Preliminary Program

Register at cns.org/2016
Advance Registration Deadline: August 25, 2016
The Congress of Neurological Surgeons welcomes

2016 International Partner

Continental Association of African Neurosurgical Societies (CAANS)

Graham Fieggen, MD
CAANS President

The Congress of Neurological Surgeons welcomes

2016 Partner Society

California Association of Neurological Surgeons (CANS)

Praveen Mummaneni, MD
CANS President
President’s Message

On behalf of the Congress of Neurological Surgeons Executive Committee, the Scientific Program Committee, and the 2016 CNS Honored Guest Edward H. Oldfield, MD, I invite you to attend this year’s CNS Annual Meeting in San Diego, California, September 24-28, 2016.

With the theme Advance, Adapt, Achieve, this year’s meeting is enhanced with an unprecedented number of innovations. We’re bringing more clinically focused content, case-based presentations, and in-depth sessions on the pathologies and techniques critical to your practice.

ADVANCE
Gain a competitive edge with high-impact education in subspecialty and practice management topics. We continue to find innovative ways to deliver content, such as the new multi-platformed Operative Neurosurgery Sessions that connect the ONS journal with a state-of-the-art vascular replication system using 3D printing. We’re also bringing back the popular daily live surgery sessions in the exhibit hall that put you in the center of the operating room.

ADAPT
The CNS Annual Meeting keeps you abreast of our rapidly changing health-care system with practical courses on implementing ICD-10 coding, developing your practice’s online presence, and navigating the regulations that affect your hospital relationships and negotiations. Plus, our new Guidelines Sessions cover the latest evidence-based treatment of traumatic brain injury, brain metastases, and thoracolumbar fractures.

ACHIEVE
Recharge and reconnect with your peers at luncheon and dinner seminars and visit with more than 150 exhibiting companies representing the newest technologies in the field. For inspiration, we present an exciting lineup of guest speakers including Steve Wozniak, co-founder of Apple Computer, Inc.; legendary baseball executive Billy Beane; Sterling Professor of Law and Political Science Akhil Reed Amar; bestselling authors Daniel James Brown (The Boys in the Boat) and Viktor Mayer-Schönberg (Big Data); and Vice Admiral Mike Shoemaker.

We are honored to host the Continental Association of African Neurosurgical Societies (CAANS) as our international partner this year. CAANS represents African continental neurosurgery, and like the CNS, promotes global improvement in neurosurgical care. We are also delighted to welcome the California Association of Neurological Surgeons (CANS).

Please join me in San Diego, a wonderful vacation destination for you and your family. I look forward to seeing you at the 2016 CNS Annual Meeting.

Sincerely,
Russell R. Lonser, MD
CNS President

The purpose of the 2016 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.

Who should attend:
Neurological surgeons, neurosurgery nurses, physician assistants, orthopedic surgeons, primary care physicians, gerontologists, radiologists, hospital administrators, oncologists, neurologists, pediatricians, physiatrists, and infectious disease specialists are welcome and encouraged to attend the 2016 CNS Annual Meeting.
**SATURDAY, SEPTEMBER 24**

8:00 am–5:00 pm  | Symposia 01: Neurovascular Update: Evidence-based Guidelines in Ischemic and Hemorrhagic Stroke for the Practicing Neurosurgeon

8:00 am–4:00 pm  | Full Day Practical Course (PC01)

8:00–11:30 am  | Morning Practical Courses (PC02–PC05)

12:30–4:00 pm  | Afternoon Practical Courses (PC06–PC12)

5:00–6:30 pm  | International Reception
Marriott Marquis San Diego Marina

6:00–8:30 pm  | Dinner Seminar (DIN01): Cervical Spondylotic Myelopathy

**SUNDAY, SEPTEMBER 25**

8:00 am–4:00 pm  | Symposia 02: Spinal Cord Stimulation: The Transformation

8:00 am–4:00 pm  | Full Day Practical Courses (PC13–PC15)

8:00–11:30 am  | Morning Practical Courses (PC16–PC23)

12:30–4:00 pm  | Afternoon Practical Courses (PC24–PC33)

1:00–3:00 pm  | CNS Resident SANS Challenge
Preliminary Rounds

4:05–6:30 pm  | General Scientific Session I
Marriott Marquis San Diego Marina

6:30–8:30 pm  | CNS Opening Reception
Marriott Marquis San Diego Marina

**MONDAY, SEPTEMBER 26**

7:00–9:00 am  | General Scientific Session II

9:00 am–3:00 pm  | Exhibit Hall Open

9:00–10:00 am  | Exhibit Hall Break

9:15–9:45 am  | Live Surgery in the Exhibit Hall

10:00–11:30 am  | General Scientific Session II, continued

11:45 am–1:15 pm  | Luncheon Seminars (M01–M15)

11:45 am–1:15 pm  | Industry Sponsored Lunch Symposia

1:15–2:15 pm  | Exhibit Hall Break

2:15–3:15 pm  | Operative Neurosurgery Session 1
Clinical Controversy Session 1
Guidelines Session 1

3:15–4:45 pm  | Section Sessions and Oral Presentations

4:45–6:15 pm  | Section Poster Viewing

4:45–6:15 pm  | Clinical Trials Update Session

7:00–9:30 pm  | Dinner Seminar (DIN02): New CPT Codes, ICD-10, MIPS, and Bundling: What These Challenges Mean to Your Bottom Line
Dinner Seminar (DIN03): Management of Meningiomas (Asymptomatic to Atypical)
### TUESDAY, SEPTEMBER 27

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<td>7:00–9:00 am</td>
<td>General Scientific Session III</td>
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<tr>
<td>9:00 am–3:00 pm</td>
<td>Exhibit Hall Open</td>
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<td>General Scientific Session III, continued</td>
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<td>11:45 am–1:15 pm</td>
<td>Luncheon Seminars (T16–T30)</td>
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<td>Exhibit Hall Break</td>
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<tr>
<td>1:15–2:15 pm</td>
<td>Annual Business Meeting</td>
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<td>1:45–3:15 pm</td>
<td>CNS Resident SANS Challenge Championship Round</td>
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<tr>
<td>2:15–3:15 pm</td>
<td><em>Operative Neurosurgery</em> Session 2</td>
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<td>Clinical Controversy Session 2</td>
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<td>Guidelines Session 2</td>
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<td>3:15–4:45 pm</td>
<td>Section Sessions and Oral Presentations</td>
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<td>4:45–5:15 pm</td>
<td>Rapid-exchange Oral Presentations Sessions</td>
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<td>5:15–6:15 pm</td>
<td>Section Poster Viewing</td>
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<td>5:45–6:45 pm</td>
<td>Resident Recruitment Social</td>
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<tr>
<td>7:00–9:30 pm</td>
<td>Dinner Seminar (DIN04): Concussion: Diagnosis, Management and Outcomes</td>
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### WEDNESDAY, SEPTEMBER 28

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<tr>
<td>7:00–9:00 am</td>
<td>General Scientific Session IV</td>
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<tr>
<td>9:00 am–2:15 pm</td>
<td>Exhibit Hall Open</td>
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<td>9:00–10:00 am</td>
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<tr>
<td>10:00–11:30 am</td>
<td>General Scientific Session IV, continued</td>
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<tr>
<td>11:45 am–1:15 pm</td>
<td>Luncheon Seminars (W31–W43)</td>
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<td>Industry Sponsored Lunch Symposia</td>
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<td>1:15–2:15 pm</td>
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<td>Clinical Controversy Session 3</td>
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<td>Guidelines Session 3</td>
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<tr>
<td>3:15–3:45 pm</td>
<td>Rapid-exchange Oral Presentations Sessions</td>
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#CNS2016
Follow us on Twitter, Facebook, and LinkedIn for the latest information and meeting updates.
Edward Oldfield holds the Crutchfield Chair in Neurosurgery and is a professor of neurosurgery and internal medicine at the University of Virginia (UVA). He also leads a multidisciplinary effort in the treatment of pituitary tumors and contributes to the research program in the Department of Neurosurgery at UVA.

In 1986, Dr. Oldfield became chief of the Surgical Neurology Branch at the National Institute of Neurological Disorders and Stroke (NINDS) at the National Institutes of Health (NIH). At the NIH he led successful laboratory and clinical research efforts in the areas of brain and pituitary tumors, syringomyelia, von Hippel-Lindau disease, spinal arteriovenous malformations, pathophysiology and therapy of cerebral vasospasm after subarachnoid hemorrhage, and development of new drug delivery approaches for the central nervous system.

He is the author of over 500 original scientific and clinical contributions to medical literature and is the co-inventor of patents on convection-enhanced drug delivery and genetic therapy. His contributions to academic and organized neurosurgery include membership on the editorial boards of Neurosurgery and the Journal of Neurosurgery, where he recently completed a term of eight years as associate editor.

Dr. Oldfield has served as vice president and president of the Society of Neurological Surgeons (SNS). He has received numerous awards including the Public Health Superior Service Award, the Grass Medal for Meritorious Research in Neurological Science (SNS), the Farber Award (AANS), the Distinguished Alumnus Award, University of Kentucky Medical Alumni Association, the Harvey Cushing Medal (AANS), the first (2013) annual AANS Cushing Award for Technical Excellence and Innovation in Neurosurgery. In 2015 he received the Charles B. Wilson Award of the Joint Tumor Section for “for career achievement and substantial contributions to understanding and treatment of brain tumors.”

Dr. Oldfield is married to Susan Wachs, and they are the proud parents of Caroline (1989).

