick R. Maloney, Brian P. Curry, Peter C. Liacouras, Paul Porensky, Michael S. Dirks, George N. Rymarczuk, Justin A. Dye

#### 1262 Comparison of Mortality in Craniotomy Versus Decompressive Craniectomy Surgery for Acute Traumatic Subdural Hematoma: Trauma Quality Improvement Program Database Study

Yaroslav Jacob Gelfand, Naomi Berezin, Erin Lewis, Reza Yassari, Michael Longo, Melvin Stone, Nrupen Baxi

**1265 Changing the Paradigm of Thoraco-lumbar Spine Fractures: Temporary Percutaneous Screw Fixation Versus Open Instrumented Fusion**

Om Neeley, Salah G. Aoun, Ben Kafka, Matthew T. Davies, Tarek Y. El Ahmadi, Jennifer Hoeft, Sonja Stutzman, DaiWai Olson, H. Hunt Batjer, Louis A. Whitworth

**1266 Spinal Trauma Outcomes at Level I Versus Level II Trauma Centers**

Lawrence Zeldin, Sean N. Neifert, Frank Yuk, Ian T. McNeill, Jonathan J. Rasouli, Jonathan S. Gal, John M. Caridi

**1267 Correlation of Inflammatory Biomarkers with Neurogenic Bowel Dysfunction and Gut Microbiota Dysbiosis in Patients with Chronic Spinal Cord Injury**

Nicholas Dietz, Manicka Vadhanam, Beatrice Ugiliweneza, Susan J. Harkema, Thomas Abell, Maxwell Boakye, Scott Whittemore, Enrico Rejc, Shirish Barve

**1268 Allogeneic Umbilical Cord Derived Mesenchymal Stem Cells Transplantation Improves Motor Function in Spinal Cord Injured Rats**

F M. Moinuddin, Kathy Petrucci, Gene Yeh, Ahad Siddiqui, Yagiz U. Yolcu, Waseem Wahood, Anshit Goyal, Mohammed A. Alvi, Sandy Goncalves, Nicolas Madigan, Anthony J. Windebank, Mohamad Bydon

**1269 A Survey of Chemoprophylaxis Techniques in Spine Surgery Among American Neurosurgery Training Programs**

Mohamed Macki, Sharath K. Anand, Mohamed Fakih, Jaafar Elmenini, Raviteja Suryadevara, Victor W. Chang

**1270 Impact of Trauma Center Designation on the Outcome of Laminectomies and Fusions in Adults: A NTDB-based Analysis**

Michael Wells, Saksham Gupta, Blake M. Hauser, Timothy R. Smith, Hasan A. Zaidi

**1271 Impact of Injury Duration to Start Regenerative Treatment in Chronic Spinal Cord Injury: A Systematic Review and Meta-Analysis of Randomized Controlled Trials**

F M. Moinuddin, Waseem Wahood, Yagiz Ugur Yolcu, Sandy Goncalves, Mohammed A. Alvi, Mohamad Bydon

**1272 Classification of Cervical Motor Incomplete Spinal Cord Injury Based on Trajectory of Recovery of Upper Limb Motor Function**

Jetan H. Badhiwala, Christopher D. Witiw, Jefferson R. Wilson, Michael G. Fehlings

**1273 Prolonged Time to Surgery after a Cervical Spine Trauma Delayed Length of Stay**

Jinseong Kim, Sean N. Neifert, Lawrence Zeldin, Trevor Hardigan, Robert J. Rothrock, Jonathan S. Gal, John M. Caridi

**1274 Adult Sport-related Traumatic Spinal Injuries: Do Different Activities Predispose to Certain Injuries?**

Blake M. Hauser, Saksham Gupta, David J. Cote, Mark M. Zaki, Ayaz M. Khawaja, Yi Lu, Timothy R. Smith, Hasan A. Zaidi

**SECTION ON TUMORS POSTERS**

**1275 Frailty & Sarcopenia Independently, Accurately, and Strongly Predicts Survival in Patients Undergoing Spine Surgery for Metastatic Tumors: A Multi-Center Retrospective Cohort Study**

Hesham M. Zakaria, Brandon M. Wilkinson, Zachary Pennington, Yamaan S. Saadeh, Darryl Lau, Ankush Chandra, A. Karim Ahmed, Mohamed Macki, Theresa A. Elder, Sharath K. Anand, Jibran A. Fateh, Jonathan W. Rick, Ramin Morshed, Adam M. Robin, Tobias Walbert, Steven N. Kalkanis, Ian Yu Lee, Dean Chou, Paul Park, Daniel M. Sciubba, Victor W. Chang

**1276 Stereotactic Radiosurgery for Head and Neck Paragangliomas: A Systematic Review and Meta-analysis**

Nida Fatima, Antonio Meola, Steven D. Chang

**1278 Outcomes After High-Dose Stereotactic Radiosurgery for Vestibular Schwannoma**

Lucas P. Carlstrom, Christopher S. Graffeo, Avital Perry, Bruce E. Pollock, Michael J. Link

**1279 A Deep Learning Algorithm for Automated Detection and Segmentation of Meningiomas**

Alessandro Boaro, Vasileios K. Kavouridis, Jakub Kaczmarzyk, Maya Harary, Marco Mammi, Omar Arnaout

**1280 Gamma Knife Stereotactic Radiosurgery for Glomus Jugulare Tumors**

Dillon Dejam, Alyssa Franks, Mahlet Mekonnen, Edwin Ng, Roan Anderson, Kevin Ding, Prasanth Romiyo, John Patrick Sheppard, Matthew Z. Sun, H. Westley Phillips, Quinton Gopen, Isaac Yang

**1281 Efficacy and Safety of Gamma Knife Radiosurgery for Posterior Cranial Fossa Meningiomas: A Systematic Review**

Fareed Jumah, Vinatak Narayan, Amjad Samara, Travis Quinoa, Rimal H. H. Hanif, Gaurav Gupta, Anil Nanda

**1282 Increased Cochlear Radiation Dose Predicts Delayed Hearing Loss Following Both Stereotactic Radiosurgery and Fractionated Stereotactic Radiotherapy for Vestibular Schwannoma**

Kunal S. Patel, Edwin Ng, Taranjit Kaur, Tyler Miao, Tania B. Kaprelian, Percy Lee, Nader Pouratian, Quinton Gopen, Stephen Tenn, Isaac Yang

**1283 Salvage Stereotactic Radiosurgery of Vestibular Schwannomas Following Tumor Progression or Initial SRS Treatment Failure**

Lucas P. Carlstrom, Avital Perry, Christopher S. Graffeo, Oystein V. Tveiten, Bruce E. Pollock, Michael J. Link

**1284 Adjuvant Radiation Does Not Decrease the Risk of Short-term Tumor Recurrence or Improve Overall Survival in Patients with Atypical Meningioma**

Jacob Ruzevick, Timothy Woodiwiss, Samuel Emerson, Anoop Patel, Lia Halasz, Jason K. Rockhill, Laligam N. Sekhar, Manuel Ferreira, Jr.



**1286 Predictors of Treatment Failure and Local Recurrence for MRI-Guided Spinal Laser Interstitial Thermal Therapy**

Kimberly Bojanowski Hoang, Jonathan D. Breshears, Vinodh P. Kumar, Claudio Esteves Tatsui

**1287 Stereotactic Radiosurgery as Salvage Therapy for High Grade Meningiomas**

Bertram Richter, Andrew M. Faramand, Hideyuki Kano, Tiffany Wilkins, L. Dade Lunsford

**1288 Glutamate Modulation in the Tumor Microenvironment Synergizes with Anti-PD-1 Immunotherapy for Treatment of Glioblastoma**

John Choi, Ravi Medikonda, Ayush Pant, Denis Routkevitch, Young-Hoon Kim, Laura Saleh, Luqing Tong, Christopher M. Jackson, Christina Jackson, Michael Lim

**1289 Near-Infrared Imaging with Second-Window Indocyanine-Green in Newly Diagnosed High-Grade Gliomas Predicts Gadolinium Enhancement on Postoperative Magnetic Resonance Imaging**

Steve Sungwon Cho, BS, Ryan Salinas, Carrie Li, Kalil G. Abdullah, Love Buch, Steven Brem, Sunil Singhal, John Y.K. Lee

**1290 Does Bilingualism Prognosticate a Favorable Outcome After Awake Surgery?**

Karim ReFaey, Sanjeet S. Grewal, Shashwat Tripathi, Adip G. Bhargav, Erik H. Middlebrooks, Adela Wu, David S. Sabsevit, Kaisorn L. Chaichana, Alfredo Quinones-Hinojosa

**1291 Non-invasive Sensitive Brain Tumor Detection Using Dual-modality Bioimaging Nanoprobe**

Austin B. Carpenter

**1292 CDK1 is Induced by Temozolomide in a p50/Bcl3 Dependent Manner in Glioblastoma**

David Voce, Giovanna Bernal, Nassir H. Mansour, Kirk Cahill, Bakhtiar Yamini

**1293 Alpha 1-antichymotrypsin Contributes to Cellular Stemness and Enhances Tumorigenicity of Glioblastoma**

Montserrat A. L. Velazquez, Natanael Zarco, Ana Carrano, Jordan Phillips, Alfredo Quinones-Hinojosa, Kaisorn L. Chaichana, Emily Norton, Hugo Guerrero Cazares

**1294 Bidirectional Interaction Between Tumor-Associated Platelets and Glioma Stem Cells in Glioblastoma Multiforme**

Alankrita Raghavan, Christine Lee-Poturski, John A. Willis, Amber Kerstetter-Fogle, Peggy Harris, Eckhard Jankowsky, Jeremy N. Rich, Andrew E. Sloan

**1295 Stimulated Raman Microscopy and Multiplexed RNA-Sequencing in Post-Treatment Recurrent High-Grade Gliomas**

Akshay Save, Zia Farooq, Deborah Boyett, Christian Freudiger, Daniel A. Orringer, Peter Sims, Peter D. Canoll, Jeffrey N. Bruce

**1296 Stimulation-induced Seizure Risk and Functional Site Localization During Intraoperative Brain Mapping Using Electrocorticography**

Rachel H. Muster, Jacob S. Young, Peter YM Woo, Annette Molinaro, Gayathri Warriar, Mitchel S. Berger, Shawn L. Hervey-Jumper

**1297 Interregional Differences in Distribution of Prognostic Copy Number Alterations in IDH-wild-type Glioblastoma**

Toru Umehara, Hideyuki Arita, Ema Yoshioka, Tomoko Shofuda, Daisuke Kanematsu, Manabu Kinoshita, Yoshinori Kodama, Masayuki Mano, Naoki Kagawa, Yasunori Fujimoto, Yoshiko Okita, Masahiro Nonaka, Kosuke Nakajo, Takehiro Uda, Naohiro Tsuyuguchi, Junya Fukai, Koji Fujita, Daisuke Sakamoto, Kanji Mori, Haruhiko Kishima, Yonehiro Kanemura

**1298 Personalized, Probabilistic Prediction of Postoperative Complication Risks for Craniotomy**

Nicholas F. Marko, Cody Woodhouse, Oleg Roderick, Andrea Seicean, Robert J. Weil, Simon Tavaré

**1299 Patient Satisfaction with Treatment Outcomes After Surgery and/or Radiotherapy for Spinal Metastases**

Anne Versteeg, Arjun Sahgal, Norio Kawahara, Laurence D. Rhines, Daniel M. Sciubba, Michael Weber, Aron Lazary, Michael G. Fehlings, James M. Schuster, Michelle J. Clarke, Paul M. Arnold, Stefano Boriani, Chetan Bettgowda, Ziya L. Gokaslan, Charles Fisher

**1300 What Does Histopathology of Tissue Specimens Resected After Completion of iMRI During Brain Tumor Surgery Reveal if Not Residual Tumor?**

Amar S. Shah, Alexander T. Yahanda, Randy L. Jensen, John H. Honeycutt, Joshua Luke Dowling, Albert H. Kim, Ralph G. Dacey, Jr., Gavin P. Dunn, Daniel P. Cahill, Garnette R. Sutherland, Michael R. Chicoine

**1301 MR Based Molecular Characterization of Lower Grade Gliomas and Glioblastoma via Radiomics**

Manabu Kinoshita, Hideyuki Arita, Takahiro Sasaki, Atsushi Kawaguchi, Masamichi Takahashi, Koji Fujita, Junya Fukai, Takehiro Uda, Yuzo Terakawa, Naohiro Tsuyuguchi, Yoshiko Okita, Masahiro Nonaka, Shusuke Moriuchi, Shuichi Izumoto, Kenichi Ishibashi, Kanji Mori, Namiko Nishida, Tomoko Shofuda, Koichi Ichimura, Yoshitaka Narita, Naoyuki Nakao, Haruhiko Kishima, Yonehiro Kanemura

**1302 Disulfiram-Copper Reduces Stem Cell-ness and Prolongs Survival in Pediatric Medulloblastoma Through Inhibition of NPL4**

Riccardo Serra, Tianna Zhao, Joshua Casaos, Noah L. Gorelick, Arba Cecilia, Renyuan Bai, Henry Brem, Eric M. Jackson, Betty Tyler

**1303 Pain Outcomes in Single-Dose Versus Fractionated Stereotactic Body Radiation Therapy for Spinal Metastases**

Christine Park, Elizabeth P. Howell, Eric W. Sankey, Vikram Mehta, Andrew Barbour, John Kirkpatrick, Scott Floyd, Justus Adamson, Jordan Torok, C. Rory Goodwin

**1304 PD-L1 and PD-L2 Expression in the Tumor Microenvironment Including Peritumoral Tissue in Primary Central Nervous System Lymphoma**  
Motomasa Furuse, Naokado Ikeda, Toshihiko Kuroiwa, Shin-Ichi Miyatake

**1305 Radiotherapy Does Not Improve Survival in WHO Grades II and III Spinal Ependymomas**  
Desmond A. Brown, Anshit Goyal, Hirokazu Takami, Christopher S. Graffeo, Mohamad Bydon

**1306 Radical Laser Interstitial Thermal Therapy Ablation Volumes Increase Progression-Free Survival in Biopsy-Proven Radiation Necrosis**  
Evan Luther, David J. McCarthy, Ashish H. Shah, Alexa M. Semonche, Veronica Borowy, Joshua D. Burks, Daniel Green Eichberg, Ricardo J. Komotar, Michael E. Ivan

**1307 Glioblastoma (GBM). Prognostic Value of 06-Methylguanine Methyltransferase Methylation (mMGMT) Obtained by Pyrosequencing Test**  
Jesus Aguas, Maria P. Mozas, Eduardo Olmos, Marta Claramonte, Julio Andres, Juan Calatayud, Javier Villagrasa

**1308 In Vitro Response Rates of Unmethylated MGMT Glioblastoma Primary Cell Lines to Various Chemotherapies**  
Anthony M. Alberico, Alastair T. Hoyt, J. Paul Muizelaar, Rida Mazagri, Nicolas Phan

**1309 Fractionated Stereotactic Radiotherapy for Local Control of Resected Brain Metastases**  
Jeffrey I. Traylor, Ahmed Habib, Rajan Patel, Matthew Muir, Ron Gadot, Tina Briere, Debra Yeboah, Jing Li, Ganesh Rao

**1310 Glioblastoma's Resistance to Immunotherapy is Partly Mediated by a CD8+CD28- senescent T-Cells**  
Wei Huff, Mario Henriquez, Jae H. Kwon, Hiromi Tanaka, Mahua Dey

**1311 Nur77 Promotes Glioma Invasion and Progression Via CXCR4**  
Yuxiang Dai

**1312 Stearoyl CoA Desaturase is Essential for Regulation of ER Homeostasis and Tumor Growth in Glioma Stem Cells**  
David J. Park

**1313 Contemporary Assessment of Extent of Resection in Molecularly-defined Categories of Diffuse Low-Grade Glioma: A Volumetric Analysis**  
Vasileios K. Kavouriadis, Alessandro Boaro, Jeffrey Dorr, Elise Y. Cho, J. Bryan Iorgulescu, David Reardon, Omar Arnaout, Timothy R. Smith

**1314 In Vitro Overexpression Screen of a MicroRNA Library for Treatment of Glioblastoma**  
Eric N. Momin, Anwar Hossain, Irtiza Hasan, Joy Gumin, Matti Annala, Frederick F. Lang

**1315 Histone H3 Tail Proteomic Analysis Reveals Epigenetic Signatures as Therapeutic Targets in Diffuse Intrinsic Pontine Glioma**  
Daphne Li, Tina Huang, Hannah Weiss, Jin Qi, Jeannie Camarillo, Amanda Muhs Saratsis

**1316 Can You Read This? Intraoperative Language Task Performance Among Patients with High Baseline Reserve**  
Alexander A. Aabedi, Jacob S. Young, Claudia Valdivia, Sofia Kakaizada, Eric Zhang, Daniel Weissman, David Brang, Shawn L. Hervey-Jumper

**1317 Natural Language as a Predictive Measure of Short-term Language Processing in Adult Glioma Management**  
Simon G. Ammanuel, Nyle C. Almeida, Garret Kurteff, Sofia Kakaizada, Eric Zhang, Edward F. Chang, Shawn L. Hervey-Jumper

**1318 Laser Interstitial Thermal Ablation (LITT) Versus Bevacizumab for Radiation Necrosis in Previously Irradiated Brain Metastases**  
Nanthiya Sujijantararat, Christopher S. Hong, Veronica Chiang

**1319 Durable Clinical Response in Recurrent Glioblastoma Patients Treated with Activated Autologous Killer Cell**  
Kyung Cho, Jaejoon Lim, Youngjoon Park, Ju Won Ahn, KyuBum Kwack

**1320 Artificial Intelligence for Real-time Fully Automated Delineation of Intracranial Vessels on Pre-operative Magnetic Resonance Imaging (MRI) for Brain Tumors**  
Jennifer L. Quon, Leo C. Chen, Lily H. Kim, Edward H. Lee, Samuel Henry Cheshier, Gerald A. Grant, Michael S. B. Edwards, Kristen Yeom

**1321 The Utility of Conventional MRI and Diffusion Tensor Imaging in the Prediction of Isocitrate Dehydrogenase 1 (IDH1) Mutation of Different Type Gliomas**  
Zhengting Cai, Qun Wang

**1322 Synergism Between Histone Decacetylase Inhibitors and Temozolomide in Adherent Human Glioma Cells**  
Charles R. Fencil, Menggui Huang, Yanling Wang, Duo Zhang, Andrew Azzam, Anna-Claire Siena, Yi Fan, Kalil G. Abdullah

**1323 Pegylated Polymeric Nanoparticles for Non-viral Gene Therapy Enhance Brain Penetration and Extend Survival in a Preclinical Brain Tumor Model**  
Sujan K. Mondal, Adip G. Bhargav, Cesar A. Garcia, Rawan Alkharboosh, Jayoung Kim, Rui Yuan, Stephany Tzeng, Jordan Green, Alfredo Quinones-Hinojosa

**1324 Down-regulation of Astrocyte Elevated Gene-1 Expression Inhibits the Glioma Vasculogenic Mimicry Formation**  
Chen Liang

**1325 Elevated Human Endogenous Retrovirus-L Family Provirus Levels in Glioblastoma**  
John Lynes, Kory Johnson, Gifty Dominah, Victoria E. Sanchez, Anthony Nwankwo, Tara Doucet-O'Hare, Abdel Elkahouloun, Avindra Nath, Chun Zhang Yang, Edjah K. Nduom

**1326 High Inter-rater Variability in Intraoperative Language Testing and Interpretation in Awake Craniotomies Among Experienced Neurosurgeons and Neuropsychologists, an Emerging Need for Standardization**

Viktoria Sefcikova, Juliana K. Sporrer, Matthew A. Kirkman, George Samandouras

**1327 Genetic Variations in Macrophage Migration Inhibitor Factor Confer Worse Prognosis in Glioblastoma**

Balint Otvos, Matthew M. Grabowski, Tyler J. Alban, Joshua L. Golubovsky, Chase Neumann, Anja Rabljenovic, Adam Lauko, Justin D. Lathia, Michael A. Vogelbaum

**1328 Subcortical Contributions to Higher Cognitive Functioning in Primary Brain Tumors**

Muhammad O. Chohan, Sananthan Sivakanthan, Christopher Wertz, Rex Jung

**1329 Validation of Multiplexed Immunohistochemistry for Use in the Study of the Immune Environment of Central Nervous System Malignancies**

Carli Bullis, Matthew Wood, Randy Woltjer, Kevin Nusser, Lisa Coussens, Seunggu J. Han, Monika Davare

**1330 Economic Analysis of Intraoperative Resection Adjuvants as an Exercise for Cost-effectiveness Decision Making**

Katherine Kunigelis, David R. Ormond

**1331 FOXP2 Expression in Glioblastoma and Its Relationship with Radiological Features**

Julio Plata-Bello

**1332 PD-L1 Expression in GBM is Linked to a Worse Prognosis and Correlates with Peripheral Neutrophil-to-lymphocyte Ratio**

Carolina Noronha, Joaquim Reis, Claudia Faria, Alfredo Calheiros, Fernando Schmitt, Joana Paredes

**1333 Serum-Derived Epigenetic Biomarkers Distinguish Functional and Invasive Subtypes of Pituitary Tumors**

Karam P. Asmaro, Michael Wells, Thais Sabedot, Maritza S. Mosella, Tathiane Malta, Kevin Nelson, James Snyder, Ana DeCarvalho, Abir Mukherjee, Dhananjay Chitale, Todd Aho, Adam M. Robin, Mark L. Rosenblum, Tom Mikkelsen, Laila Poisson, Ian Yu Lee, Tobias Walbert, Arti Bhan, Steven N. Kalkanis, Jack P. Rock, Houtan Noushmehr, Anavaleria Castro

**1334 Analysis of Circulating Tumor Cells Reveals that LDHB, NXPH1, IMP2L, and a Metabolomic Shift are Associated with Brain Metastasis**

Marcus Zachariah, Richard Ebright, Ben S. Wittner, Kira L. Niederhoffer, Brian V. Nahed, Shyamala Maheswaran, Daniel A. Haber

**1335 Neurosurgical Resection of Locally Recurrent Brain Metastases**

Alexander F. C. Hulsbergen, Fidelia Ida, Vasileios K. Kavouridis, Logan D. Cho, Abdullah M. Abunimer, Rania A. Mekary, Marike Broekman, Timothy R. Smith

**1337 To Drive or Not to Drive, that is Still the Question: Determining Fitness to Drive in Patients With Brain Tumors**

Ann Mansur, Megan A. Hird, Alexa Desimone, Sara Vaughan, Iryna Pyshonyak, Tom Schweizer, Sunit Das

**1338 Genomic Landscape of Gliosarcoma**

Mark M. Zaki, Eleanor Woodward, Leila A. Mashouf, Saksham Gupta, Brian V. Nahed, Wenya Linda Bi

**1339 Clinical Factors and Molecular Markers Associated with Postoperative Seizures in Glioblastoma**

Ankush Chandra, Ishan Kanungo, Jonathan William Rick, John K. Yue, Fara Dayani, Alan T. Nguyen, Patrick Michael Flanagan, Michael W. McDermott, Mitchel S. Berger, Manish K. Aghi

**1340 Does Delay in Surgical Management of Glioma Patients Matter? Experience from a Large Tertiary Referral Center**

Kimberly Bojanowski Hoang, Amparo M. Wolf, Sherise D. Ferguson, Ganesh Rao, Ian E. McCutcheon, Jeffrey S. Weinberg, Amy B. Heimberger, Frederick F. Lang, Sujit S. Prabhu

**1341 Co-administration of Chemotherapeutic Agents 5-fluorouracil and Temozolomide Enhances 5-aminolevulinic Acid-Based Photodynamic Therapy Killing of Patient-derived Glioma Stem Cells In Vitro**

Alexa Semonche, Ashish H. Shah, Daniel Green Eichberg, Ricardo J. Komotar, Michael E. Ivan

**1343 Sustained Localized Delivery of Immunotherapy to Lymph Nodes Reverses Immunosuppression and Increases Long-term Survival in Glioblastoma**

John Choi, Ayush Pant, Young-Hoon Kim, Denis Routkevitch, Laura Saleh, Yuanxuan Xia, Christopher M. Jackson, Christina Jackson, Michael Lim

**1344 Multicoloured-assisted Surgery for Resection of High Grade Gliomas with 5-aminolevulinic acid**

Cleopatra Charalampaki, Dimitrios Athanasopoulos, Makoto Nakamura

**1345 Resection of Tumors Within the Primary Motor Cortex by Using High-Frequency Stimulation: Oncological and Functional Efficiency of This Versatile Approach Based Upon Clinical Conditions.**

Marco Rossi, Marco C. Nibali, Luca Viganò, Guglielmo Puglisi, Henrietta Howells, Lorenzo Gay, Tommaso Sciortino, Antonella Leonetti, Marco Riva, Luca Fornia, Gabriella Cerri, Lorenzo Bello

**1346 Effect of Patient Age on Glioblastoma Perioperative Treatment Costs: A Value-Driven Outcome Database Analysis**

Brandon Sherrod, Nicholas T. Gamboa, Christopher G. Wilkerson, Herschel Wilde, Mohammed Azab, Michael Karsy, Randy L. Jensen, Sarah T. Menacho

**1347 Is Supratotal Resection Doable in Low-grade Gliomas? Feasibility, Putative Factors, Safety and Functional Outcome**

Marco Rossi, Federico Ambroggi, Lorenzo Gay, Marcello Gallucci, Marco C. Nibali, Antonella Leonetti, Guglielmo Puglisi, Tommaso Sciortino, Henrietta Howells, Marco Riva, Federico Pessina, Pierina Navarra, Ciro Franzese, Matteo Simonelli, Roberta Rudà, Lorenzo Bello

**1348 Treatment and Survival of Primary Intracranial Germ Cell Tumors: A Population-based Study**

Abhiraj D. Bhimani, Steven Denyer, Shashank Patil, Andrew Mudreac, Mandana Behbahani, Ankit I. Mehta

**1349 Preliminary Identification of Genetic Events Associated with Prognosis and Surgical Treatment Response in Glioblastoma**

Albert H. Kim, Peter H. Yang, Mounica Paturu, Sonika Dahiya, Gavin P. Dunn, Yu Tao, Jingqin Luo, Samantha McNulty, Jonathan Heusel

**1350 Developing Therapeutic Guidance for Potentially Unstable Spinal Metastases by Evaluating Health-Related Quality of Life Outcomes for Surgery and/or Radiotherapy**