Look for Dr. Oldfield at the following sessions:

**Monday, March 26**
- 8:40–9:00 am
  - Honored Guest Presentation: Cushing’s Disease: Lessons Learned from 1400 Cases
- 11:45–1:15 pm
  - M01: Honored Guest Luncheon

**Tuesday, March 27**
- 8:17–8:37 am
  - Honored Guest Presentation: Pathogenesis of Chiari I Pathophysiology of Syringomyelia: Implications for Therapy

**Wednesday, March 28**
- 8:16–8:32 am
  - Honored Guest Presentation: Spinal Dural Arteriovenous Fistulas: 40 Years of Progress—Unanswered Issues
Featured Speakers

WALTER E. DANDY ORATOR

Steve Wozniak

Co-founder of Apple Computer Inc. and Philanthropist

A Silicon Valley icon and philanthropist, Steve Wozniak helped shape the computing industry with his design of Apple's first line of products; the Apple I and II, and influenced the popular Macintosh. In 1976, Wozniak and Steve Jobs founded Apple Computer Inc. with Wozniak's Apple I personal computer.

For his achievements at Apple, Wozniak was awarded the National Medal of Technology by the President of the United States, the highest honor bestowed on America's leading innovators. He has been inducted into the Inventors Hall of Fame and was awarded the prestigious Heinz Award for Technology, The Economy and Employment. In 2014, he was inducted into the IndustryWeek Manufacturing Hall of Fame.

Wozniak is involved in various business and philanthropic ventures, focusing primarily on computer capabilities in schools and encouraging creativity for students. He founded the Electronic Frontier Foundation, and was the founding sponsor of the Tech Museum, Silicon Valley Ballet, and Children's Discovery Museum of San Jose.

Wozniak is Chief Scientist at Primary Data and authored the New York Times bestselling autobiography, iWoz: From Computer Geek to Cult Icon. Television appearances include Kathy Griffin: My Life on the D-List, ABC's Dancing with the Stars, and The Big Bang Theory.

11:00–11:30 am
General Scientific Session II
iWoz: A Conversation with Steve Wozniak

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

Akhil Reed Amar

Sterling Professor of Law and Political Science, Yale University

Akhil Reed Amar is a leading constitutional scholar. His work has won awards from the American Bar Association and the Federalist Society. He has been favorably cited by Supreme Court justices across the spectrum in over 30 cases, and he regularly testifies before Congress at the invitation of both parties.


5:47–6:07 pm
General Scientific Session I
2016: The Constitution at a Crossroads
NEUROSURGERY LECTURER

Billy Beane
Oakland A’s Executive VP of Baseball Operations

Considered one of the most progressive and talented baseball executives in the game today, Billy Beane has molded the Oakland Athletics into one of professional baseball’s most consistent winners since taking over as General Manager following the 1997 season.

Beane shattered traditional MLB beliefs that big payrolls equated wins by implementing a statistical methodology that led the Oakland A’s, one of the worst teams in baseball with one of the lowest payrolls, to six American League West Division Titles. That strategic methodology has come to be known as the *Moneyball* philosophy, named for the bestselling book and Oscar-nominated film chronicling Beane’s journey from General Manager to hero to celebrated management genius. Most recently, Beane was named Major League Baseball Executive of the Year for the second time by *Baseball America* in 2013 (first earned in 2002).

JOB THOMPSON HISTORY OF MEDICINE LECTURER

Daniel James Brown
*New York Times* bestselling author

Daniel James Brown is the *New York Times* bestselling author of *The Boys in the Boat: Nine Americans and Their Epic Quest for Gold at the 1936 Berlin Olympics*. The novelist grew up in the San Francisco Bay Area and attended the University of California at Berkeley. He taught writing at San Jose State University and Stanford before becoming a technical writer and editor, first in Silicon Valley and later at Microsoft. He now writes narrative nonfiction books full time. His primary interest as a writer is in bringing compelling historical events to life as vividly and accurately as he can. He lives in the country outside of Seattle, Washington, with his wife, two daughters, and an assortment of cats, dogs, chickens, and honeybees. When he is not writing, he is likely to be birding, gardening, fly fishing, reading American history, or chasing bears away from the bee hives.

**General Scientific Session III**

6:30-7:30 pm
Book signing at the CNS Opening Reception
Why is Big Data transforming the way we live, work and think? How will Big Data offer new sources of revenue to businesses, and how will organizations change in the Big Data age? These are just a few of the questions Viktor Mayer-Schönberger has addressed in over a hundred presentations since the publication of the internationally bestselling book he co-authored, *Big Data: A Revolution That Will Transform How We Live, Work, and Think*.

An acclaimed and sought-after keynote speaker, Mayer-Schönberger discusses Big Data's role in changing the face of everything from product development and scientific discovery, to human learning and health care, transportation, retail, finance and marketing.

Mayer-Schönberger’s media presence straddles international print media such as the *New York Times*, the *Wall Street Journal*, the *Guardian*, or *Die Zeit, Der Spiegel*; international broadcast media such as CNN, BCC, or PBS; and online media such as *Ars Technica, Daily Kos*, and *Wired*. More generally, he has spoken about the evolution of the information economy, and how our work and our lives change because of our digital tools and networks.

### 8:40–9:00 am
**General Scientific Session III**  
Big Data’s Impact on Medicine

### 9:00-10:00 am
Book signing at the CNS booth in the Exhibit Hall

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**Viktor Mayer-Schönberger**  
*International bestselling author*

In January 2015, Vice Admiral Mike Shoemaker assumed command of Naval Air Forces, becoming naval aviation’s seventh “Air Boss.” His command is responsible for 10 aircraft carriers and their air wings, including 170 squadrons and more than 100,000 personnel. A native of St. Petersburg, Florida, he graduated with honors from the US Naval Academy in 1982 with a Bachelor of Science degree in systems engineering and was designated a naval aviator in July 1984.

Vice Admiral Shoemaker most recently served as commander, Naval Air Force Atlantic (AIRLANT). He also served as aide to the vice chief of Naval Operations and Commander, US Pacific Command, was assigned to Navy Personnel Command, and was executive assistant to Commander, US Pacific Fleet. As a flag officer, he served as assistant commander, Navy Personnel Command for Career Management. Vice Admiral Shoemaker has accumulated more than 4,400 flight hours, primarily in the A-7E Corsair and the F/A-18C Hornet, and has 1,066 carrier-arrested landings. His commands include Strike Fighter Squadron (VFA) 105, VFA-106, Carrier Air Wing 17, Carrier Strike Group (CSG) 9, and CSG 3. His personal decorations include the Legion of Merit (6), Defense Meritorious Service Medal, Meritorious Service Medal (3), Air Medal (3), and other personal, campaign, and service ribbons.

### 4:51–5:11 pm
**General Scientific Session I**
PRESIDENT

Russell R. Lonser, MD

Dr. Lonser is professor and chair of the Department of Neurological Surgery at Ohio State University. He earned his MD from Loma Linda University and received his neurosurgical training at the University of Utah. During his residency, he completed a research fellowship in the Surgical Neurology Branch at the National Institutes of Health (NIH). Upon completion of his residency, he joined the staff of the Surgical Neurology Branch at the NIH. He became chief of the Surgical Neurology Branch in 2007 where he started the NIH Neurological Surgery Residency Training Program, before moving to Ohio State University in 2012.

Dr. Lonser’s research interests include the development of drug delivery paradigms for the central nervous system pathology, as well as investigation of tumor pathogenesis and biology. His clinical and surgical interests are centered on the treatment of brain, skull base, and spinal cord tumors. He is an author on over 250 scientific and clinical publications. He received the Young Investigator Award in 2001 and Mahaley Clinical Research Award in 2013 from the Joint Section on Tumors. He is co-inventor on a patent for imaging delivery of therapeutic agents in the nervous system.

He has served the Congress of Neurological Surgeons as a member-at-large of the Executive Committee, scientific meeting chair, annual meeting chair, and treasurer. He also served on the Executive Committee for the Joint Section on Tumors. He chairs the research sub-committee of the National Football League Head, Neck and Spine Injury Committee. He has been actively involved in the mentoring and training of over 40 neurosurgical fellows. He is on the editorial boards for *Neurosurgery, World Neurosurgery, and Journal of Neurosurgery*. He is an academic editor for *PLoS One* and *Science Reports* and is consulting editor for *Neurosurgery Clinics of North America*.

Dr. Lonser is married to Carolyn, and they have three daughters, Hannah (2001), Sarah (2004), and Alicia (2007).

PRESIDENT-ELECT

Alan M. Scarrow, MD, JD

Dr. Scarrow is a staff neurosurgeon and president of the Mercy Health System in Springfield, Missouri. He is a graduate of the medical and law schools at Case Western Reserve University and completed his neurosurgery residency at the University of Pittsburgh in 2003. During his residency he spent a year in Washington, DC, working in the US Senate as part of the Congress of Neurological Surgeons (CNS) Public Policy Fellowship. Dr. Scarrow is married to Meera Scarrow, who is an OB/GYN at Mercy Clinic in Springfield. They have three children, Evelyn, William, and Harrison. They enjoy working on their farm in their free time.
ANNUAL MEETING CHAIR
Steven N. Kalkanis, MD

Dr. Kalkanis is professor and chair of the Department of Neurosurgery and co-director of the Neuroscience Institute at Henry Ford Health System in Detroit, Michigan, where he also serves as Director of the Henry Ford Cancer Center. Dr. Kalkanis joined Henry Ford in 2004 after completing his neurosurgical training at Massachusetts General Hospital. He graduated with highest honors from Harvard University, where he was awarded the John Harvard Scholarship, and then Harvard Medical School, where he served as class marshal and received the Linnane Prize for highest academic achievement.

In 2009, Dr. Kalkanis led a multidisciplinary team of experts to publish the first and largest guideline to date in organized neurosurgery on the clinical treatment pathways for metastatic brain tumors. Since that time, he has chaired the guidelines efforts of the Joint Section on Tumors and was the founding chair of the CNS Guidelines Committee. Dr. Kalkanis also serves as a vice-chair on the Joint Guidelines Committee and has helped to spearhead ten separate clinical practice guidelines in a myriad of neurosurgical topics. Dr. Kalkanis has served on the CNS Executive Committee since 2009, and was recently elected as Chair for the Section on Tumors.

With the goal of refining future personalized medicine treatment protocols, and as the Mark Rosenblum Endowed Chair in Neurosurgery, Dr. Kalkanis runs a funded translational research laboratory investigating the molecular genetic differences between short-term and long-term glioma survivors. Specializing in brain tumor surgery, he has been involved in numerous clinical trials for brain tumors and has authored over 100 peer-reviewed publications.

Steve and his wife, Laurel, enjoy traveling with and cheering on their three children, Nicholas, Connor, and Grace, in multiple sporting, scouting, and musical activities.

SCIENTIFIC PROGRAM CHAIR
James S. Harrop, MD, FACS

Dr. Harrop is professor of neurological and orthopedic surgery at the Sidney Kimmel Medical College of Thomas Jefferson University. He is the director of the Neurosurgery Department Spine and Peripheral Nerve Surgery Program and co-chief of the TJHU Spine Service. In addition, he is the neurosurgical director of the Delaware Valley Model SCI Center, which is designated as one of the nation’s 14 Model Spinal Cord Injury Centers by the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR) within the Administration for Community Living (ACL), Department of Health and Human Services (HHS).

Dr. Harrop completed a neurosurgical residency at Thomas Jefferson University Hospital that included a 6-month designated rotation in pediatric neurosurgery at the Children’s Hospital of Philadelphia. He also completed a combined neurosurgical and orthopedic spine fellowship at the Cleveland Clinic in 2002.

He is actively involved in academic research and has over 230 peer-reviewed publications and over 120 chapters on spinal disorders. His research is funded through numerous agencies including NIH, DOD, PICORI. He is actively involved in numerous organizations and projects within the CNS and has served as the director of both the Publications and the Simulation Committees.

Jim and his wife, Elyse, enjoy traveling with their two children, Matthew and Casey.
Annual Meeting Committee

Guidelines and Update Sessions
Brian Hoh, MD
Geoffrey Manley, MD, PhD
Jeffrey Olsen, MD
Jennifer Sweet, MD
John O'Toole, MD, MS
Kevin Cockcroft, MD
Lissa Baird, MD
Sepideh Amin-Hanjani, MD, FACS, FAHA
Steven Kalkanis, MD
Tim Ryken, MD, MS, FACS

Live Surgery
Elad Levy, MD, FACS, FAHA
Daniel Prevedello, MD

Luncheon Seminars
Bernard Bendok, MD, FACS
J. Bradley Elder, MD
Chen Wu, MD, MS
Christopher Neal, MD
Ciaran Powers, MD, PhD
Erol Veznedaroglu, MD
Joseph "Jody" Miller, MD
Joshua Beardsley, PA-C
Julie Pittitis, MD, PhD
Lynda Yang, MD, PhD
Paul Klimo, MD, MPH

Neurosurgery
Gerald Grant, MD
Nelson Oyesiku, MD, PhD, FACS

Posters
Daniel Scuibba, MD
Edward Smith, MD
Ekkehard Kasper, MD, PhD
Frank Farhadi, MD
Jody Leonardo, MD
Joseph Neimat, MD, MS
Nicholas Bambakidis, MD
Patrick Yousef, MD
Shawn Hervey-Jumper, MD

Practical Courses and
Special Symposia
Nadar Pouratian, MD, PhD
Manish Aghi, MD, PhD
Jeffrey Leonard, MD
Jonas Sheehan, MD, FACS
Michael Wang, MD, FACS
Paul Larson, MD

Private Practice Management
Christopher Abood, MD, BS
George Bovis, MD
Matthew McGirt, MD

Scientific Advisors
Mustafa Baskaya, MD
Paul Gardner, MD
Christopher Maulucci, MD
Nadar Pouratian, MD, PhD

Sergeant-at-Arms
Alexander Khlessi, MD, MS
Michael Lang, MD

Simulation Committee
Darlene Lobel, MD
Henry Woo, MD, FACS
Ahmed Raslan, MBBS MCh
Bernard Bendok, MD, FACS

Association of Physician
Neurosurgical Assistants
Josh Beardsley, PA-C

Advance Practice Provider
CME Liaison
Andrea Strayer, MS, NP

SECTION REPRESENTATIVES

Council of State
Neurosurgical Societies
Clemens Shirmer, MD, PhD
Michael Steinmetz, MD

Section on Cerebrovascular Surgery
Adam Arthur, MD, MPH, FACS
Phil Taussky, MD
Sepideh Amin-Hanjani, MD, FACS, FAHA

Section on Disorders of the
Spine and Peripheral Nerves
Ali Baaj, MD
Ehud Mendel, MD
Lynda Yang, MD, PhD
Marcella Madera, MD
R. John Hurlbut, MD, PhD, FACS, FRCS(C)

Section on Neurotrauma
and Critical Care
Craig Rabb, MD
David Okonkwo, MD, PhD

Section on Pain
Jason Schwab, MD, FACS
Jonathan Miller, MD

Section on Pediatric
Neurological Surgery
Andrew Jea, MD
Joshua Chern, MD, PhD

Section on Stereotactic and
Functional Neurosurgery
Aviva Abood, MD, PhD
Brian Kopell, MD
Robert Gross, MD, PhD

Section on Tumors
Ekkehard Kasper, MD, PhD
Ian Lee, MD

Women in Neurosurgery (WINS)
Uzma Samadani, MD

CME/Education Chair
Bernard A. Bendok, MD, FACS

Resident Liaison
Krystal Tomei, MD, MPH
Michael Lang, MD

Basic Science
Daniel Cahill, MD
Kareem Zaghloul, MD, PhD
Kristopher Kahle, MD, PhD
Manish Aghi, MD, PhD
Nicholas Boulis, MD
Shahid Nimjee, MD, PhD
William Curry, MD

Continental Association of
African Neurosurgical Societies
and International Partner
Benjamin Warf, MD
Edjah Nduom, MD
Graham Fieggen, MD
Michael du Trevou, MD
Mustafa Baskaya, MD
Nelson Oyesiku, MD, PhD, FACS
Shekar Kurpad, MD, PhD

Clinical Controversies and
Late Breaking Abstracts
Bill Mack, MD
Glen Manzano, MD
Kelly Foote, MD
Ricardo Komotor, MD
Todd Hankinson, MD, MBA
Zach Hickman, MD

Dinner Seminars
Brian Ragel, MD
Ian Lee, MD
Krystal Tomei, MD, MPH
Michael Steinmetz, MD

Exhibit Hall
John Ratliff, MD, FACS

Annual Meeting Chair
Steven N. Kalkanis, MD

Scientific Program Chair
James S. Harrop, MD, FACS

Vice Scientific Program Chair
Brian L. Hoh, MD

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Paul Larson, MD

Private Practice Management
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Neurosurgical Assistants
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Advance Practice Provider
CME Liaison
Andrea Strayer, MS, NP

SECTION REPRESENTATIVES

Council of State
Neurosurgical Societies
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Michael Steinmetz, MD

Section on Cerebrovascular Surgery
Adam Arthur, MD, MPH, FACS
Phil Taussky, MD
Sepideh Amin-Hanjani, MD, FACS, FAHA

Section on Disorders of the
Spine and Peripheral Nerves
Ali Baaj, MD
Ehud Mendel, MD
Lynda Yang, MD, PhD
Marcella Madera, MD
R. John Hurlbut, MD, PhD, FACS, FRCS(C)

Section on Neurotrauma
and Critical Care
Craig Rabb, MD
David Okonkwo, MD, PhD

Section on Pain
Jason Schwab, MD, FACS
Jonathan Miller, MD

Section on Pediatric
Neurological Surgery
Andrew Jea, MD
Joshua Chern, MD, PhD

Section on Stereotactic and
Functional Neurosurgery
Aviva Abood, MD, PhD
Brian Kopell, MD
Robert Gross, MD, PhD

Section on Tumors
Ekkehard Kasper, MD, PhD
Ian Lee, MD

Women in Neurosurgery (WINS)
Uzma Samadani, MD

CME/Education Chair
Bernard A. Bendok, MD, FACS

Resident Liaison
Krystal Tomei, MD, MPH
Michael Lang, MD
Technology in Action

The Exhibit Hall is the place to learn, explore, network, and find solutions for your practice. With more than 160 leading companies in attendance, the exhibit hall is the best way to see all the latest advances in one place. Take advantage of opportunities to see how leading subspecialty experts utilize the latest product innovations and be sure to try out new devices for yourself.

In-booth demonstrations provide opportunities to get hands on with the newest technologies and devices!

Best Times to Visit the Exhibit Hall

Morning Break | 9:00–10:00 am

DAILY LIVE SURGERY PRESENTATIONS VIA TELEMEDICINE TECHNOLOGY

The centerpiece of the Exhibit Hall is our Live Surgery Theater, where surgeons at some of the top institutions in the US will operative live via telemedicine, giving you the chance to observe and ask questions of the operating surgeon.

Sponsored by

Lunch Break | 11:45 am–1:15 pm

DAILY SPONSORED LUNCH AND LEARN SESSIONS WITH INDUSTRY LEADERS

Connect with peers and enjoy a complimentary lunch from our corporate partners. Led by neurosurgeon faculty, these educational presentations cover important clinical topics.

Sponsored by

Afternoon Break | 1:15–2:15 pm

EDUCATIONAL UPDATE & LEADERSHIP IN HEALTHCARE UPDATE SESSIONS

Grab a beverage and catch up on the latest developments in your subspecialty with quick 10-minute daily presentations by our valued corporate partners.

On Monday, catch the planning session for a live surgery presentation featuring the impressive SNAP 3D virtual reality system from Surgical Theater. Join Medtronic Tuesday and Wednesday afternoon for a 30-minute discussion on key ways to influence and become a leader in your workplace.

Sponsored by

VISIT CNS.ORG/2016 FOR BREAKING UPDATES!