Anne Versteeg, Arjun Sahgal, Laurence D. Rhines, Daniel M. Sciubba, James M. Schuster, Michael Weber, Aron Lazary, Stefano Boriani, Chetan Bettegowda, Michael G. Fehlings, Michelle J. Clarke, Paul M. Arnold, Ziya L. Gokaslan, Charles Fisher

**1351 Substance P and Neurokinin Type 1 Receptor Immunoexpression in Glioblastomas and Disease Aggressiveness**

Allan D. Polverini, Gisele C. de Almeida, Suely Kazue Nagahashi Marie, Carlos Clara

**1352 Comparing Language Activation Areas of Movie-watching-fMRI with Task-fMRI in Patients with Brain Tumors**

Fuxing Yang, Yanmei Tie

**1353 Language and Speech Networks Suggested by Cluster Probabilistic Mapping in Awake Craniotomy for Gliomas**

Masashi Kinoshita, Riho Nakajima, Xiaoliang Liu, Mitsutoshi Nakada

**1354 Molecular Imaging for Automated Tissue Differentiation in Highly-heterogeneous Primary Brain Tumors**

Igor A. Popov, Vsevolod Shurkhay, Stanislav Pekov, Alexander Potapov, Eugene Nikolaev, Evgeny Zhvansky, Pavel Nikitin, Daniil Ivanov

**1355 Creating Artificial Tumors with Similar Biomechanical and Imaging Characteristics to Human Brain Tumors**

Alexander Winkler-Schwartz, Recai Yilmaz, Binbin Ying, Housseem Gueziri, Vladimir Cherniak, Louis Collins, David Rudko, Jianyu Li, Rolando Del Maestro

**1356 Imaging Metastatic Brain Tumors Using Brain Metastasis-initiating Cell Targeting Peptides**

Jongmyung Kim, James K. C. Liu

**1357 The Predictive Capability of Immunohistochemistry and DNA Sequencing for Determining TP53 Functional Mutation Status: A Comparative Study of 41 Glioblastoma Patients**

Christopher Busch, Joshua A. Cuoco, Cara Rogers, Harald Sontheimer

**1358 Plasma Exosomal Biomarkers Following 5-Ala Use in Malignant Glioma**

Pamela S. Jones, Anudeep Yekula, Elizabeth Lansbury, Julia Small, Caroline M. Ayinon, John Tigges, Bethany Delcuze, Alain Charest, Ionita Ghiran, Leonora Balaj, Bob S. Carter





**TeDan Surgical  
Innovations**

# PHANTOM CS™ PIVOTING TECHNOLOGY

Experience it at  
Booth #454

*"The Phantom CS System pivoting technology minimizes pressure on the incision and vital structures in the anterior cervical approach, while still using the same small skin incision, with better access"*

Phantom CS is a trademark of TeDan Surgical Innovations, LLC.

**Ph:** 713-726-0886 **Fax:** 713-726-0846 **Toll Free:** 877-726-0886

12615 West Airport Blvd., Suite #200, Sugar Land, Texas 77478

**Email:** [info@tedansurgical.com](mailto:info@tedansurgical.com)

[www.tedansurgical.com](http://www.tedansurgical.com)

# CONTINUING MEDICAL EDUCATION

## 2019 ANNUAL MEETING OBJECTIVES

### Our Mission

The CNS exists to enhance health and improve lives through the advancement of neurosurgical education and scientific exchange.

### Our Vision

To be the premier educational organization in neurological surgery.

### Our Work

Our mission drives us to cultivate great neurosurgeons. We advance the practice of neurosurgery globally by inspiring and facilitating scientific discovery and its translation to clinical practice.

The CNS CME program is designed, planned, and implemented to evaluate a comprehensive collection of activities within the subspecialty of neurosurgery. The CNS plans to yield results that not only contribute to lifelong learning, but also demonstrate change and improvement in competence.

At the conclusion of the 2019 CNS Annual Meeting participants will be able to

1. Alter their current practice patterns in accordance with the latest data.
2. Compare techniques based on findings discussed during case presentations.
3. Apply and/or perform new techniques based on best practices and current procedures.
4. Practice evidence-based, informed neurosurgical medicine.
5. Interpret newly found outcomes as a result of the scientific abstract presentations.
6. Demonstrate change in competence.

## EDUCATIONAL FORMAT DESCRIPTIONS

The CNS offers sessions in a variety of formats to enhance your educational experience. Each session is open to all who have paid the general medical registration fee with the exception of optional Symposia, Luncheon Seminars, and Dinner Seminars, which are available for an additional fee.

### SYMPOSIA

Didactic and hands-on courses with expert neurosurgical educators demonstrating clinical techniques and applications via technology, models, and simulation. Hands-on Symposia provide an opportunity to improve surgical skills by applying and demonstrating learned techniques. Symposia also provide an opportunity to review casebased complex issues and discuss potential solutions.

- Symposia are offered Saturday, October 19, and Sunday, October 20.

## GENERAL SCIENTIFIC SESSION, SECTION SESSIONS, GUIDELINE SESSIONS, LUNCHEON SEMINARS, INTERNATIONAL SESSIONS, OPERATIVE TECHNIQUE SESSIONS, INTERACTIVE MULTIMEDIA RESEARCH PRESENTATION SESSION, AND DINNER SEMINARS

Expert lecturers present research, scientific evidence and associated outcomes, and demonstrate clinical techniques and applications. The basics of translational development, clinical trials, guideline review, and updated changes and evaluation of clinical experience, followed by examples of successful application, are presented in various sessions. Basic skills and information that can be applied in daily practice and professional life are also presented.

- General Scientific Sessions, Section Sessions, Guidelines Session, International Sessions, Operative Technique Sessions, and Interactive Multimedia Research Presentation Session are offered Sunday, October 20, through Wednesday, October 23.
- Luncheon Seminars are offered Monday, October 21, through Wednesday, October 23.
- Dinner Seminars are offered on Saturday, October 19; Monday, October 21; and Tuesday, October 22.

## OPERATIVE TECHNIQUES AND CASE-BASED DISCUSSION SESSIONS

*During these sessions, the faculty presents cases to be examined, discussed, and debated by both the audience and panel. Registered attendees will have the opportunity to submit their own cases prior to the meeting to be presented at these sessions. Don't miss these interactive sessions designed to encourage participation from everyone.*

- Operative Technique and Case-based Discussion Sessions will take place on Monday, October 21, and Tuesday, October 22.
- Live Surgery via telemedicine technology in the Exhibit Hall will take place Monday, October 21, through Wednesday, October 23. CME is not offered for these sessions.

## ORIGINAL SCIENCE PROGRAM

- Scientific abstract presentations offer original science, ground-breaking research, and the best clinical and basic neurosurgical science in the CNS Original Science Program, and allows for audience questions and moderated discussions.
- Oral Presentations by subspecialty will be presented on Monday, October 21, Tuesday, October 22, and Wednesday, October 23.
- Interactive Multimedia Research Presentation Session will take place on Tuesday, October 22
- Sunrise Science Oral Presentations by subspecialty Oral Presentations will be presented on Monday, October 21, Tuesday, October 22, and Wednesday, October 23.
- Late-breaking Abstracts will be presented on Monday, October 21, Tuesday October 22 and Wednesday, October 23.

## ACCREDITATION

The Congress of Neurological Surgeons is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

## CME CREDIT

The CNS designates this live activity for a maximum of 49.5 *AMA PRA Category 1 Credits™*. Physicians should only claim credit commensurate with the extent of their participation in the activity.

\*A maximum of 26 *AMA PRA Category 1 Credits™* may be earned for general sessions only.

Additional CME Credits can be earned by attending the following:

### SYMPOSIA

Attendees will receive a maximum of 3.5 *AMA PRA Category 1 Credits™* for each Saturday or Sunday half-day Symposia, a maximum of 6 *AMA PRA Category 1 Credits™* for each eligible Saturday or Sunday full-day Symposia.

### LUNCHEON SEMINARS

Attendees will receive a maximum of one-and-a-half (1.5) *AMA PRA Category 1 Credits™* for all eligible Luncheon Seminars. Physicians should only claim credit commensurate with the extent of their participation in the activity.

### DINNER SEMINARS

Attendees will receive a maximum of two (2) *AMA PRA Category 1 Credits™* for all eligible Dinner Seminars. Physicians should only claim credit commensurate with the extent of their participation in the activity.

### INTERACTIVE MULTIMEDIA RESEARCH PRESENTATIONS

Physicians may claim a maximum of five (5) *AMA PRA Category 1 Credits™* directly from the AMA for preparing a poster presentation, which is also included in the published abstracts. Physicians may claim them on their AMA PRA certificate application or apply directly to the AMA for an *AMA PRA Category 1 Credits™* certificate.

Physicians may claim 1.5 *AMA PRA Category Credits™* for viewing scientific posters. Physicians should selfclaim credit on their AMA PRA certificate application form. Please visit the AMA web site for details at [www.ama-assn.org](http://www.ama-assn.org).

## NURSING CREDIT

This continuing nursing education activity was approved by the American Association of Neuroscience Nurses, an accredited approver by the American Nurses Credentialing Center's Commission on Accreditation.

Each attendee may only be awarded a maximum of 49.5 nursing contact hours for this educational event.

## CLAIMING CME CREDIT

CME credits can be claimed through the online CME system at [www.cns.org](http://www.cns.org). The CME tracking system allows you to create and print a CME certificate immediately

following the CNS Annual Meeting while you are still in San Francisco, or from the convenience of your home or office. Upon completion of this process, your CME certificate will be sent to you via email at the email address you provided at registration.

## DISCLOSURES

The Accreditation Council for Continuing Medical Education Standards for Commercial Support requires that anyone in a position to control the content of the educational activity has disclosed all financial relationships with any commercial interest. Failure or refusal to disclose or the inability to satisfactorily resolve the identified conflict may result in the withdrawal of the invitation to participate in any of the CNS educational activities. The ACCME defines a "commercial interest" as any entity producing, marketing, reselling, or distributing healthcare goods or services consumed by, or used on, patients. It is also each speaker's responsibility to include the FDA clearance status of any device or drug requiring FDA approval discussed or described in their presentation or to describe the lack of FDA clearance for any "off label" uses discussed. Speakers from the audience are also required, therefore, to indicate any relevant personal/professional relationships as they discuss a given topic.

See the addendum for listing of all Annual Meeting disclosures.

## FDA STATEMENT

Some drugs or medical devices demonstrated at the Annual Meeting have not been cleared by the FDA or have been cleared by the FDA for specific purposes only. The FDA has stated that it is the responsibility of the physician to determine the FDA clearance status of each drug or medical device he or she wishes to use in clinical practice. The CNS policy provides that "off label" uses of a drug or medical device may be described at the Annual Meeting so long as the "off label" use of the drug or medical device is also specifically disclosed. Any drug or medical device is "off label" if the described use is not set forth on the products approval label. It is also each speaker's responsibility to include the FDA clearance status of any device or drug requiring FDA approval discussed or described in their presentation or to describe the lack of FDA clearance for any "off label" uses discussed. Speakers from the audience are also required, therefore, to indicate any relevant personal/professional relationships as they discuss a given topic.

# GENERAL INFORMATION

## 2019 CNS ANNUAL MEETING APP

Download the 2019 CNS Annual Meeting App to access everything you need to know about the Annual Meeting in the palm of your hand. Search for course details, upcoming events, and exhibitors. You can also save your favorite sessions, send and receive messages with colleagues, take notes on sessions, and more!

Download the app by going to <https://ativ.me/cns2019>.

## AMERICANS WITH DISABILITIES ACT

The Moscone West Convention Center and the San Francisco Marriott Marquis are in compliance with the Americans with Disabilities Act (ADA) and prepared to accommodate all visitors. For wheelchair or electric scooter rental, please contact either Scoot Around at 877-484-5482 or [www.scootaround.com](http://www.scootaround.com) or Cloud of Goods at 415-621-9757 or [www.cloudofgoods.com](http://www.cloudofgoods.com).

## ATTIRE

Professional attire is appropriate at the Annual Meeting and in the Exhibit Hall. Some San Francisco restaurants require coats and ties for men. Please check each restaurant's policy when making reservations. Business/cocktail attire is appropriate for social events, unless otherwise noted.

## BADGES

CNS Annual Meeting badge colors represent the registration category of attendees:

- Blue:** Medical attendees including CNS Members and Non-members, Associate Members
- Gray:** Graduate Students/Post-doctoral Scholars, Medical Students, PA/Physician Extenders, Nurses, Nurse Practitioners
- Orange:** Non Member Corporate Representatives
- Clear:** Guests and Spouses
- Yellow:** Exhibitors
- Red:** Staff

## BAGGAGE AND COAT CHECK

Baggage and coat check will be available at Moscone West Convention Center.

|                       |                 |
|-----------------------|-----------------|
| Tuesday, October 22   | 6:30 am–7:30 pm |
| Wednesday, October 23 | 6:30 am–5:00 pm |

## CHILDREN

Children may be registered as guests. (Please note that children under the age of 18 are not allowed in the CNS Exhibit Hall.) Should you require babysitting services, please contact the concierge desk at your hotel. The CNS has no control over and assumes no responsibility for the care that is provided through hotels for these services. This information is provided solely to assist participants in identifying possible sources for childcare.

## CNS CENTRAL

CNS Central is conveniently located adjacent to the CNS Registration Area, in the lobby of the Moscone West Convention Center. Visit CNS Central with your questions on CNS membership, education, or CME. CNS staff will be available to assist you in navigating our new website, review our case-based Nexus product or download any apps on your mobile device. From accessing your favorite learning tools to discovering new ones, the CNS staff is here to help you with your questions about programs, products, and services.

## CNS XPERIENCE LOUNGE

Immerse yourself in the best of the CNS Annual Meeting in the CNS Xperience Lounge! Get up close and personal with the featured speakers at their book signings, hear the Innovator of the Year finalists present their innovations, view digital posters, and enjoy the Voices of Neurosurgery presentations by peers while enjoying a fruit smoothie on Tuesday's Wellness Afternoon. The CNS Xperience Lounge is a great place to connect with your colleagues and mentors and enjoy a beverage – be sure to stop by!

## COURSE AGENDA AND FACULTY

Agendas are occasionally subject to change. As we continue to strive to improve the quality of your educational experience, the CNS may substitute faculty with comparable expertise when necessary.

## DIGITAL POSTERS

Digital Posters are displayed electronically, Monday through Wednesday, in the CNS Xperience Lounge, located in the Exhibit Hall and can be searched by author, topic or keyword.



## DISCLAIMER

The material presented at the 2019 Annual Meeting has been made available by the Congress of Neurological Surgeons for educational purposes only. The material is not intended to represent the only, nor necessarily the best, method, procedure or technique appropriate for the medical situations discussed, but rather is intended to present an approach, view, statement, or opinion of the faculty which may be helpful to others who face similar situations. The material is not meant to replace independent judgement by a physician for any given issue. Neither the content (whether written or oral) of any course, seminar, or other presentation in the program, nor the use of a specific product in conjunction therewith, nor the exhibition of any materials by any parties coincident with the program, should be construed as indicating endorsement or approval by the CNS, or by its committees or affiliates of the views presented; methods, procedures and/or techniques described or discussed; the products used; or the materials exhibited. The CNS disclaims any and all liability for injury or other damages resulting to any individual attending the Annual Meeting, and for all claims which may arise out of the use of the material, methods, procedures, and/or techniques demonstrated therein by such individuals, whether these claims shall be asserted by physicians or any other person. No reproductions of any kind, including audiotapes and videotape, may be made of the presentations at the CNS Annual Meeting. The CNS reserves all of its rights to such material, and commercial reproduction is specifically prohibited.

## EXHIBIT HALL

|                       |                 |
|-----------------------|-----------------|
| Monday, October 21    | 9:30 am–4:00 pm |
| Tuesday, October 22   | 9:30 am–3:00 pm |
| Wednesday, October 23 | 9:30 am–2:00 pm |

Admittance to the Exhibit Hall is by CNS name badge only. Children under the age of 18 are not allowed in the Exhibit Hall.

## FACULTY REGISTRATION

All faculty should register at the Faculty Registration counter at Moscone West Convention Center to receive a special gift.

## BREAKS AND LIVE SURGERY IN THE EXHIBIT HALL

Join your colleagues and exhibitors for unopposed networking in the Exhibit Hall. Presentation stage schedules will be posted in the Exhibit Hall.

### Monday, October 21

|                                               |                |
|-----------------------------------------------|----------------|
| Morning Beverage Break                        | 9:40–10:40 am  |
| Live Surgery in Xperience Lounge              | 10:00–10:30 am |
| Afternoon Beverage Break                      | 1:45–2:45 pm   |
| Beer and Wine Social Hour in Xperience Lounge | 1:45–2:45 pm   |

### Tuesday, October 22

|                                        |                |
|----------------------------------------|----------------|
| Morning Beverage Break                 | 9:40–10:40 am  |
| Live Surgery in Xperience Lounge       | 10:00–10:30 am |
| Afternoon Beverage Break               | 1:45–2:45 pm   |
| Wellness Afternoon in Xperience Lounge | 1:45–2:45 pm   |

### Wednesday, October 23

|                                  |                |
|----------------------------------|----------------|
| Morning Beverage Break           | 9:40–10:40 am  |
| Live Surgery in Xperience Lounge | 10:00–10:30 am |

## FUTURE MEETINGS

|                      |                 |
|----------------------|-----------------|
| 2020: Miami, Florida | September 12–16 |
| 2021: Austin, Texas  | October 16–20   |

## MEMBER SERVICES

Be sure to stop and visit the CNS Member Services staff in CNS Central or the CNS Xperience Lounge for demos of our most popular products, or to answer any of your questions about the CNS, your NEUROSURGERY® Publications subscriptions, and your CNS membership.

## POSTERS

The CNS posters will be located on the Level 2 Lobby of the Moscone West Convention Center. Poster viewing and mini podium presentations will take place during the Interactive Multimedia Research Presentation Session on Tuesday, October 22 from 5:45–7:15 pm.

## PRESS

All media representatives and journalists attending the Annual Meeting are required to register in advance. Registration, Press Room guidelines and media credentialing policies are available online at [cns.org/2019](http://cns.org/2019) or by calling 847-240-2500. Once on-site, media are required to check in at the CNS registration area to pick up their press badges and then proceed to the Press Room to pick up their press kits.

## REGISTRATION INFORMATION

Items included in registration fee:

- General Scientific Sessions, Sunday through Wednesday
- Scientific Program to include Section Sessions, Oral Abstract Presentations, Sunrise Science/Late-breaking Abstract Sessions, Guideline Sessions, Operative Technique Sessions, International Sessions, Interactive Multimedia Research Presentation Session
- CNS Xperience Lounge
- Live Surgeries
- Exhibit Hall, Monday through Wednesday
- One ticket to the Opening Reception on Sunday, October 20

## REGISTRATION HOURS

Registration is located in the Level 1 Lobby of the Moscone West Convention Center.

|                       |                 |
|-----------------------|-----------------|
| Saturday, October 19  | 7:00 am–5:30 pm |
| Sunday, October 20    | 7:00 am–7:30 pm |
| Monday, October 21    | 6:30 am–6:30 pm |
| Tuesday, October 22   | 6:30 am–6:30 pm |
| Wednesday, October 23 | 6:30 am–3:15 pm |

Registration will also be located in the 2nd Level Atrium at the San Francisco Marriott.

|                      |                  |
|----------------------|------------------|
| Saturday, October 19 | 7:00 am–5:00 pm  |
| Sunday, October 20   | 7:00 am–5:00 pm  |
| Monday, October 21   | 7:00 am–12:00 pm |

## RESTAURANT RESERVATIONS

Contact your hotel concierge in advance for assistance in securing popular restaurant reservations.

## SMOKING

The Moscone West Convention Center and official CNS hotels are non-smoking facilities.

## SPEAKER READY ROOM

All speakers and abstract presenters should check in at the Speaker Ready Room, located in Room 3000 at the Moscone West Convention Center, a minimum of one hour prior to the scheduled start time of their session.

|                       |                 |
|-----------------------|-----------------|
| Saturday, October 19  | 7:00 am–4:30 pm |
| Sunday, October 20    | 7:00 am–6:30 pm |
| Monday, October 21    | 6:30 am–6:30 pm |
| Tuesday, October 22   | 6:30 am–5:30 pm |
| Wednesday, October 23 | 6:30 am–3:30 pm |

## SPOUSE HOSPITALITY

All registered CNS Annual Meeting spouses and guests are invited to visit the spouse hospitality suite, Monday through Wednesday, for daily continental breakfast from 8:00–10:30 am in the 2nd Floor Atrium of the San Francisco Marriott Marquis. (Please note that admittance to spouse hospitality suite is by spouse/guest badge only.) A representative from the San Francisco Convention and Visitors Bureau will be available in the Spouse Hospitality Suite to answer city questions, assist you with dinner reservations, and provide tour and activity recommendations.

## WI-FI SERVICE

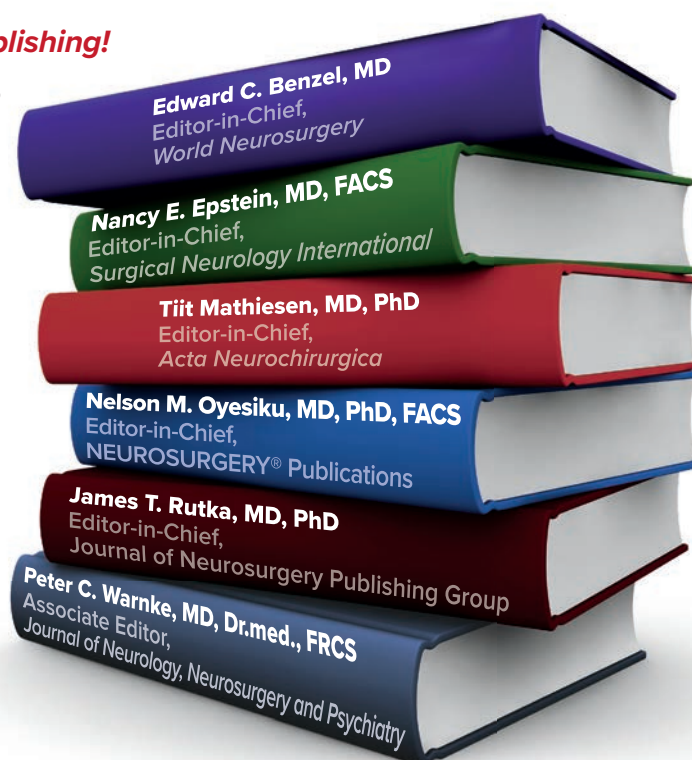
For your convenience, complimentary Wi-Fi service is provided by the CNS throughout the Moscone West Convention Center and the San Francisco Marriott Marquis wherever CNS events are being held. Please use the CNS19 network at both facilities. The password at the Marriott Marquis is sanfran19.

*Hear from leading voices in scholarly publishing!*

# NEUROSURGERY® Publications: Meet the Editors

**Tuesday, October 22 | 1:00–2:00 pm**  
**Room 3002 at the Moscone West Convention Center**

Attendees will be treated to presentations from the Editors-in-Chief of several leading journals in neurosurgery outlining their experiences with the peer review process. Panelists will share their thoughts on how to most effectively contribute to this process and then stay for a Q&A with the audience.



# 2019 EXHIBITORS

| Exhibiting As                                 | Booth Number | Booth Contact URL                                                                       | Booth Phone   |
|-----------------------------------------------|--------------|-----------------------------------------------------------------------------------------|---------------|
| 7D Surgical                                   | 831          | <a href="http://www.7dsurgical.com">http://www.7dsurgical.com</a>                       | 647-484-0078  |
| ACE Medical Co.                               | 948          | <a href="http://www.acemedicalco.com">http://www.acemedicalco.com</a>                   | 513-321-0055  |
| Ad-Tech Medical Instrument Corp.              | 712          | <a href="http://www.adtechmedical.com">http://www.adtechmedical.com</a>                 | 262-634-1555  |
| Aesculap, Inc.                                | 209          | <a href="http://www.aesculapusa.com">http://www.aesculapusa.com</a>                     | 800-282-9000  |
| American Association of Neurological Surgeons | 348          | <a href="http://www.aans.org">http://www.aans.org</a>                                   | 847-378-0528  |
| Apex Medical, Inc.                            | 329          | <a href="http://www.apexmed.com">http://www.apexmed.com</a>                             | 610-240-4905  |
| Arbor Pharmaceuticals, LLC                    | 531          | <a href="http://www.arborpharma.com">http://www.arborpharma.com</a>                     | 678-334-2420  |
| Arkis BioSciences                             | 431          | <a href="http://www.arkisbiosciences.com">http://www.arkisbiosciences.com</a>           | 844-247-5383  |
| Baylor Scott & White Health                   | 428          | <a href="https://www.bswhealth.com/">https://www.bswhealth.com/</a>                     | 254-724-2111  |
| Best Medical International                    | 455          | <a href="http://www.teambest.com">http://www.teambest.com</a>                           | 613-854-7018  |
| Bien-Air Surgery SA                           | 346          | <a href="http://www.bienair.com">http://www.bienair.com</a>                             | 949-477-6050  |
| Biocomposites Inc.                            | 550          | <a href="http://www.biocomposites.com">http://www.biocomposites.com</a>                 | 910-350-8015  |
| Biologica Technologies                        | 236          | <a href="http://www.biologicatechnologies.com">http://www.biologicatechnologies.com</a> | 800-677-6610  |
| Bioplate, Inc.                                | 849          | <a href="http://www.bioplate.com">http://www.bioplate.com</a>                           | 310-815-2100  |
| BK Medical                                    | 332          | <a href="http://bkmedical.com">http://bkmedical.com</a>                                 | 800-876-7226  |
| Boss Instruments Ltd.                         | 644          | <a href="http://www.bossinst.com">http://www.bossinst.com</a>                           | 540-832-5000  |
| Boston Scientific                             | 508          | <a href="http://www.bostonscientific.com">http://www.bostonscientific.com</a>           | 661-949-4339  |
| Brain Aneurysm Foundation                     | 446          | <a href="http://www.bafound.org">http://www.bafound.org</a>                             | 781-826-5556  |
| Brain Navi Biotechnology Co., Ltd             | 127          | <a href="http://www.brainnavi.com">http://www.brainnavi.com</a>                         | 886-937659759 |
| Brown & Brown Insurance                       | 460          | <a href="http://www.bbphoenix.com">http://www.bbphoenix.com</a>                         | 602-494-6762  |
| Carle Physician Group                         | 910          | <a href="https://carleconnect.com/">https://carleconnect.com/</a>                       | 217-383-6945  |
| Centinel Spine                                | 328          | <a href="http://centinelspine.com">http://centinelspine.com</a>                         | 484-887-8831  |
| Clarus Medical LLC                            | 836          | <a href="http://www.clarus-medical.com">http://www.clarus-medical.com</a>               | 763-525-8400  |
| CoreLink                                      | 449          | <a href="http://www.corelinksurgical.com">http://www.corelinksurgical.com</a>           | 314-223-8361  |
| CTL Amedica                                   | 548          | <a href="http://www.cltmed.com">http://www.cltmed.com</a>                               | 214-545-5820  |
| DePuy Synthes                                 | 619          | <a href="http://www.depuysynthes.com">http://www.depuysynthes.com</a>                   | 508-828-2820  |
| Designs for Vision, Inc.                      | 544          | <a href="http://www.designsforvision.com">http://www.designsforvision.com</a>           | 631-585-3300  |
| DIXI Medical USA                              | 342          | <a href="http://www.diximedus.com">http://www.diximedus.com</a>                         | 248-845-3494  |
| DJO                                           | 629          | <a href="http://www.djoglobal.com">http://www.djoglobal.com</a>                         | 760-212-8986  |
| elliquence, LLC.                              | 633          | <a href="http://www.elliquence.com">http://www.elliquence.com</a>                       | 516-277-9000  |
| Elsevier, Inc.                                | 401          | <a href="http://www.elsevierhealth.com">http://www.elsevierhealth.com</a>               | 215-239-3900  |
| Essentia Health                               | 946          | <a href="http://essentiahealth.org">http://essentiahealth.org</a>                       | 218-786-3908  |
| Fehling Surgical Instruments, Inc.            | 513          | <a href="http://www.fehlingsurgical.com">http://www.fehlingsurgical.com</a>             | 800-334-5464  |
| Gauthier Biomedical Inc.                      | 331          | <a href="http://www.gauthierbiomedical.com">http://www.gauthierbiomedical.com</a>       | 262-546-0010  |
| GE Healthcare                                 | 837          | <a href="http://www.gehealthcare.com">http://www.gehealthcare.com</a>                   | 847-277-4700  |
| Globus Medical                                | 731          | <a href="http://www.globusmedical.com">http://www.globusmedical.com</a>                 | 610-930-1800  |
| GT Medical Technologies, Inc.                 | 545          | <a href="http://www.gtmedtech.com">http://www.gtmedtech.com</a>                         | 833-662-0044  |
| Hayes Locums                                  | 502          | <a href="http://www.hayeslocums.com">http://www.hayeslocums.com</a>                     | 954-617-9033  |
| HCA                                           | 245          | <a href="http://www.hcahealthcare.com">http://www.hcahealthcare.com</a>                 | 937-235-5890  |
| Hemedex                                       | 651          | <a href="http://www.hemedex.com">http://www.hemedex.com</a>                             | 617-577-1759  |
| Hitachi Healthcare                            | 925          | <a href="http://www.hitachihealthcare.com">http://www.hitachihealthcare.com</a>         | 800-800-3106  |
| IMRIS                                         | 812          | <a href="http://www.imris.com">http://www.imris.com</a>                                 | 763-203-6346  |
| Innovasis                                     | 660          | <a href="http://www.innovasis.com">http://www.innovasis.com</a>                         | 801-261-2236  |
| Integra LifeSciences                          | 700          | <a href="http://www.integralife.com">http://www.integralife.com</a>                     | 609-275-0500  |
| Intrinsic Therapeutics, Inc.                  | 330          | <a href="http://www.barricaid.com">www.barricaid.com</a>                                | 781-932-0222  |