Details on all sessions will be available on the CNS Annual Meeting App this summer!
**Cerebrovascular**

**PRACTICAL COURSES**
- **PC02**: Cerebrospinal Fluid Abnormalities Update (Chiari, Pseudotumor, Hydrocephalus): Case-based Learning (page 18)
- **SYM01**: Neurovascular Update: Evidence-based Guidelines in Ischemic and Hemorrhagic Stroke for the Practicing Neurosurgeon (page 17)
- **PC12**: Neurocritical Care and Neurosurgical Emergencies Update (page 20)
- **PC19**: Advanced Cerebrovascular Surgery: 2D and 3D Operative Video-based Surgical and Anatomical Pearls (page 25)

**LUNCHEON SEMINARS**
- **M05**: Intraoperative Vascular Complications—Prevention and Management (page 32)
- **M09**: Brain Arteriovenous Malformation: Multi-disciplinary Approach (page 33)
- **T16**: Seven Aneurysms (page 40)
- **T28**: Guidelines for Management of ICH and IVH (page 41)
- **T30**: Carotid Disease Management (page 41)
- **W32**: Lessons Learned: Avoidance and Management of Complications of Aneurysm Surgery (page 48)
- **W34**: Pediatric Head Trauma and Sports (page 48)

**AFTERNOON SESSIONS**
- **Operative Neurosurgery Session 1**: Live Neuroendovascular Surgery: Novel Devices and Treatment Controversies (page 34)
- **Clinical Controversy Session 2**: Clinical Controversies: Intraparenchymal Hemorrhage (page 42)

**Neurotrauma and Critical Care**

**PRACTICAL COURSES**
- **PC12**: Neurocritical Care and Neurosurgical Emergencies Update (page 20)
- **PC22**: Trauma Update Part I: Traumatic Brain Injury—Case-based Learning (page 25)
- **PC31**: Spinal Trauma Cased-Based Guidelines Update (page 27)
- **PC32**: Sports-related Head and Spinal Cord Injury: Return to Play and Other Management Considerations (page 27)

**LUNCHEON SEMINARS**
- **M02**: Athletic Head Injuries: Return to Play (page 32)
- **T21**: Guidelines for Neurocritical Care Management (page 40)
- **T29**: Managing Intracranial Pressure in the Trauma Patient (page 41)
- **W36**: Neurovascular Emergencies: Case-based Discussion (page 48)
- **W38**: Pediatric Head Trauma and Sports (page 48)

**AFTERNOON SESSION**
- **Guidelines Session 1**: Guidelines for the Management of Traumatic Brain Injury (page 34)

**DINNER SEMINAR**
- **DIN04**: Concussion: Diagnosis, Management, and Outcomes (page 45)

**Pain**

**SYM02**: Spinal Cord Stimulation: The Transformation (page 23)

**LUNCHEON SEMINARS**
- **M14**: Functional Neurosurgery: Emerging Opportunities (page 33)
- **T17**: Trigeminal Neuralgia Management Update (page 40)

**Pain Section Sessions and Oral Presentations occur Monday (page 35) and Tuesday (page 43) afternoon**
**PRACTICAL COURSES**

PC05: Minimally Invasive Spine Surgery: What You Know and Where We Need to Go  (page 18)

PC07: Peripheral Nerve Surgical Exposures and Techniques  (page 19)

PC10: Cervical Degenerative Case Management  (page 19)

PC11: My Worst Spine Complication: Case-based Examples and What I Learned  (page 20)

PC12: Neurocritical Care and Neurosurgical Emergencies Update  (page 20)

SYM02: Spinal Cord Stimulation: The Transformation  (page 23)

PC20: Spinal Deformity: Case-based Update  (page 25)

PC21: Thoracolumbar: Trauma, Tumor, and Degenerative: Case-based Presentations  (page 25)

PC25: Spinal Biomechanics in Clinical Practice  (page 26)

PC31: Spinal Trauma Case-based Guidelines Update  (page 27)

**LUNCHEON SEMINARS**

M03: Guidelines for Lumbar Spine Degenerative Disease  (page 32)

M04: Controversies in Spinal Deformity Surgery  (page 32)

M06: Peripheral Nerve Pain Syndromes: Diagnosis and Management  (page 32)

M08: Challenging Pediatric Neurosurgery Cases: Interactive Case-based Discussion  (page 32)

T25: Pediatric and Adult Moyamoya Disease  (page 41)

W35: Chiari Malformation  (page 48)

W38: Pediatric Head Trauma and Sports  (page 48)

**DINNER SEMINAR**

DIN01: Cervical Spondylotic Myelopathy  (page 20)

**Pediatric Section Sessions and Oral Presentations occur Monday**  (page 36) **and Tuesday**  (page 43) **afternoon**

**M10:** Spinal Cord Stimulator for Back and Leg Pain: Show Me the Evidence  (page 33)

M12: Spinal Column Metastases Management  (page 33)

M15: Cervical Radiculopathy: Anterior Versus Posterior Cervical  (page 33)

T18: Cervical Arthroplasty: Is There a Role?  (page 40)

T20: Managing Complications in Spine Surgery  (page 40)

T22: Peripheral Nerve Board Review  (page 40)

T27: Managing Degenerative Thoracic Spine Disease  (page 41)

W31: Guidelines for Acute Cervical Spine and Cord Injuries  (page 48)

W37: Guidelines for Managing the Aging Spine  (page 48)

W39: Minimally Invasive Deformity: New Frontiers  (page 48)

**AFTERNOON SESSIONS**

Clinical Controversy Session 1: L4/5 Lumbar Spondylolisthesis  (page 34)

Guidelines Session 3: Guidelines for the Management of Thoracolumbar Fractures  (page 49)

**Pediatric Section Sessions and Oral Presentations occur Monday**  (page 36) **and Tuesday**  (page 43) **afternoon**

**STEREOTACTIC AND FUNCTIONAL**

**PRACTICAL COURSE**

PC27: Laser Ablation Surgery: Opportunities, Indications, Technique, and Outcome  (page 26)

**LUNCHEON SEMINARS**

M14: Functional Neurosurgery: Emerging Opportunities  (page 33)

W42: Epilepsy: Current and Emerging Treatment Strategies  (page 49)

**AFTERNOON SESSION**

Clinical Controversy Session 3: Epilepsy Associated Cavernomas  (page 49)

**Stereotactic and Functional Section Sessions and Oral Presentations occur Monday**  (page 36) **and Tuesday**  (page 44) **afternoon**

Register now at cns.org/2016
**PRACTICAL COURSES**

- **PC01**: Comprehensive Endoscopic Skull Base Surgery: Hands On Cadaver Course—Part 1 (page 18)
- **PC04**: Surgical Management of Eloquent Area Tumors: Functional Mapping and/or Navigation (page 19)
- **PC06**: Complex Skull Base and Brain Tumor Surgery: 3D Surgical Anatomy and Technical Nuances (page 19)
- **PC08**: Brain Metastases: Case-Based Approach to Surgery, Radiosurgery, and Laser Ablation (page 19)
- **PC15**: Comprehensive Endoscopic Skull Base Surgery: Hands-on Cadaver Course—Part 2 (page 24)
- **PC17**: Cased-based Approach for Surgery/SRS for Malignant Tumors (page 24)
- **PC18**: Surgical Neuroanatomy I (Supratentorial) (page 25)
- **PC24**: Pituitary Surgery: Indications, Techniques, and Outcomes (page 26)
- **PC28**: Surgical Neuroanatomy II (Infratentorial) (page 27)
- **PC30**: My Worst Cranial Complication: Case-based Examples and What I Learned (page 27)
- **PC33**: Surgery/SRS for Benign Tumors (page 28)

**LUNCHEON SEMINARS**

- **M07**: Non-functioning Pituitary Adenomas: Operative Nuances and Management (page 32)
- **M11**: Acoustic Neuroma: Current Management Strategies (page 33)
- **M13**: Low Grade Glioma: Current Management Strategies (page 33)
- **T19**: Radiosurgery for Brain Metastases: Update and Controversies (page 40)
- **T23**: Mapping for Eloquent Tumors (page 40)
- **T24**: Malignant Glioma: Advances in Surgery and Adjuvant Therapy (page 40)
- **T26**: Meningioma: Management Strategies (page 41)
- **W33**: Skull Base Endoscopy: Utility and Limitations (page 48)
- **W34**: Hematology and Coagulation for Neurosurgeons: Dangers and Solutions (page 48)

**AFTERNOON SESSION**

- **Guidelines Session 2**: Guidelines for the Management of Brain Metastases (page 42)
- **Operative Neurosurgery Session 2**: Live Endoscopic Endonasal Resection of Nonsecretory Pituitary Macroadenoma (page 42)

**DINNER SEMINAR**

- **DIN03**: Management of Meningiomas (Asymptomatic to Atypical) (page 37)

Tumor Section Sessions and Oral Presentations occur Monday (page 36) and Tuesday (page 44) afternoon
SPECIAL INTEREST SESSION TRACKS

Resident

PRACTICAL COURSES
PC03: Leadership Development for the Practicing Neurosurgeon (page 18)
PC10: Cervical Degenerative Case Management (page 19)
PC12: Neurocritical Care and Neurosurgical Emergencies Update (page 20)
PC14: ABNS Primary Examination High Yield Review (page 24)
PC18: Surgical Neuroanatomy I (Supratentorial) (page 25)
PC21: Thoracolumbar: Trauma, Tumor and Degenerative: Case-based Presentations (page 25)
PC22: Trauma Update Part I: Traumatic Brain Injury—Case-based Learning (page 25)

LUNCHEON SEMINARS
M01: Honored Guest Luncheon (Complimentary to CNS Resident members) (page 32)
M03: Guidelines for Lumbar Spine Degenerative Disease (page 32)
M09: Brain Arteriovenous Malformation: Multi-disciplinary Approach (page 33)
M10: Spinal Cord Stimulator for Back and Leg Pain: Show Me the Evidence (page 33)
M11: Acoustic Neuroma: Current Management Strategies (page 33)
M12: Spinal Column Metastases Management (page 33)
M13: Low Grade Glioma: Current Management Strategies (page 33)
M14: Functional Neurosurgery: Emerging Opportunities (page 33)
M15: Cervical Radiculopathy: Anterior Versus Posterior Cervical (page 33)
T16: Seven Aneurysms (page 40)
T22: Peripheral Nerve Board Review (page 40)
T29: Managing Intracranial Pressure in the Trauma Patient (page 41)
T30: Carotid Disease Management (page 41)
W34: Hematology and Coagulation for Neurosurgeons: Dangers and Solutions (page 48)
W35: Chiari Malformation (page 48)
W40: From Residency to Practice: Getting the Job You Want and What to Ask For (page 48)
W43: Women in Neurosurgery (WINS): Becoming a Neurosurgery Leader: Mentorship (page 49)