| Exhibiting As                                 | Booth Number | Booth Contact URL                                                                       | Booth Phone      |
|-----------------------------------------------|--------------|-----------------------------------------------------------------------------------------|------------------|
| Invenio Imaging Inc                           | 555          | <a href="http://www.invenio-imaging.com">http://www.invenio-imaging.com</a>             | 857-413-9322     |
| IRRAS                                         | 662          | <a href="http://www.iras.com">http://www.iras.com</a>                                   | 530-219-4799     |
| JEIL Medical Corporation                      | 737          | <a href="http://www.jeilmed.co.kr">http://www.jeilmed.co.kr</a>                         | 822-850-3598     |
| joimax, Inc. - Endoscopic Spine Surgery       | 840          | <a href="http://www.joimax.com">http://www.joimax.com</a>                               | 949-859-3472     |
| Journal of Neurosurgery                       | 349          | <a href="http://www.thejns.org">http://www.thejns.org</a>                               | 847-378-0528     |
| JTS Surgical                                  | 944          | <a href="http://jtssurgical.com">http://jtssurgical.com</a>                             | 909-799-3900     |
| Kaiser Permanente                             | 340          | <a href="https://scpmgphysiciancareers.com">https://scpmgphysiciancareers.com</a>       | 800-541-7946     |
| Karl Storz Endoscopy – America, Inc.          | 709          | <a href="http://www.karlstorz.com">http://www.karlstorz.com</a>                         | 424-218-8100     |
| Kelynam Global Inc.                           | 451          | <a href="http://www.kelynam.com/">http://www.kelynam.com/</a>                           | 800-280-8192-702 |
| Kirwan Surgical Products                      | 408          | <a href="http://www.ksp.com">http://www.ksp.com</a>                                     | 781-834-9500     |
| KLS Martin                                    | 800          | <a href="http://www.klsmartinnorthamerica.com">http://www.klsmartinnorthamerica.com</a> | 904-641-7746     |
| Kogent Surgical                               | 813          | <a href="http://www.kogentneuro.com">http://www.kogentneuro.com</a>                     | 636-399-7644     |
| Koros USA, Inc.                               | 409          | <a href="http://www.korosusa.com">http://www.korosusa.com</a>                           | 805-529-0825     |
| LeMaitre Vascular, Inc.                       | 847          | <a href="http://www.lemaitre.com">http://www.lemaitre.com</a>                           | 781-221-2266     |
| Leica Microsystems                            | 745          | <a href="http://www.leica-microsystems.com">http://www.leica-microsystems.com</a>       | 847-405-7039     |
| Life Instrument Corporation                   | 613          | <a href="http://www.lifeinstruments.com">http://www.lifeinstruments.com</a>             | 781-849-0109     |
| MDOCHaus                                      | 243          | <a href="http://www.mdochaus.com">http://www.mdochaus.com</a>                           | 866-985-8217     |
| Medical Education & Research Institute        | 546          | <a href="http://www.meri.org">http://www.meri.org</a>                                   | 901-275-7020     |
| Medivis                                       | 244          | <a href="https://www.medivis.com/">https://www.medivis.com/</a>                         | 631-747-7887     |
| Medtronic                                     | 719          | <a href="http://www.medtronic.com">http://www.medtronic.com</a>                         | 763-514-4000     |
| MedWaves, Inc.                                | 338          | <a href="http://www.medwaves.com">http://www.medwaves.com</a>                           | 858-946-0015     |
| MicroVention, Inc.                            | 413          | <a href="http://www.microvention.com">http://www.microvention.com</a>                   | 714-247-8000     |
| Misonix, Inc.                                 | 115          | <a href="http://www.misonix.com">http://www.misonix.com</a>                             | 631-694-9555     |
| Mizuho America, Inc.                          | 937          | <a href="http://www.mizuho.com">http://www.mizuho.com</a>                               | 415-846-5392     |
| Mizuho OSI                                    | 936          | <a href="http://www.mizuhosi.com">http://www.mizuhosi.com</a>                           | 510-429-1500     |
| Mobius Imaging                                | 929          | <a href="http://www.mobiusimaging.com">http://www.mobiusimaging.com</a>                 | 978-796-5068     |
| Monteris Medical                              | 808          | <a href="http://www.monteris.com">http://www.monteris.com</a>                           | 763-253-4710     |
| MRI Interventions Inc.                        | 238          | <a href="http://www.mriinterventions.com">http://www.mriinterventions.com</a>           | 949-900-6833     |
| Nadia International, Inc.                     | 741          | <a href="http://www.ronadro.com">http://www.ronadro.com</a>                             | 512-301-3888     |
| Natus Neuro                                   | 501          | <a href="https://neuro.natus.com/">https://neuro.natus.com/</a>                         | 847-949-5200     |
| NeuroPace, Inc.                               | 336          | <a href="http://www.neuropace.com">http://www.neuropace.com</a>                         | 650-237-2700     |
| NeuroPoint Alliance                           | 351          | <a href="http://www.aans.org">http://www.aans.org</a>                                   | 847-378-0500     |
| NICO Corporation                              | 945          | <a href="http://www.niconeuro.com">http://www.niconeuro.com</a>                         | 317-660-7118     |
| North American Neuromodulation Society (NANS) | 950          | <a href="http://www.neuromodulation.org">http://www.neuromodulation.org</a>             | 847-375-4714     |
| North American Spine Society                  | 845          | <a href="http://www.spine.org">http://www.spine.org</a>                                 | 630-230-3600     |
| Nova Surgical Innovations, Inc.               | 612          | <a href="http://www.nsiweb.com">http://www.nsiweb.com</a>                               | 951-228-0071     |
| NovaBone Products                             | 444          | <a href="http://www.novabone.com">http://www.novabone.com</a>                           | 386-462-7600     |
| Novocure, Inc.                                | 344          | <a href="http://www.novocure.com">http://www.novocure.com</a>                           | 603-436-2809     |
| NSK America Corp.                             | 649          | <a href="http://www.nsk-surgery.com">http://www.nsk-surgery.com</a>                     | 800-585-4675     |
| NuTech Spine                                  | 430          | <a href="https://www.nutechspine.com">https://www.nutechspine.com</a>                   | 205-329-7285     |
| NX Development Corp                           | 121          | <a href="http://www.gleolan.com">http://www.gleolan.com</a>                             | 833-453-6526     |
| Olympus America, Inc.                         | 354          | <a href="http://www.olympusamerica.com">http://www.olympusamerica.com</a>               | 484-896-5000     |
| Orthofix                                      | 839          | <a href="http://www.orthofix.com">http://www.orthofix.com</a>                           | 214-937-2000     |
| OssDsign                                      | 912          | <a href="http://www.ossdsign.com">http://www.ossdsign.com</a>                           | 011-46-18-553993 |
| OsteoMed                                      | 509          | <a href="http://www.osteomed.com">http://www.osteomed.com</a>                           | 972-677-4600     |
| Oxford University Press                       | 551          | <a href="http://www.global.oup.com">http://www.global.oup.com</a>                       | 800-451-7556     |



| Exhibiting As                                    | Booth Number | Booth Contact URL                                                                                                 | Booth Phone  |
|--------------------------------------------------|--------------|-------------------------------------------------------------------------------------------------------------------|--------------|
| Panasonic                                        | 645          | <a href="https://na.panasonic.com/us/industries/healthcare">https://na.panasonic.com/us/industries/healthcare</a> | 201-348-5377 |
| Penumbra, Inc.                                   | 637          | <a href="http://www.penumbrainc.com">http://www.penumbrainc.com</a>                                               | 510-748-3200 |
| Phasor Health LLC                                | 748          | <a href="http://www.phasorhealth.com">http://www.phasorhealth.com</a>                                             | 212-729-6161 |
| PMT Corporation                                  | 608          | <a href="http://www.pmtcorp.com">http://www.pmtcorp.com</a>                                                       | 952-470-0866 |
| Portola Pharmaceuticals                          | 561          | <a href="http://www.portola.com">http://www.portola.com</a>                                                       | 650-246-7000 |
| pro med instruments, Inc.                        | 648          | <a href="http://www.pmisurgical.com">http://www.pmisurgical.com</a>                                               | 239-369-2310 |
| Providence Medical Technology                    | 347          | <a href="http://www.providencemt.com">http://www.providencemt.com</a>                                             | 415-923-9376 |
| RAPID                                            | 229          | <a href="https://rapid.ai">https://rapid.ai</a>                                                                   | 650-388-9767 |
| Rapid Medical                                    | 447          | <a href="http://www.rapid-medical.com">http://www.rapid-medical.com</a>                                           | 805-558-2433 |
| Renishaw Inc.                                    | 512          | <a href="http://www.renishaw.com/neuro">http://www.renishaw.com/neuro</a>                                         | 847-376-9269 |
| Ronin Surgical Corp.                             | 242          | <a href="http://www.roninsurgical.com">http://www.roninsurgical.com</a>                                           | 415-226-9414 |
| Rose Micro Solutions                             | 345          | <a href="http://www.rosemicrosolutions.com">http://www.rosemicrosolutions.com</a>                                 | 716-608-0009 |
| RosmanSearch, Inc.                               | 809          | <a href="http://www.rosmansearch.com">http://www.rosmansearch.com</a>                                             | 216-287-2302 |
| RTI Surgical                                     | 355          | <a href="http://www.rtix.com">http://www.rtix.com</a>                                                             | 386-418-8888 |
| Scanlan International, Inc.                      | 500          | <a href="http://www.scanlangroup.com">http://www.scanlangroup.com</a>                                             | 651-298-0997 |
| Second Sight Medical Products                    | 462          | <a href="http://www.secondsight.com">http://www.secondsight.com</a>                                               | 818-833-5000 |
| Shukla Medical                                   | 333          | <a href="http://www.shuklamedical.com">http://www.shuklamedical.com</a>                                           | 727-626-2770 |
| Siemens Industry, Inc.                           | 412          | <a href="http://usa.siemens.com/Healthineers">http://usa.siemens.com/Healthineers</a>                             | 914-524-5168 |
| Silk Road Medical                                | 448          | <a href="http://www.silkroadmedical.com">http://www.silkroadmedical.com</a>                                       | 408-585-2124 |
| Sophysa                                          | 612          | <a href="http://www.sophysa.com">http://www.sophysa.com</a>                                                       | 219-663-7711 |
| Spine23                                          | 250          | <a href="https://dimespine.com">https://dimespine.com</a>                                                         | 408-661-3664 |
| SpineFrontier                                    | 549          | <a href="http://www.spinefrontier.com">www.spinefrontier.com</a>                                                  | 978-232-3990 |
| Spine Wave                                       | 728          | <a href="http://www.spinewave.com">http://www.spinewave.com</a>                                                   | 203-944-9494 |
| Spineology Inc.                                  | 708          | <a href="http://www.spineology.com">http://www.spineology.com</a>                                                 | 651-256-8500 |
| Stimwave Technologies                            | 239          | <a href="http://www.stimwave.com">www.stimwave.com</a>                                                            | 800-965-5134 |
| Stryker                                          | 419          | <a href="http://stryker.com">http://stryker.com</a>                                                               | 419-345-1465 |
| Surgeons Capital Management                      | 841          | <a href="http://www.surgeonscapitalmanagement.com">http://www.surgeonscapitalmanagement.com</a>                   | 610-660-4526 |
| Surgical Theater                                 | 337          | <a href="http://www.surgicaltheater.net">http://www.surgicaltheater.net</a>                                       | 216-496-7884 |
| SurgiTel                                         | 851          | <a href="http://www.surgitel.com">http://www.surgitel.com</a>                                                     | 734-892-7430 |
| Sutter Medical Technologies USA                  | 403          | <a href="http://www.sutter-usa.com">http://www.sutter-usa.com</a>                                                 | 303-489-1537 |
| Synaptive Medical                                | 318          | <a href="http://www.synaptivemedical.com">http://www.synaptivemedical.com</a>                                     | 647-925-3435 |
| Takayama Instrument, Inc                         | 445          | <a href="http://www.takayamamicro.com">http://www.takayamamicro.com</a>                                           | 508-907-6012 |
| TeDan Surgical Innovations                       | 454          | <a href="http://www.tedansurgical.com">http://www.tedansurgical.com</a>                                           | 713-554-1025 |
| Thieme Medical Publishers                        | 609          | <a href="http://www.thieme.com">http://www.thieme.com</a>                                                         | 212-760-0888 |
| ThinkFirst National Injury Prevention Foundation | 547          | <a href="http://www.thinkfirst.org">http://www.thinkfirst.org</a>                                                 | 630-961-1400 |
| Thompson Surgical Instruments, Inc.              | 744          | <a href="http://www.thompsonsurgical.com">http://www.thompsonsurgical.com</a>                                     | 231-922-0177 |
| TOBRA MEDICAL INC                                | 838          | <a href="http://www.tobramedical.com">http://www.tobramedical.com</a>                                             | 866-777-1505 |
| Tocagen                                          | 233          | <a href="http://www.tocagen.com">http://www.tocagen.com</a>                                                       | 858-412-8400 |
| UFSK International                               | 251          | <a href="https://www.ufsk-osys.com/en.html">https://www.ufsk-osys.com/en.html</a>                                 | 866-491-6243 |
| Weatherby Healthcare                             | 237          | <a href="http://www.weatherbyhealthcare.com">http://www.weatherbyhealthcare.com</a>                               | 801-930-4163 |
| WebMD & Vitals.com                               | 908          | <a href="http://webmdprofiles.com">http://webmdprofiles.com</a>                                                   | 310-280-4436 |
| Xoran Technologies                               | 313          | <a href="http://xorantech.com">http://xorantech.com</a>                                                           | 734-418-5168 |
| Xtant Medical                                    | 363          | <a href="https://xtantmedical.com/">https://xtantmedical.com/</a>                                                 | 406-388-0480 |
| Zap Surgical Systems, Inc.                       | 109          | <a href="http://www.zapsurgical.com">http://www.zapsurgical.com</a>                                               | 415-533-4743 |
| ZEISS                                            | 437          | <a href="http://www.meditec.zeiss.com">http://www.meditec.zeiss.com</a>                                           | 925-557-4541 |
| Zimmer Biomet                                    | 909          | <a href="http://www.zimmerbiomet.com">http://www.zimmerbiomet.com</a>                                             | 904-741-4400 |

# PRODUCTS & SERVICES

| Category                                    | Company                                       | Booth Number |
|---------------------------------------------|-----------------------------------------------|--------------|
| Allografts / Human Tissue                   | Biologica Technologies                        | 236          |
|                                             | CoreLink                                      | 449          |
|                                             | CTL Amedica                                   | 548          |
|                                             | DePuy Synthes                                 | 619          |
|                                             | LeMaitre Vascular, Inc.                       | 847          |
|                                             | NuTech Spine                                  | 430          |
|                                             | Providence Medical Technology                 | 347          |
|                                             | Spineology Inc.                               | 708          |
|                                             | TOBRA MEDICAL INC                             | 838          |
| Anatomical Charts / Models                  | Takayama Instrument, Inc.                     | 445          |
| Aneurysm Clips and Accessories              | Aesculap, Inc.                                | 209          |
|                                             | Apex Medical, Inc.                            | 329          |
|                                             | JTS Surgical                                  | 944          |
|                                             | Mizuho America, Inc.                          | 937          |
|                                             | Rapid Medical                                 | 447          |
|                                             | Scanlan International, Inc.                   | 500          |
| Bone Growth Stimulators                     | Biologica Technologies                        | 236          |
|                                             | DJO                                           | 629          |
| Bone Substitute                             | Biocomposites Inc.                            | 550          |
|                                             | Biologica Technologies                        | 236          |
|                                             | CoreLink                                      | 449          |
|                                             | DePuy Synthes                                 | 619          |
|                                             | NovaBone Products                             | 444          |
|                                             | RTI Surgical                                  | 355          |
|                                             | TOBRA MEDICAL INC                             | 838          |
| Business Management Solutions               | NeuroPoint Alliance                           | 351          |
| Cervical Collars                            | DJO                                           | 629          |
|                                             | PMT Corporation                               | 608          |
| Computer Hardware                           | MRI Interventions Inc.                        | 238          |
| Computer Software for Surgical Applications | 7D Surgical                                   | 831          |
|                                             | Monteris Medical                              | 808          |
|                                             | MRI Interventions Inc.                        | 238          |
|                                             | NeuroPoint Alliance                           | 351          |
| Continuing Medical Education Courses        | American Association of Neurological Surgeons | 348          |
|                                             | North American Neuromodulation Society (NANS) | 950          |
|                                             | North American Spine Society                  | 845          |
|                                             | Synaptive Medical                             | 318          |
| Craniotomes, Drills & Accessories           | Aesculap, Inc.                                | 209          |
|                                             | Bien-Air Surgery SA                           | 346          |
|                                             | JTS Surgical                                  | 944          |
|                                             | NSK America Corp.                             | 649          |
|                                             | Phasor Health LLC                             | 748          |
|                                             | Sophysa                                       | 612          |
|                                             | Stryker                                       | 419          |
| CSF Drainage Devices                        | Arkis BioSciences                             | 431          |
|                                             | Brain Navi Biotechnology Co., Ltd.            | 127          |
|                                             | IRRAS                                         | 662          |

| Category                                                       | Company                                       | Booth Number |
|----------------------------------------------------------------|-----------------------------------------------|--------------|
|                                                                | Natus Neuro                                   | 501          |
|                                                                | Phasor Health LLC                             | 748          |
|                                                                | Sophysa                                       | 612          |
| <b>CT/MRI Magnetic Source Imaging</b>                          | GE Healthcare                                 | 837          |
|                                                                | IMRIS                                         | 812          |
|                                                                | Mobius Imaging                                | 929          |
| <b>Diagnostic Imaging</b>                                      | BK Medical                                    | 332          |
|                                                                | GE Healthcare                                 | 837          |
|                                                                | IMRIS                                         | 812          |
|                                                                | Invenio Imaging Inc                           | 555          |
|                                                                | MRI Interventions Inc.                        | 238          |
|                                                                | Mobius Imaging                                | 929          |
| <b>Dura Substitute</b>                                         | JTS Surgical                                  | 944          |
|                                                                | LeMaitre Vascular, Inc.                       | 847          |
|                                                                | Natus Neuro                                   | 501          |
| <b>Electronics</b>                                             | Nova Surgical Innovations, Inc.w              | 612          |
| <b>Endoscopes, Neurological</b>                                | Aesculap, Inc.                                | 209          |
|                                                                | Apex Medical, Inc.                            | 329          |
|                                                                | Clarus Medical LLC                            | 836          |
|                                                                | elliquence, LLC.                              | 633          |
|                                                                | Invenio Imaging Inc                           | 555          |
|                                                                | joimax, Inc. – Endoscopic Spine Surgery       | 840          |
|                                                                | Karl Storz Endoscopy - America, Inc.          | 709          |
|                                                                | Kirwan Surgical Products                      | 408          |
|                                                                | Olympus America, Inc.                         | 354          |
| <b>Endovascular Devices</b>                                    | NICO Corporation                              | 945          |
|                                                                | Rapid Medical                                 | 447          |
|                                                                | Stryker                                       | 419          |
| <b>Functional Stereotactic Surgery</b>                         | 7D Surgical                                   | 831          |
|                                                                | Integra LifeSciences                          | 700          |
|                                                                | North American Neuromodulation Society (NANS) | 950          |
|                                                                | PMT Corporation                               | 608          |
|                                                                | Zimmer Biomet                                 | 909          |
| <b>Halo Systems / Spinal Orthosis / Spinal Support Systems</b> | Integra LifeSciences                          | 700          |
|                                                                | PMT Corporation                               | 608          |
|                                                                | pro med instruments, Inc.                     | 648          |
| <b>Headlights, Surgical</b>                                    | Designs for Vision, Inc.                      | 544          |
|                                                                | Integra LifeSciences                          | 700          |
|                                                                | KLS Martin                                    | 800          |
|                                                                | Ronin Surgical Corp.                          | 242          |
|                                                                | Rose Micro Solutions                          | 345          |
|                                                                | SurgiTel                                      | 851          |
| <b>Health &amp; Sports Equipment</b>                           | Phasor Health LLC                             | 748          |
| <b>Hemostats</b>                                               | Scanlan International, Inc.                   | 500          |
| <b>Image-Guided Navigation Systems</b>                         | 7D Surgical                                   | 831          |
|                                                                | Brain Navi Biotechnology Co., Ltd.            | 127          |
|                                                                | DePuy Synthes                                 | 619          |
|                                                                | Globus Medical                                | 731          |
|                                                                | Invenio Imaging Inc                           | 555          |

| Category               | Company                                       | Booth Number |
|------------------------|-----------------------------------------------|--------------|
|                        | Medtronic                                     | 719          |
|                        | Mobius Imaging                                | 929          |
|                        | Monteris Medical                              | 808          |
|                        | MRI Interventions Inc.                        | 238          |
|                        | Siemens Industry, Inc.                        | 412          |
|                        | Stryker                                       | 419          |
|                        | Synaptive Medical                             | 318          |
| <b>Imaging Agents</b>  | GE Healthcare                                 | 837          |
|                        | NX Development Corp                           | 121          |
| <b>Lasers</b>          | Invenio Imaging Inc                           | 555          |
|                        | Monteris Medical                              | 808          |
| <b>Medical Devices</b> | 7D Surgical                                   | 831          |
|                        | Ad-Tech Medical Instrument Corp.              | 712          |
|                        | Apex Medical, Inc.                            | 329          |
|                        | Arkis BioSciences                             | 431          |
|                        | BK Medical                                    | 332          |
|                        | Bien-Air Surgery SA                           | 346          |
|                        | Biocomposites Inc.                            | 550          |
|                        | Boston Scientific                             | 508          |
|                        | Brain Navi Biotechnology Co., Ltd.            | 127          |
|                        | Clarus Medical LLC                            | 836          |
|                        | CoreLink                                      | 449          |
|                        | CTL Amedica                                   | 548          |
|                        | DePuy Synthes                                 | 619          |
|                        | DIXI Medical USA                              | 342          |
|                        | elliquence, LLC.                              | 633          |
|                        | Gauthier Biomedical Inc.                      | 331          |
|                        | Globus Medical                                | 731          |
|                        | GT Medical Technologies, Inc.                 | 545          |
|                        | Hemedex                                       | 651          |
|                        | Innovasis                                     | 660          |
|                        | IRRAS                                         | 662          |
|                        | JEIL Medical Corporation                      | 737          |
|                        | Hitachi Healthcare                            | 925          |
|                        | Innovasis                                     | 660          |
|                        | IRRAS                                         | 662          |
|                        | JEIL Medical Corporation                      | 737          |
|                        | joimax, Inc. – Endoscopic Spine Surgery       | 840          |
|                        | Karl Storz Endoscopy - America, Inc.          | 709          |
|                        | Kelyniam Global Inc.                          | 451          |
|                        | Kirwan Surgical Products                      | 408          |
|                        | KLS Martin                                    | 800          |
|                        | Kogent Surgical                               | 813          |
|                        | LeMaitre Vascular, Inc.                       | 847          |
|                        | Medtronic                                     | 719          |
|                        | Misonix, Inc.                                 | 115          |
|                        | Mizuho America, Inc.                          | 937          |
|                        | Mizuho OSI                                    | 936          |
|                        | Mobius Imaging                                | 929          |
|                        | Monteris Medical                              | 808          |
|                        | Natus Neuro                                   | 501          |
|                        | NeuroPace, Inc.                               | 336          |
|                        | NICO Corporation                              | 945          |
|                        | North American Neuromodulation Society (NANS) | 950          |
|                        | Nova Surgical Innovations, Inc.               | 612          |
|                        | NovaBone Products                             | 444          |