Advanced Practice Provider

PRACTICAL COURSES
PC02: Cerebrospinal Fluid Abnormalities Update (Chiari, Pseudotumor, Hydrocephalus): Case-based Learning (page 18)
PC05: Minimally Invasive Spine Surgery: What You Know and Where We Need to Go (page 18)
PC12: Neurocritical Care and Neurosurgical Emergencies Update (page 20)
PC13: ANSNA Annual Fall CME Meeting: Presented in Collaboration with the CNS (page 24)
PC21: Thoracolumbar: Trauma, Tumor and Degenerative: Case-based Presentations (page 25)
PC22: Trauma Update Part I: Traumatic Brain Injury—Case-based Learning (page 25)
PC26: Improve Quality, Reduce Cost, and Increase Revenue (page 26)
PC32: Sports-Related Head and Spinal Cord Injury: Return to Play and Other Management Considerations (page 27)

Socioeconomic

PRACTICAL COURSES
PC03: Leadership Development for the Practicing Neurosurgeon (page 18)
PC09: CPT Coding and All You Need for ICD-10 (page 19)
PC16: eNeurosurgery: Adapting Your Practice for 2016 and Beyond (page 24)
PC23: Neurosurgeon-Hospital Relationships: Options, Negotiations, and Achieving What You are Worth (page 26)
PC26: Improve Quality, Reduce Cost, and Increase Revenue (page 26)

LUNCHEON SEMINAR
W40: From Residency to Practice: Getting the Job You Want and What to Ask For (page 48)

DINNER SEMINAR
DIN02: New CPT Codes, ICD-10, MIPS, and Bundling: What These Challenges Mean to Your Bottom Line (page 37)

The Council of State Neurosurgical Societies Sessions occur Monday (page 35) and Tuesday (page 43) afternoon

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PROGRAM HIGHLIGHTS

SATURDAY, SEPTEMBER 24

8:00 AM – 5:00 PM
SYM01
NEUROVASCULAR UPDATE:
Evidence-based Guidelines in Ischemic and Hemorrhagic Stroke for the Practicing Neurosurgeon

8:00 AM – 4:00 PM
PRACTICAL COURSES
PC01–PC12

5:00 – 6:30 PM
INTERNATIONAL RECEPTION

6:00 – 8:30 PM
DINNER SEMINAR
DIN01: Cervical Spondylotic Myelopathy

INTERNATIONAL RECEPTION

Marriott Marquis San Diego Marina
Saturday, September 24
5:00–6:30 pm

Join your colleagues from around the world at the exciting 2016 International Reception.

Take in breathtaking views of the San Diego Bay while enjoying delicious hors d’oeuvres and cocktails.

All international attendees and their registered guests are invited to attend.

*International attendees are considered those who live outside the US, Canada, or Mexico.
SYMPOSIUM 01

SYM01: Neurovascular Update: Evidence-based Guidelines in Ischemic and Hemorrhagic Stroke for the Practicing Neurosurgeon

COURSE DIRECTORS: Peter Kan, Adnan H. Siddiqui


COURSE DESCRIPTION: This symposium provides a forum for attendees to obtain the latest information about current endovascular therapy for acute ischemic stroke. We will review recent literature regarding patient selection for endovascular stroke therapy as well as endovascular and surgical revascularization (endovascular versus EC-IC bypass) for intracranial atherosclerotic or vaso-occlusive diseases. In addition, we will discuss endovascular and surgical revascularization (CAS versus CEA) for extracranial atherosclerotic or vaso-occlusive diseases. The course will also cover optimal treatment of intracranial aneurysms, including flow diversion and other new technologies, and the optimal treatment options of intracranial arteriovenous malformations, dural arteriovenous fistulas, and intracerebral hemorrhage.

LEARNING OBJECTIVES: Upon the completion of this course, participants will be able to:

- Review recent clinical trials on endovascular therapy for acute ischemic stroke.
- Discuss patient selection and ongoing research on endovascular and surgical revascularization (endovascular versus EC-IC bypass) for intracranial atherosclerotic or vaso-occlusive diseases.
- Interpret recent clinical trials on endovascular and surgical revascularization (CAS versus CEA) for extracranial atherosclerotic or vaso-occlusive diseases.
- Apply recent literature on flow diversion and new technologies to treatment of intracranial aneurysms in their own practices.
- Identify the spectrum of treatment options for intracranial arteriovenous malformations and dural arteriovenous fistulas.

8:00–8:15 am
Welcome
Peter Kan, Adnan H. Siddiqui

8:15–9:00 am
Didactic Session 1: Patient Selection and Advanced Imaging for Acute Stroke Intervention: An Update

8:15–8:30 am
Who Should We Select for Endovascular Stroke Therapy: State-of-the-Art Evidence
Raymond D. Turner

8:30–8:45 am
Advanced Imaging Versus Collateral Imaging for Patient Selection for Stroke Intervention
Kenneth V. Snyder

8:45–9:00 am
Wake Up Stroke: Where Are We
Mandy Jo Binning

9:00–9:30 am
Morning Breakout Session with Penumbra

9:30–10:15 am
Didactic Session 2: Interventional Therapy for Stroke: An Update

9:30–9:45 am
Where Should We Select Patients for Endovascular Stroke Therapy? Emergency Room, Ambulance, or the Anglo Suite?
Adam S. Arthur

9:45–10:00 am
Endovascular Therapy for Posterior Circulation Stroke
Elad I. Levy

10:00–10:15 am
Glarling Gaps in Current Understanding and Role for New Technologies
Adnan H. Siddiqui

10:15–10:45 am
Morning Breakout Session with Corporate Sponsor

10:45–11:30 am
Didactic Session 3: Management of Intracranial Atherosclerotic and Vaso-occlusive Disease: An Update

10:45–11:00 am
Interventional Management for ICAD: Who and How?
Alexander Arash Khalessi

11:00–11:15 am
EC-IC Bypass for Moyamoya Disease
Gary K. Steinberg

11:15–11:30 am
EC-IC Bypass for Extracranial or Intracranial Vaso-occlusive Disease
Sepideh Amin-Hanjani

11:30–12:15 pm
Didactic Session 4: Management of Extracranial Atherosclerotic and Vaso-occlusive Disease: An Update

11:30–11:45 am
CAS for Extracranial Atherosclerotic Disease
Stavropoula I. Tjoumakaris

11:45 am–12:00 pm
CEA for Extracranial Atherosclerotic Disease
Christopher S. Ogilvy

12:00–12:15 pm
An Update on CREST-2
Bernard R. Bendok

12:15–1:15 pm
Lunch Breakout Session with Corporate Sponsor

1:15–2:15 pm
Didactic Session 5: Optimal Treatment of Intracranial Aneurysms: An Update

1:15–1:30 pm
Management of Unruptured Aneurysms: Natural History and Indications
Michael F. Stiefel

1:30–1:45 pm
Primary or Adjunctive Coiling of Intracranial Aneurysms in the Era of Expanding Technology
Brian Lim Hoh

1:45–2:00 pm
Bypass for Intracranial Aneurysms in the Era of Flow Diversion
Jacques J. Morcos

2:00–2:15 pm
Management of Vasospasm: A Critical Update
R. Loch Macdonald

2:15–3:00 pm
Didactic Session 6: New Technologies for Interventional Treatment of Intracranial Aneurysms: An Update

2:15–2:30 pm
Flow Diversion
Peter Kan

2:30–2:45 pm
Endovascular Devices
Alexander Lewis Coon

2:45–3:00 pm
Novel Stents and Coils
Ricardo A. Hanel

3:00–3:30 pm
Afternoon Breakout Session with Corporate Sponsor

3:30–4:30 pm
Didactic Session 7: Management of Arteriovenous Malformations and Dural Arteriovenous Fistula: An Update

3:30–3:45 pm
Surgical Treatment
Michael T. Lawton

3:45–4:00 pm
Endovascular Treatment
Babu Guai Welch

4:00–4:15 pm
Radiosurgical Treatment
Bruce E. Pollock

4:15–4:30 pm
Current Management of Dural Arteriovenous Fistula
Ali Alaraj

4:30–4:45 pm
Didactic Session 8: Management of ICH: An Update

4:30–4:45 pm
Surgery for ICH: Latest Evidence and Device
J D. Mocco

4:45–5:00 pm
Questions and Discussion

Register now at cns.org/2016
approaches to particular cranial base

Particular emphasis will be placed on open and endoscopic approaches to similar cranial base targets.

Describe and implement advanced skills and techniques in managing institutional risk.

Describe and implement advanced skills and techniques in managing organizational change.

Describe and implement advanced skills and techniques in creating strategic vision.

Describe and implement advanced skills and techniques in managing institutional risk.

Describe and implement advanced skills and techniques in managing conflict.

NEW!

COURSE DESCRIPTION: This course will focus on the pitfalls and unique problems encountered in endonasal surgery. Faculty will illustrate the techniques required for these procedures through cadaveric lab.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Avoid complications in complicated hydrocephalus patients.
- Discuss the indications for treatment in Chiari patients with craniocervical abnormalities.
- Identify and discuss treatment options for pseudotumor patients.
- Identify pseudotumor patients who may benefit from endovascular treatment.
- Develop patient selection tools for patients who may benefit from CSF diversion, and apply these tools to their clinical practice.

Fee: $450

NEW!