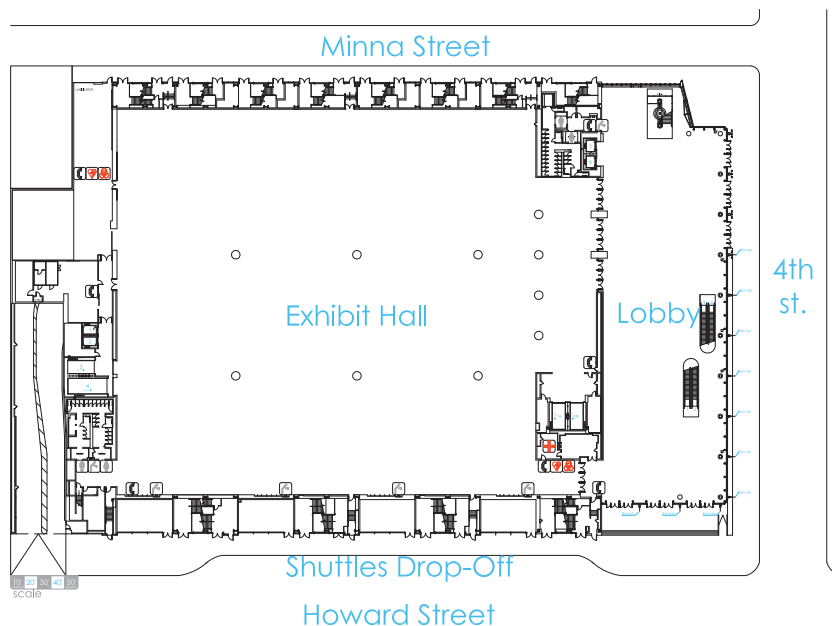


| Category                                  | Company                                          | Booth Number |
|-------------------------------------------|--------------------------------------------------|--------------|
|                                           | Novocure, Inc.                                   | 344          |
|                                           | NSK America Corp.                                | 649          |
|                                           | NuTech Spine                                     | 430          |
|                                           | Olympus America, Inc.                            | 354          |
|                                           | OssDsign                                         | 912          |
|                                           | OsteoMed                                         | 509          |
|                                           | Panasonic                                        | 645          |
|                                           | Penumbra, Inc.                                   | 637          |
|                                           | Phasor Health LLC                                | 748          |
|                                           | PMT Corporation                                  | 608          |
|                                           | pro med instruments, Inc.                        | 648          |
|                                           | Providence Medical Technology                    | 347          |
|                                           | RTI Surgical                                     | 355          |
|                                           | Ronin Surgical Corp.                             | 242          |
|                                           | Shukla Medical                                   | 333          |
|                                           | Silk Road Medical                                | 448          |
|                                           | Sophysa                                          | 612          |
|                                           | Spine Wave                                       | 728          |
|                                           | Spineology Inc.                                  | 708          |
|                                           | Synaptive Medical                                | 318          |
|                                           | TOBRA MEDICAL INC                                | 838          |
|                                           | UFSK International                               | 251          |
|                                           | Zimmer Biomet                                    | 909          |
| <b>Microscope Systems</b>                 | Aesculap, Inc.                                   | 209          |
|                                           | Invenio Imaging Inc                              | 555          |
|                                           | Leica Microsystems                               | 745          |
|                                           | Olympus America, Inc.                            | 354          |
|                                           | Panasonic                                        | 645          |
|                                           | Rose Micro Solutions                             | 345          |
|                                           | Synaptive Medical                                | 318          |
|                                           | Takayama Instrument, Inc.                        | 445          |
| <b>Microsurgical Instrumentation</b>      | Apex Medical, Inc.                               | 329          |
|                                           | Bien-Air Surgery SA                              | 346          |
|                                           | Boss Instruments Ltd.                            | 644          |
|                                           | Fehling Surgical Instruments, Inc.               | 513          |
|                                           | Kirwan Surgical Products                         | 408          |
|                                           | KLS Martin                                       | 800          |
|                                           | Mizuho America, Inc.                             | 937          |
|                                           | NICO Corporation                                 | 945          |
|                                           | NSK America Corp.                                | 649          |
|                                           | Scanlan International, Inc.                      | 500          |
|                                           | Sutter Medical Technologies USA                  | 403          |
|                                           | TOBRA MEDICAL INC                                | 838          |
| <b>Monitoring Systems</b>                 | Hemedex                                          | 651          |
|                                           | IRRAS                                            | 662          |
|                                           | Sophysa                                          | 612          |
| <b>Operating Tables &amp; Accessories</b> | IMRIS                                            | 812          |
|                                           | Mizuho America, Inc.                             | 937          |
|                                           | Mizuho OSI                                       | 936          |
| <b>Patient Education Information</b>      | American Association of Neurological Surgeons    | 348          |
|                                           | Brain Aneurysm Foundation                        | 446          |
|                                           | DePuy Synthes                                    | 619          |
|                                           | Nadia International, Inc.                        | 741          |
|                                           | North American Neuromodulation Society (NANS)    | 950          |
|                                           | North American Spine Society                     | 845          |
|                                           | ThinkFirst National Injury Prevention Foundation | 547          |
| <b>Pharmaceuticals</b>                    | Portola Pharmaceuticals                          | 561          |
|                                           | Tocagen                                          | 233          |

| Category                          | Company                                       | Booth Number |
|-----------------------------------|-----------------------------------------------|--------------|
| Practice Management               | NeuroPoint Alliance                           | 351          |
|                                   | North American Spine Society                  | 845          |
| Publishers, Scientific / Journals | Elsevier, Inc.                                | 401          |
|                                   | Journal of Neurosurgery                       | 349          |
|                                   | North American Spine Society                  | 845          |
|                                   | Oxford University Press                       | 551          |
|                                   | Thieme Medical Publishers                     | 609          |
| Radiation Protection Products     | 7D Surgical                                   | 831          |
| Recruiters                        | Baylor Scott & White Health                   | 428          |
|                                   | Carle Physician Group                         | 910          |
|                                   | Essentia Health                               | 946          |
|                                   | Hayes Locums                                  | 502          |
|                                   | Kaiser Permanente                             | 340          |
|                                   | RosmanSearch, Inc.                            | 809          |
|                                   | Weatherby Healthcare                          | 237          |
| Research, Medical Marketing       | Kelyniam Global Inc.                          | 451          |
|                                   | North American Spine Society                  | 845          |
|                                   | WebMD & Vitals.com                            | 908          |
| Rigid Fixation / Plating Systems  | Bioplate, Inc.                                | 849          |
|                                   | DePuy Synthes                                 | 619          |
|                                   | JTS Surgical                                  | 944          |
|                                   | Kelyniam Global Inc.                          | 451          |
|                                   | RTI Surgical                                  | 355          |
|                                   | Spineology Inc.                               | 708          |
|                                   | Stryker                                       | 419          |
| Robotics                          | Brain Navi Biotechnology Co., Ltd.            | 127          |
|                                   | Globus Medical                                | 731          |
|                                   | Hitachi Healthcare                            | 925          |
|                                   | Medtronic                                     | 719          |
|                                   | Monteris Medical                              | 808          |
|                                   | Synaptive Medical                             | 318          |
|                                   | Zap Surgical Systems, Inc.                    | 109          |
|                                   | Zimmer Biomet                                 | 909          |
| Shunts & Valves                   | Aesculap, Inc.                                | 209          |
|                                   | Integra LifeSciences                          | 700          |
|                                   | LeMaitre Vascular, Inc.                       | 847          |
|                                   | Natus Neuro                                   | 501          |
|                                   | Sophysa                                       | 612          |
| Spinal Cord Stimulation Systems   | Boston Scientific                             | 508          |
|                                   | Globus Medical                                | 731          |
|                                   | Medtronic                                     | 719          |
|                                   | North American Neuromodulation Society (NANS) | 950          |
| Spinal Fixation Instrumentation   | CoreLink                                      | 449          |
|                                   | CTL Amedica                                   | 548          |
|                                   | DePuy Synthes                                 | 619          |
|                                   | Gauthier Biomedical Inc.                      | 331          |
|                                   | Globus Medical                                | 731          |
|                                   | Medtronic                                     | 719          |
|                                   | Phasor Health LLC                             | 748          |
|                                   | pro med instruments, Inc.                     | 648          |
|                                   | Providence Medical Technology                 | 347          |
|                                   | RTI Surgical                                  | 355          |

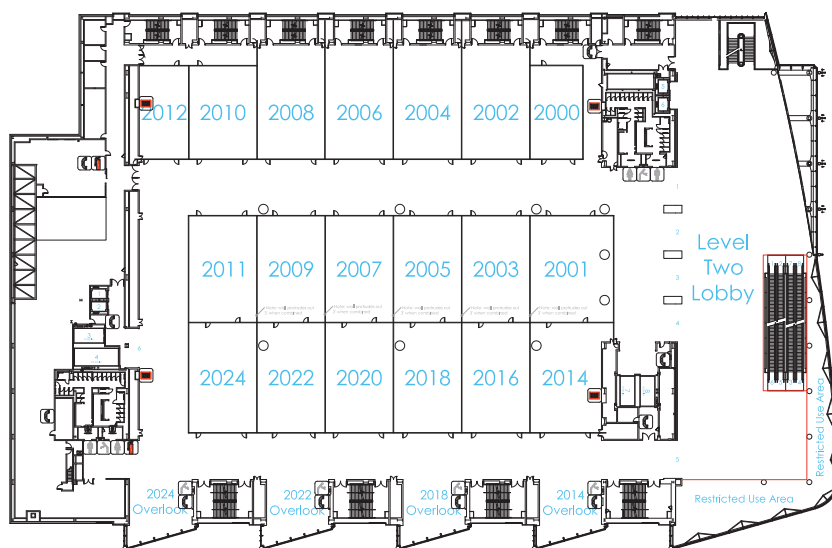
| Category                                 | Company                              | Booth Number |
|------------------------------------------|--------------------------------------|--------------|
|                                          | Shukla Medical                       | 333          |
|                                          | Spineology Inc.                      | 708          |
|                                          | Stryker                              | 419          |
| <b>Spinal Support Systems</b>            | Shukla Medical                       | 333          |
| <b>Stereotactic Radiosurgery Systems</b> | Integra LifeSciences                 | 700          |
|                                          | Zap Surgical Systems, Inc.           | 109          |
| <b>Sterilization Containers</b>          | Fehling Surgical Instruments, Inc.   | 513          |
|                                          | Kirwan Surgical Products             | 408          |
|                                          | Scanlan International, Inc.          | 500          |
| <b>Surgical Instruments / Supplies</b>   | Apex Medical, Inc.                   | 329          |
|                                          | Bien-Air Surgery SA                  | 346          |
|                                          | Arkis BioSciences                    | 431          |
|                                          | Boss Instruments Ltd.                | 644          |
|                                          | Clarus Medical LLC                   | 836          |
|                                          | CoreLink                             | 449          |
|                                          | CTL Amedica                          | 548          |
|                                          | DIXI Medical USA                     | 342          |
|                                          | elliquence, LLC                      | 633          |
|                                          | Fehling Surgical Instruments, Inc.   | 513          |
|                                          | Gauthier Biomedical Inc.             | 331          |
|                                          | JTS Surgical                         | 944          |
|                                          | Karl Storz Endoscopy - America, Inc. | 709          |
|                                          | Kelyniam Global Inc.                 | 451          |
|                                          | Kirwan Surgical Products             | 408          |
|                                          | KLS Martin                           | 800          |
|                                          | Kogent Surgical                      | 813          |
|                                          | Koros USA, Inc.                      | 409          |
|                                          | Mizuho America, Inc.                 | 937          |
|                                          | Mizuho OSI                           | 936          |
|                                          | Nova Surgical Innovations, Inc.      | 612          |
|                                          | Olympus America, Inc.                | 354          |
|                                          | Phasor Health LLC                    | 748          |
|                                          | PMT Corporation                      | 608          |
|                                          | Providence Medical Technology        | 347          |
|                                          | Rose Micro Solutions                 | 345          |
|                                          | Scanlan International, Inc.          | 500          |
|                                          | Shukla Medical                       | 333          |
|                                          | Spineology Inc.                      | 708          |
|                                          | Sutter Medical Technologies USA      | 403          |
|                                          | Takayama Instrument, Inc.            | 445          |
|                                          | TeDan Surgical Innovations           | 454          |
|                                          | Thompson Surgical Instruments, Inc.  | 744          |
|                                          | TOBRA MEDICAL INC.                   | 838          |
| <b>Telescopes, Surgical (Loupes)</b>     | Designs for Vision, Inc.             | 544          |
|                                          | Rose Micro Solutions                 | 345          |
|                                          | SurgiTel                             | 851          |
| <b>Ultrasound Equipment</b>              | BK Medical                           | 332          |
|                                          | GE Healthcare                        | 837          |
|                                          | Hitachi Healthcare                   | 925          |
| <b>Video Equipment</b>                   | Karl Storz Endoscopy - America, Inc. | 709          |
|                                          | SurgiTel                             | 851          |
| <b>Web Page Developers</b>               | WebMD & Vitals.com                   | 908          |





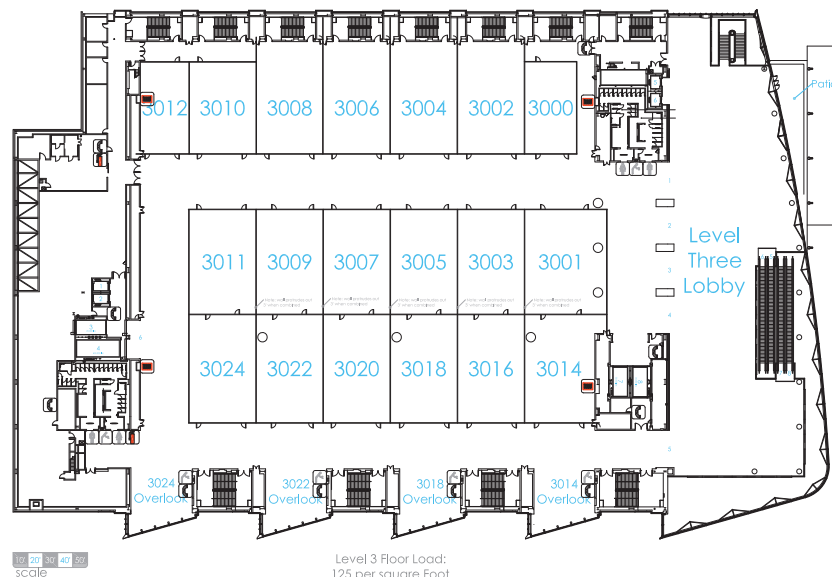
### LEVEL ONE

- Registration
- CNS Central
- CNS Foundation Booth – Donate Today!



### LEVEL TWO

- Sessions
- Sergeant-at-Arms (2022 Overlook)
- Resident SANS Challenge (Room 2018)
- CNS Resident Social and CSNS Young Neurosurgeons Reception (Room 2000)
- Interactive Multimedia Research Presentation Session (Level 2 Lobby)
- Opening Reception (Level Two Lobby)

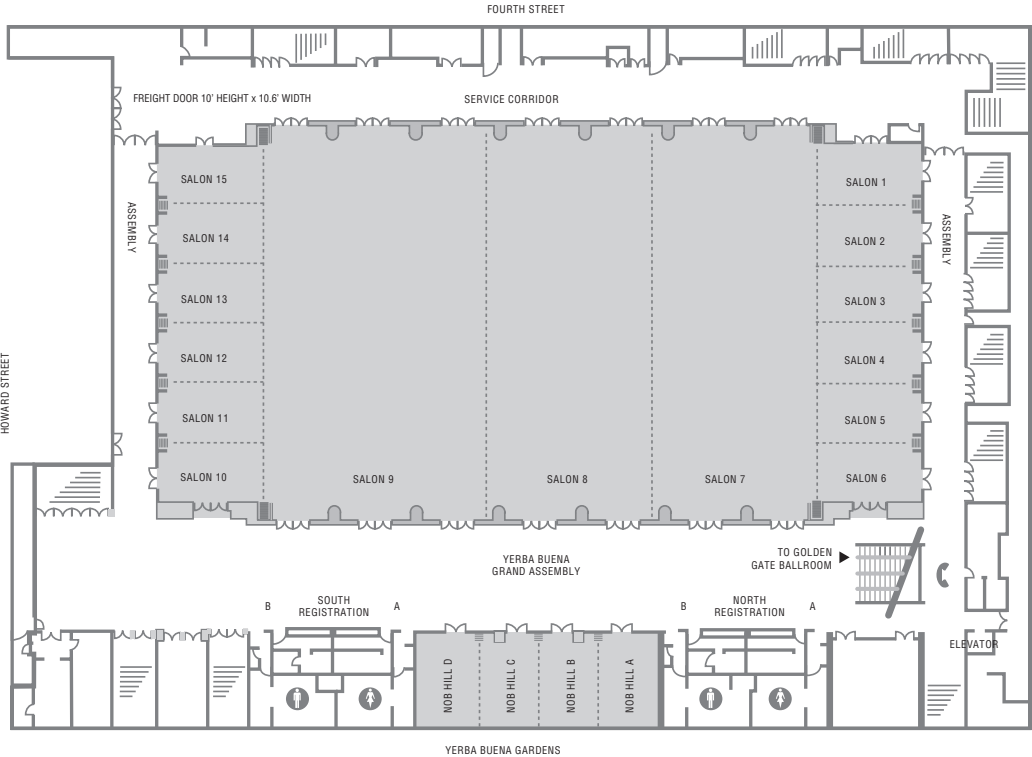


### LEVEL THREE

- General Scientific Sessions
- Speaker Ready Room (Room 3000)
- Sessions

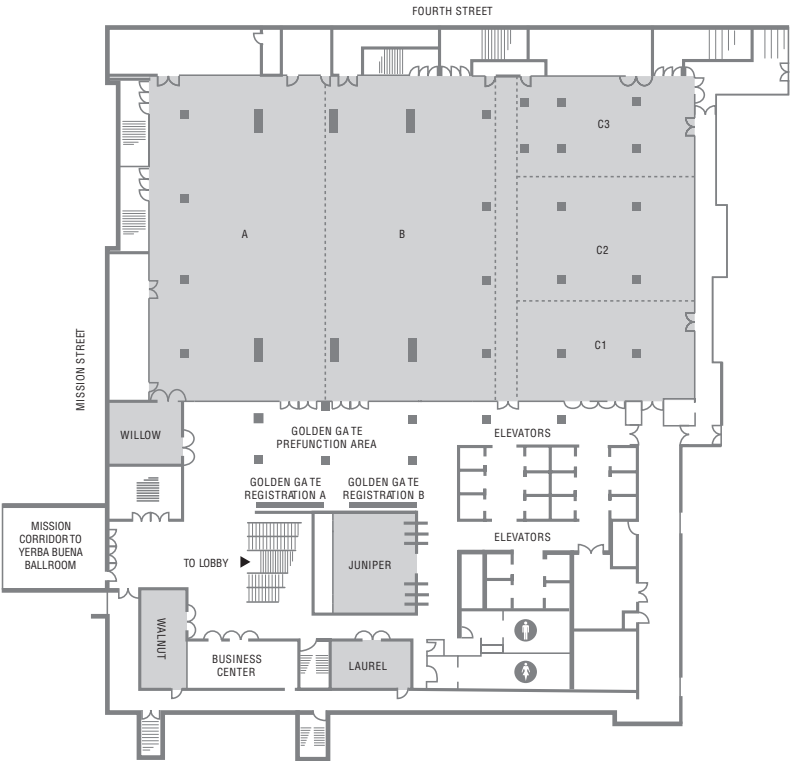


# SAN FRANCISCO MARRIOTT MARQUIS



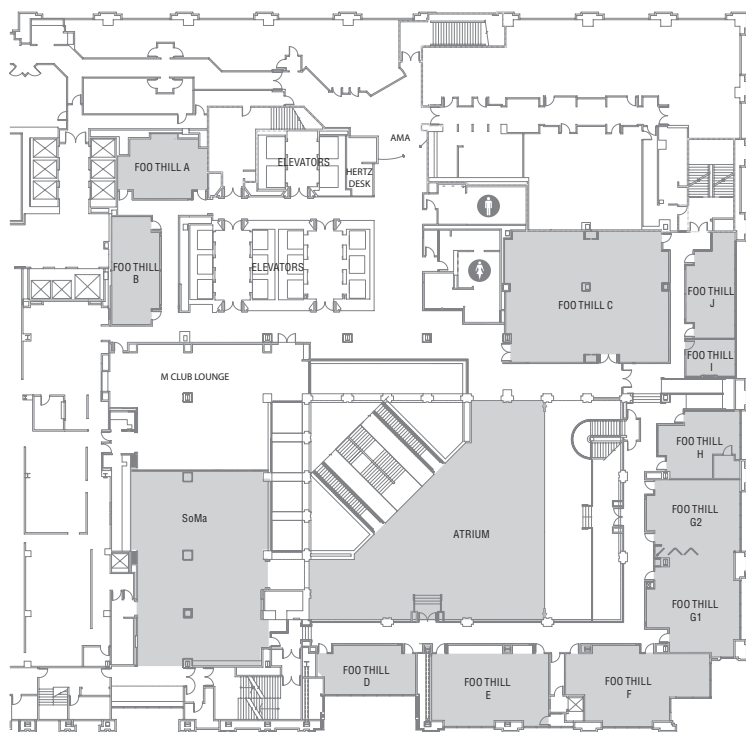
## LOWER B2 LEVEL

■ Committee Meetings



## B2 LEVEL

■ Committee Meetings  
■ Oral Boards Course

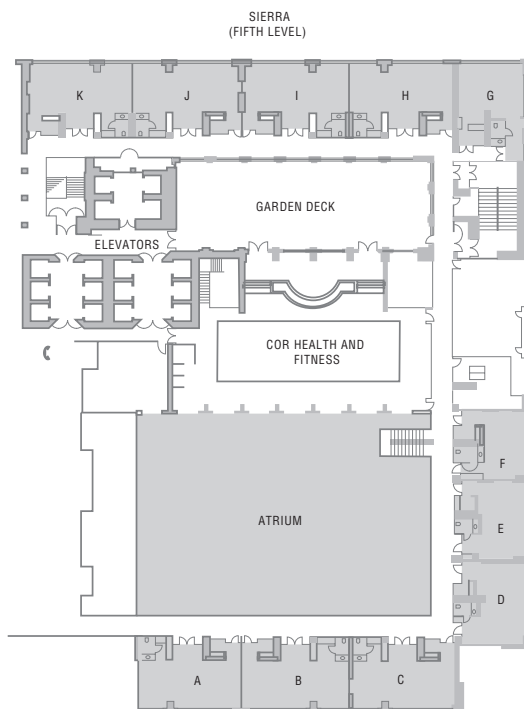
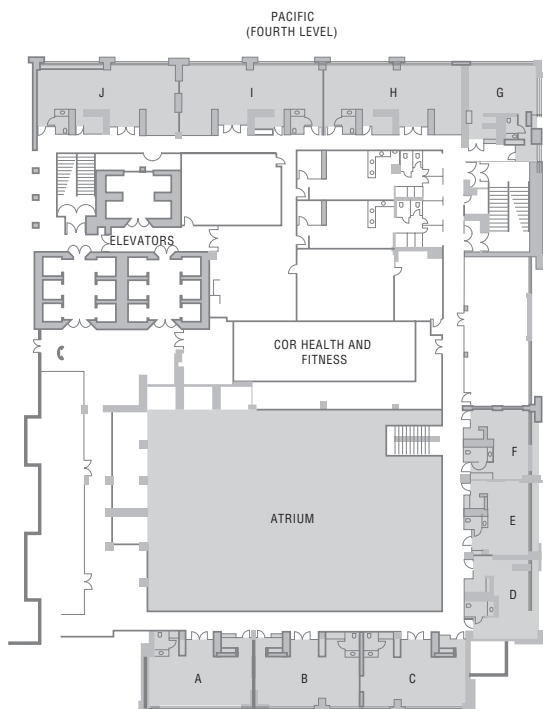


## SECOND LEVEL

- Committee Meetings
- Spouse Hospitality (2nd Floor Atrium)

## FOURTH AND FIFTH LEVEL

- Committee Meetings



# See you next year!



# CNS

## 2020 ANNUAL MEETING



VISION FOR THE FUTURE

**MIAMI, FLORIDA**  
**SEPTEMBER 12-16, 2020**



CNS President  
Steven N. Kalkanis



Annual Meeting Chair  
Nader Pouratian



Scientific Program Chair  
Brian V. Nahed



There is robotic navigation...  
**then there is ExcelsiusGPS®**



**SMARTER**

Smart tools to maintain  
navigation integrity

**FASTER**

Streamlined workflow  
for less disruption

**STRONGER**

Rigid arm guidance  
for any approach



*Only* with  
**ExcelsiusGPS®**

[www.Excelsius-GPS.com](http://www.Excelsius-GPS.com)

Life moves us 

# PRECISION, UNRIVALED. POSSIBILITIES, UNLEASHED.



## Stealth Autoguide<sup>TM</sup>

Cranial Robotic Guidance Platform

ROBOTIC PRECISION.  
**POWERED BY YOU.**

**STEALTH + ROBOTICS**



## Midas Rex<sup>TM</sup> MR8<sup>TM</sup>

High Speed Drill System

**ADVANCING**  
SURGICAL POSSIBILITIES.

Visit our booth at CNS to learn more  
about incorporating our **innovative  
technology** into your care continuum.

Stealth Autoguide<sup>TM</sup> - Pending 510(k) clearance.

© 2019 Medtronic. All rights reserved. Medtronic, Medtronic logo and Further, Together are trademarks of Medtronic. All other brands are trademarks of a Medtronic company. UC202004580 EN

## Medtronic

**Neurosurgery  
Enabling Technologies**  
826 Coal Creek Circle  
Louisville, CO 80027 USA  
Toll free: (877) 242-9504  
Telephone: (720) 890-3200  
Fax: (720) 890-3500

**Midas Rex**  
4620 N. Beach St.  
Fort Worth, TX 76137 USA  
Toll free: (800) 433-7080  
Fax: (800) 468-9713

[medtronic.com](http://medtronic.com)