COURSE DESCRIPTION: This course will focus on the indications and limitations of endonasal management of cranial base tumors. National and international leaders in the field will teach by didactic presentations, case discussions, prosections, and by guiding participants through cadaveric dissection. Particular emphasis will be placed on comparing open and endoscopic approaches to particular cranial base targets.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Describe the indications and limitations of endonasal management of cranial base tumors.
- Review methods for complication avoidance during endonasal surgery.
- Compare and contrast the merits of open and endoscopic approaches to similar cranial base targets.
- Build competence in the surgical techniques required for these procedures through cadaveric lab.

Fee: $450

NEW!

COURSE DESCRIPTION: This is a course that will outline in detail the management strategies for removing tumors in eloquent or functional areas utilizing the technique of functional brain mapping.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Review decision-making for surgical management of tumors in eloquent regions.
- Discuss the use of functional mapping and imaging for removing functional area tumors.
- Identify the use of functional mapping to expedite extent of resection and outcome for brain tumors in functional regions.
- Identify the tools and operating room required to safely perform these procedures in their practice.

Fee: $450

NEW!

COURSE DESCRIPTION: This course will focus on open and endoscopic surgical techniques. National and international leaders in the field will teach by didactic presentations, case discussions, prosections, and by guiding participants through cadaveric dissection. Particular emphasis will be placed on open and endoscopic approaches to similar cranial base targets.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Describe and implement advanced skills and techniques in creating strategic vision.
- Discuss and implement advanced skills and techniques in managing institutional risk.
- Describe and implement advanced skills and techniques in managing conflict.
- Describe and implement advanced skills and techniques in managing organizational change.

Fee: $450

NEW!

COURSE DESCRIPTION: This course will focus on the indications and limitations of endonasal management of cranial base tumors. National and international leaders in the field will teach by didactic presentations, case discussions, prosections, and by guiding participants through cadaveric dissection. Particular emphasis will be placed on open and endoscopic approaches to similar cranial base targets.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Describe the indications and limitations of endonasal management of cranial base tumors.
- Review methods for complication avoidance during endonasal surgery.
- Compare and contrast the merits of open and endoscopic approaches to similar cranial base targets.
- Build competence in the surgical techniques required for these procedures through cadaveric lab.
this course, participants will be able to:

- Discuss the expanding indications for MIS spine surgery as well as the contraindications.
- Explore the causes of complications and management.
- Learn the impact of MIS surgery on quality parameters and length of stay and reops/readmissions.
- Consider introduction or expansion of MIS techniques in their own practice.

**Tuition:** Fee: $450

**NEW!**

**PC06 Complex Skull Base and Brain Tumor Surgery: 3D Surgical Anatomy and Technical Nuances**

**COURSE DIRECTOR:** Juan Carlos Fernandez-Miranda

**FACULTY:** Mustafa Kemal Baskaya, Aaron Cohen-Gadol, William T. Couldwell, Jacques J. Morcos, Ugur Ture

**COURSE DESCRIPTION:** This special 3D course will review relevant surgical anatomy and technical nuances for improving patient outcomes during complex skull base and brain tumor procedures. After a focused 3D surgical anatomy review, illustrative clinical cases will be presented by experienced surgeons using 3D high-definition surgical videos to maximize the learning experience for the participants. Targeted audience includes senior-level trainees, general neurosurgeons with an interest in cranial surgery, and subspecialized neurosurgeons.

**LEARNING OBJECTIVES:** Upon completion of this course, participants will be able to:

- Outline general techniques and surgical approaches for complex skull base and brain tumors.
- Identify key anatomical landmarks for the performance of transcranial and endonasal skull base approaches to the anterior, middle, and posterior skull base.
- Describe major water pathways and surgical techniques required for resection of complex intrinsic brain tumors.
- Implement these transcortical and skull base approaches in their own practice with the benefit of 3D interactive walkthrough of surgical landmarks.

**Tuition:** Fee: $450

**NEW!**

**PC07 Peripheral Nerve Surgical Exposures and Techniques**

**COURSE DIRECTORS:** Rajiv Midha, Robert J. Spinner

**FACULTY:** Holly Gilmer, Amgad S. Hanna, Line Jacques, Mark Alexander Mahan, Elias Rizk, Lynda Jun-San Yang, Eric L. Zager

**COURSE DESCRIPTION:** Using a combination of didactic lectures, case-based discussion, and prospection demonstration, the faculty will provide learners with fundamental knowledge in peripheral nerve evaluation, surgical exposure and management of common surgical nerve conditions.

**LEARNING OBJECTIVES:** Upon completion of this course, participants will be able to:

- Demonstrate common surgical exposures to nerves throughout the body.
- Discuss the management of common peripheral nerve disorders, including entrapments, tumor, trauma, and pain.
- Cite examples of commonly performed new techniques (e.g., nerve transfers) and their indications.
- Develop familiarity and increased competence in these procedures through cadaveric practice.

**Tuition:** Fee: $450

**SP**

**12:30–4:00 pm**

** Fee: $450**

**PC08 Brain Metastases: Case-based Approach to Surgery, Radiosurgery, and Laser Ablation**

**COURSE DIRECTOR:** J. Bradley Elder, Steven Kalkanis

**FACULTY:** Gene Barnett, Lawrence Chin, Matthew Ewend, Jeffrey J. Olson, Michael Weaver

**COURSE DESCRIPTION:** This practical course offers critical analysis of current and emerging treatment strategies for patients with brain metastases. Interventions including surgical resection, radiosurgery, and laser interstitial thermal therapy (LITT) are discussed using case presentations as examples. Emphasis will be placed on understanding current guidelines and published evidence for each treatment strategy alone and in combination. Rationale for emerging treatment strategies will also be evaluated. Participants should expect to finish the course with a current understanding of standard and emerging treatment strategies available for neurosurgeons for the treatment of patients with brain metastases.

**LEARNING OBJECTIVES:** Upon completion of this course, participants will be able to:

- Outline general techniques and surgical approaches for complex skull base and brain tumors.
- Identify key anatomical landmarks for the performance of transcranial and endonasal skull base approaches to the anterior, middle, and posterior skull base.
- Describe major water pathways and surgical techniques required for resection of complex intrinsic brain tumors.
- Implement these transcortical and skull base approaches in their own practice with the benefit of 3D interactive walkthrough of surgical landmarks.

**Tuition:** Fee: $450

**SP**

**12:30–4:00 pm**

**PC09 CPT Coding and All You Need for ICD-10**

**COURSE DIRECTOR:** Henry H. Woo

**FACULTY:** Joseph S. Cheng, Darlene Angela Lobel, John K. Ratliff, Clemens M. Schirmer

**COURSE DESCRIPTION:** This course will include brief primers on CPT coding and how various codes are selected for specific cases. Summarize the update on new CPT codes recently passed. Review the new ICD-10 classification. Implement these coding changes in their own practices to insure accuracy and reimbursement.

**Tuition:** Fee: $450

**SP**

**12:30–4:00 pm**

**PC10 Cervical Degenerative Case Management**

**COURSE DIRECTOR:** Michael G. Kaiser

**FACULTY:** Kurt M. Eichholz, Francis Farhadl, Daniel J. Hoh, Langston T. Holly, John E. O’Toole, Srinivas K. Prasad, Charles A. Sansur, Jason E. Tullis

**COURSE DESCRIPTION:** The indications, techniques, and complication management involving surgical intervention for degenerative disease of the cervical spine will be reviewed with an emphasis on case presentations. Cases presented by the faculty will be supplemented by brief didactic presentations incorporating medical evidence for current, well-designed clinical studies. Audience participation will be encouraged through open discussions during case presentations and sawbone demonstrations. Upon completion of this course, participants will be able to discuss the appropriate indications, state-of-the-art surgical techniques, as well as effective strategies to avoid and address operative complications.

**Register now at cns.org/2016**
• Identify appropriate surgical indications for management of cervical degenerative spine disease.
• Provide reasonable surgical alternatives for the various degenerative pathologies.
• Identify appropriate strategies to avoid and address surgical complications.
• Counsel patients on surgical management and risks of cervical degenerative disease.

PC11 My Worst Spine Complication: Case-based Examples and What I Learned
COURSE DIRECTORS: Juan S. Uribe
FACULTY: Joseph S. Cheng, Robert F. Heary, R. John Hurlbert, J. Patrick Johnson, Laurence D. Rhines, Michael P. Steinmetz
COURSE DESCRIPTION: Faculty will bring and present their own cases (complications) systematically from diagnosis to surgical procedure followed by postoperative short and long clinical follow up. Complications will be disclosed, followed by learning facts that include complication avoidance and management. Each faculty member will also serve as panelist during case discussions. The course is designed to have active interaction with participants.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Identify potential factors that contribute to surgical complications.
- Review how to avoid complications by recognizing standard surgical techniques and best surgical practices.
- Discuss the value of effective preoperative and intraoperative planning.
- Manage complications related to specific surgical procedures.
- Apply these lessons in their own surgical management of spinal disease.

Fee: $450

PC12 Neurocritical Care and Neurosurgical Emergencies Update
COURSE DIRECTORS: Jack Jallo, Christopher J. Madden
FACULTY: Kamran Athar, Randall Matthew Chesnut, Catriona Harrop, Ryan Kitagawa, Ian E. McCutcheon, Kim L. Rickert, Lynda Yang
COURSE DESCRIPTION: Course is designed to review a variety neurosurgical emergencies using a case-based model. Cases reviewed include cranial and peripheral nerve injury.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Review the diagnosis and management of cerebral trauma, spinal trauma, and peripheral nerve injury.
- Identify the correction of coagulopathy for the neurosurgeon.
- Discuss the management of malignant stroke and status epilepticus.
- Identify neurosurgical emergencies within their own practice and apply urgent, time sensitive therapies.

Fee: $450

INTERNATIONAL Reception
5:00–6:30 pm

Dinner Seminar 01
Complimentary shuttle service will be provided for all dinner seminars. Shuttles will depart from the Marriott Marquis San Diego Marina Hotel.
Saturday, September 24 • 6:00–8:30 pm • Fee: $190

SP DIN01 Cervical Spondylotic Myelopathy
MODERATORS: Michael G. Fehlings, Robert F. Heary
SPEAKERS: Paul M. Arnold, Andrew T. Dailey, Langston T. Holly
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Discuss etiology and natural history of cervical spondylosis.
- Define cervical myelopathy.
- Review advantages of various surgical approaches to treat CSM.

Eddie V’s
Consistently named as one of the best restaurants in the Marina District, Eddie V’s offers elegant, fine-dining with a charismatic vibe. Seafood and steaks are a specialty. Fish arrive daily from pristine waters around the world and USDA Prime steaks are specially aged to ensure peak flavor. Enjoy world-class wine and service, beautiful artwork, and enticing live jazz in the V lounge.
Neurosurgical Residents!

The 2016 CNS Annual Meeting has more of everything you want

Free or Discounted Registration to the Annual Meeting
The first 80 CNS Resident members receive complimentary registration* for the CNS Annual Meeting, and all residents enjoy discounted registration, with access to General Scientific Sessions, Original Science Program, Live Surgery Sessions, Exhibit Hall, and more. *Registration fee reimbursed after residents attend the CNS Annual Meeting. Educational grant provided by DePuy Synthes.

Complimentary Resident Housing
Free hotel accommodations in San Diego available on a first come, first-serve basis for CNS Resident members. Application deadline July 1.

Sergeant-at-Arms Program
Volunteer as a Sergeant-at-Arms and receive complimentary admission to a practical course or luncheon seminar.

Resident Educational Courses
Take advantage of specialized learning opportunities.

Discounted tickets to Luncheon Seminars
Three days of neurosurgical courses served up with a plated lunch.

Invitation to Honored Guest Luncheon
Complimentary lunch and a talk from 2016 Honored Guest Dr. Edward H. Oldfield.

Resident Recruitment Social
A relaxed and informal networking event with recruiters and prospective employers.

SANS Challenge
Annual residency program battle for SANS dominance.

Visit cns.org/2016 to join the CNS Annual Meeting
SUNDAY, SEPTEMBER 25
PROGRAM HIGHLIGHTS

8:00 AM–4:00 PM
SYM02: SPINAL CORD STIMULATION:
The Transformation

4:51–5:11 PM
FEATURED SPEAKER
Vice Admiral Mike Shoemaker

5:47–6:07 PM
MICHAEL L.J. APUZZO
LECTURER ON CREATIVITY AND INNOVATION
2016: The Constitution at a Crossroads
Akhil Reed Amar

6:10–6:30 PM
JOHN THOMPSON
HISTORY OF MEDICINE LECTURE
Daniel James Brown

6:30–8:30 PM
OPENING RECEPTION
Marriott Marquis San Diego Marina

ANSPA Annual Fall CME Meeting:
Presented in Collaboration with the CNS
Sunday, September 25 | 8:00 am–4:00 pm

The ANSPA Annual CME Meeting, presented for the first time in collaboration with the CNS, is created specifically for PAs and NPs working in, or interested in, neurosurgery.

See Page 24 for course details.
SYMPOSIUM 02

8:00 am–4:00 pm
Fee: $300

NEW!

SYM02: Spinal Cord Stimulation: The Transformation

COURSE DIRECTORS: Nandan Lad, Jennifer Sweet, Ashwini D. Sharan

FACULTY: Jeff Arle, John Chae, Milind Deogaonkar, Steven Falowski, Andre Machado, Jonathan Miller, Richard North, Erika Petersen, Ali Rezai, Joshua Rosenow, Jason Schwalb, Konstantin Slavin

COURSE DESCRIPTION: New data and technologies are rapidly changing the field of Spinal Cord Stimulation. Historically, this technology has been utilized for management of spinal pain for over three decades. Today, there are new technology releases occurring every year. These have included changes in the understanding on paradigms in the frequency of stimulation, target structures such as the dorsal root ganglion, and the emergence of new tools. This symposium includes a collection of experts to update the attendee on all these revolving changes.

LEARNING OBJECTIVES: Upon the completion of this course, participants will be able to:

- Identify the prospective RCT data on the use of 10kHz stimulation on the spinal cord.
- Identify the prospective data on the use of dorsal root ganglion stimulation.
- Distinguish neurostimulation technologies and their interaction with MRI.
- Discuss the nuances in equipment and technology evolving in Spinal Cord Stimulation Technologies.
- Develop strategies for the introduction of new stimulation technologies into their practice.
- Recognize patients in their practice who may benefit from these advancements.

8:00–9:10 am
Didactic Session 1—Data Driven

8:00–8:15 am
High Frequency Stimulation: RCT and Two-year Follow-up Data
Ashwini D. Sharan

8:15–8:30 am
Dorsal Root Ganglion Stimulation for CRPS
Jennifer Sweet

8:30–8:45 am
MRI Compatibility and Its Significance
Nandan Lad

8:45–9:00 am
Socio-economics of SCS
Nandan Lad

9:00–9:10 am
Discussion

9:10–9:50 am
Morning Breakout Session with Corporate Sponsor

9:50–10:20 am
Didactic Session 2—Equipoise

9:50–10:00 am
Emerging Science on Neuronal Stimulation Parameters: High Frequency vs. Tonic Stimulation Science
Jonathan Miller

10:00–10:10 am
Burst Stimulation for Pain
Konstantin Slavin

10:10–10:20 am
Panel Discussion

10:20–11:00 am
Morning Breakout Session with Corporate Sponsor

11:00–11:35 am
Didactic Session 2—Equipoise, continued

11:00–11:10 am
SCS and Low Back Pain: Why and How Would Waveform Matter
Jeff Arle

11:10–11:25 am
Muscle Stimulation for Pain
John Chae

11:25–11:35 am
Clinical Panel Discussion—How Will This Fit into Your Practice?
Erika Petersen, Andre Machado

11:35 am–12:30 pm
Lunch

12:30–1:00 pm
Didactic Session 3—Nuts & Bolts

12:30–12:40 pm
The Differences Between Paddles
Erika Petersen

12:40–12:50 pm
The Differences Between IPGs
Erika Petersen

12:50–1:00 pm
Discussion

1:00–1:40 pm
Afternoon Breakout Session with Corporate Sponsor

1:40–2:20 pm
Didactic Session 3—Nuts & Bolts, continued

1:40–1:52 pm
Surgical Techniques for Complication Avoidance—Percutaneous
Joshua Rosenow

1:52–2:04 pm
Surgical Techniques: Awake vs. Asleep Placement
Steven Falowski

2:04–2:16 pm
Revision SCS: When and How to Do What?
Jason Schwalb

2:16–2:20 pm
Discussion

2:20–3:00 pm
Afternoon Breakout Session with Corporate Sponsor

3:00–4:00 pm
Didactic Session 4—Emerging Therapies

3:00–3:15 pm
Emergence of Autonomic Stimulation
Ali Rezai

3:15–3:30 pm
Emergence of Stimulation for Headaches
Milind Deogaonkar

3:30–3:45 pm
Minimally Invasive Peripheral Nerve Stimulation
John Chae

3:45–4:00 pm
Wireless Stimulation
Richard North

Register now at cns.org/2016
LEARNING OBJECTIVES:
Upon completion of this course, participants will be able to:
• Identify and discuss common diagnoses related to neurological pathology across multiple specialties.
• Identify and discuss treatment options related to neurological pathology.
• Gain an understanding of the work up required to diagnose and treat patients with neurosurgery related conditions.
• Apply neurosurgical principles in their triage and treatment of patients in their PA/NP Practice.

LEARNING OBJECTIVES:
Upon completion of this course, participants will be able to:
• Describe the indications and limitations of endonasal management of cranial base tumors.
• Review methods for complication avoidance during endonasal surgery.
• Compare and contrast the merits of open and endoscopic approaches to similar cranial base targets.
• Apply these surgical techniques in their own practice and develop increased competence through use of hands-on cadaveric dissections.

LEARNING OBJECTIVES:
Upon completion of this course, participants will be able to:
• Formulate treatments plans for malignant brain tumors, particularly high-grade gliomas, based on evidence-based guidelines.
• Integrate techniques such as intraoperative MRI and 5-ALA fluorescence to improve extent of resection.
• Discuss the role of neuro-monitoring in improving functional outcomes after surgery for gliomas.
• Review basic principles of stereotactic radiosurgery when used to treat malignant tumors.
• Discuss novel, minimally invasive image-guided treatments for malignant brain tumors like laser interstitial thermotherapy (LITT), convention-enhanced delivery (CED), and surgical simulation.

LEARNING OBJECTIVES:
After completion of this course, participants should be able to:
• Identify one’s online reputation through private and federal websites and databases, and how to build an online presence.
• Identify and apply metrics used to rate neurosurgeons and effective measures to minimize the effort to surpass these metrics.
• Outline alternative practices (group vs hospital practices, and concierge practices).
• Identify and maximize the new role of physician extenders in the evolving healthcare environment.
• Discuss individual physician, hospital, institutional, and insurance company efforts that have been successful in reducing medical malpractice.
• Apply these strategies in improving practice development and visibility.
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:

- Discuss the surgical anatomy of the prefrontal and orbitozygomatic exposures.
- Review the surgical anatomy of the far lateral exposure.
- Identify the surgical anatomy of the transtemporal exposures.
- Describe the surgical anatomy of the ventricles, interhemispheric fissure, and pineal region.
- Apply these surgical approaches in their own practice.

COURSE DESCRIPTION: This course will employ a dynamic senior faculty and use high-quality educational content to present the latest in surgical neuroanatomy. The course will review anatomy encountered in the surgical approaches and surgical techniques used to treat vascular pathologies and skull base tumors. The content will be anatomy and clinical cases from expert neurosurgeons that demonstrate the application of anatomical knowledge needed to perform these operations skillfully.

NEW!

PC18 Surgical Neuroanatomy I (Supratentorial)

COURSE DIRECTOR: Michael T. Lawton

FACULTY: Arthur L. Day, Juan Carlos Fernandez-Miranda, Michael William McDermott, Nader Sanai

COURSE DESCRIPTION: The course will present surgical neuroanatomy as it relates to common neurosurgical procedures covering the supratentorial space. The course will review anatomy encountered in the surgical approaches and surgical techniques used to treat vascular pathologies and skull base tumors. The content will be anatomy and clinical cases from expert neurosurgeons that demonstrate the application of anatomical knowledge needed to perform these operations skillfully.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:

- Discuss the surgical anatomy of the prefrontal and orbitozygomatic exposures.
- Review the surgical anatomy of the far lateral exposure.
- Identify the surgical anatomy of the transtemporal exposures.
- Describe the surgical anatomy of the ventricles, interhemispheric fissure, and pineal region.
- Apply these surgical approaches in their own practice.

TU 8:00–11:30 am Fee: $450

PC19 Advanced Cerebrovascular Surgery: 2D and 3D Operative Video-based Surgical and Anatomical Pearls

COURSE DIRECTOR: Peter Nakaji


COURSE DESCRIPTION: This course will employ a dynamic senior faculty and use high-quality video content to illustrate important points in the management of open cerebrovascular pathologies, including aneurysms, AVMs, cavernous malformations, fistulae, and bypass. The course will highlight difficult cases and special challenges such as the management of intraoperative rupture of aneurysms and the management of unexpected complications.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:

- Approach basic and complicated aneurysms in a systematic way to achieve clipping and reconstruction.
- Select approaches to aneurysms in different locations, including minimally invasive approaches.
- Employ strategies to manage intraoperative complications, including intraoperative aneurysm rupture.
- Plan approaches that include multimodality therapy with endovascular therapy.
- Apply these technical lessons in their own surgical management of vascular lesions.

8:00–11:30 am Fee: $450

PC20 Spinal Deformity: Case-based Update

COURSE DIRECTOR: Christopher I. Shaffrey

FACULTY: Ian G. Dorward, Daniel Robert Fassett, Jeremy L. Fogelson, Praveen V. Mummaneni, Juan S. Uribe

COURSE DESCRIPTION: A series of cases ranging from simpler degenerative spine, with a component of deformity, to progressively greater levels of spinal deformity will be presented. Emphasis on the appropriate evaluation of spinal deformity and the entire spectrum of treatment options will be discussed. Nonsurgical management and indications for simple decompression or limited fusion, and cases requiring more complex reconstructive surgery will also be presented. Experts in minimally invasive approaches, anterior, lateral, and posterior approaches and osteotomy procedures will debate the merits of the different approaches available. Interaction between faculty and participants will be strongly encouraged, and there will be opportunities for participants to present their own cases.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:

- Describe current clinical trials
- Identify radiographic parameters associated with spinal deformity.
- Discuss the spectrum of treatment options available to patients with spinal deformity.
- Determine the factors that determine when an anterior, lateral or posterior approach may give the best outcomes in the surgical management of spinal deformity.
- Describe when limited and minimally invasive approaches may be most effective and an option for reducing complications.
- Recognize common complications associated with treatment of spinal deformity and strategies for reducing complications.

8:00–11:30 am Fee: $450

NEW!

PC21 Thoracolumbar: Trauma, Tumor, and Degenerative: Case-based Presentations

COURSE DIRECTOR: Michael Y. Wang

FACULTY: Ali A. Bajaj, Daniel Robert Fassett, Adam S. Kanter, Christopher Michael Maulucci, Laurence D. Rhines

COURSE DESCRIPTION: This half-day didactic practical course will be conducted in an engaging, case-based format to enhance audience participation. Controversial aspects of both common and complex spinal conditions will be discussed utilizing specific cases. In this way potential pitfalls in diagnosis, medical management, and surgical technique will be highlighted. Attendees are also encouraged to bring their own cases for discussion.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:

- Describe complications and their management in spinal trauma.
- Discuss various surgical approaches to spinal column tumors.
- Outline optimal management strategies for adult degenerative deformity.
- Apply these patient selection criteria and operative strategies to their practice.

8:00–11:30 am Fee: $450

PC22 Trauma Update: Traumatic Brain Injury–Case-based Learning

COURSE DIRECTOR: Shelly D. Timmons

FACULTY: Rocco Armonda, Gregory J. Murad, David O. Okonkwo, Roland A. Torres, Jamie S. Ullman

COURSE DESCRIPTION: The modern management of traumatic brain injury (TBI) is ever-changing and complex. Clinical trials in TBI are complicated, and the results often lead to new controversies in the neurosurgical treatment of TBI. New technologies in neuroimaging and neuromonitoring are improving the neurosurgeon’s ability to take care of TBI patients. Understanding evolving guidelines on TBI is important to every neurosurgeon. This course will cover current clinical trials, new technologies, and the most up-to-date guidelines. This course will be of interest not only to the neurosurgeon who takes care of TBI on a daily basis, but also to the general neurosurgeon interested in updating his or her knowledge base.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:

- Describe current clinical trials
in traumatic brain injury.
• Discuss new technologies and monitoring for traumatic brain injury
• Analyze the most up-to-date guidelines on traumatic brain injury.
• Apply these new data to their own management of patients with traumatic brain injury.

LEARNING OBJECTIVES:

• Discuss new technologies and monitoring for traumatic brain injury.
• Apply these new data to their own management of patients with traumatic brain injury.

PC23 Neo-surgeons-Hospital Relationships: Options, Negotiations, and Achieving What You Are Worth

COURSE DIRECTOR: Dong H. Kim

FACULTY: Deborah L. Benzil, Robert E. Harbaugh, Stephen Papadopoulos, Alan M. Scarrow, Mitesh Shah, Robert J. Weil, Edie E. Zusman

COURSE DESCRIPTION: This course will cover the major changes occurring in the U.S. healthcare system, and the resulting effects on neurosurgical practice. Demographic trends will be reviewed, from increasing employment by hospitals to the rise of new entities like Accountable Care Organizations. A trainee looking for a job, or an established surgeon looking at new opportunities or different relationships to local institutions, will be able to understand the options available and factors relevant to a successful negotiation. How do hospitals and other institutions value neurosurgeons currently, and how might that change? What is the legal basis for such relationships, which define what is and is not possible? What makes an opportunity attractive now, and how can one determine viability in the future? This course will review macro-level changes coupled with faculty that can provide concrete examples, from real-world experience, of individuals and groups that conducted successful negotiations and established new working relationships.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Describe what major changes will affect US healthcare, and alter the demographics of neurosurgical practice.
• Describe what laws regulate physician-hospital relationships, and what options are available to neurosurgeons contemplating employment, joint ventures, or other types of affiliation.
• Describe what gives a neurosurgeon value, and what negotiating strategies are most likely to produce favorable outcomes.
• Learn of different hospital relationships negotiated by other surgeons or groups, and advantages or disadvantages of each approach.
• Recognize the changing environment of neurosurgical practice and engage their local environment to improve service line performance and patient care.

PC24 Pituitary Surgery: Indications, Techniques, and Outcomes

COURSE DIRECTORS: John A. Jane Jr., Edward R. Laws

FACULTY: Ian F. Dunn, Juan Carlos Fernandez-Miranda, Daniel F. Kelly, Andrew S. Little, Edward H. Oldfield, Oluch Olunya, Nelson M. Oyesiku, Theodore H. Schwartz, Jason P. Sheehan, Gabriel Zada

COURSE DESCRIPTION: The course will feature leading surgeons in the field of pituitary surgery, who will discuss the anatomy of the parasellar region as well as microscopic, 2D and 3D endoscopic techniques. The indications for extended approaches as well as transcranial techniques will also be discussed. Complication avoidance, skull base repair, and indications for radiosurgery will also be emphasized. Lastly, faculty will also discuss the indications for and outcomes after radiosurgery of pituitary adenomas.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Describe the relevant surgical anatomy for the transsphenoidal technique.
• Outline the current surgical techniques and nuances for the resection of pituitary adenomas.
• Describe the indications for extended transsphenoidal and transcranial approaches for pituitary adenomas.
• Explain the indications for radiosurgery and complication avoidance in pituitary surgery.
• Apply these principles in their own patient selection and surgical management of patients requiring pituitary surgery.

PC25 Spinal Biomechanics in Clinical Practice

COURSE DIRECTOR: Tyler R. Koski


COURSE DESCRIPTION: This course will present the physical principles and biomechanical foundations of spinal surgery and stabilization via a didactic and interactive case discussion format.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Integrate biomedical principles and strategies of spinal surgery into their surgical planning.
• Strategize to avoid and manage complications.
• Apply biomechanical principles in counseling patients with spinal disease.

PC26 Improve Quality, Reduce Cost, and Increase Revenue

COURSE DIRECTOR: Zoher Ghogawala


COURSE DESCRIPTION: This course will use a case-based approach to demonstrate what quality looks like from a neurosurgical perspective. It is important that we recognize the importance of traditional quality metrics (SSIs, re-admissions, etc.) but also identify neurological quality measures that document what excellent care represents. We will include health economic impact of quality assessment and will also include unique revenue opportunities based upon documentation of high neurosurgical quality.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Define Quality Care from Neurosurgical Perspective and differentiate it from traditional quality metrics.
• Define how surgical site infection and unplanned hospital admissions increase health costs.
• Discuss how improving quality lowers cost.
• Learn about novel strategies for increasing revenue using quality data.
• Apply these data collection methods and quality outcomes assessment in their own practice.
applications, and outcomes to illustrate the gaps that this emerging technology can fill for neurosurgeons and prospective patients.

**LEARNING OBJECTIVES:** Upon completion of this course, participants will be able to:
- Explain the underlying principles of image-guided laser ablation.
- List the indications for MR-guided laser ablation.
- Describe the outcomes and risks of MR-guided laser ablation surgery.
- Apply these principles of patient selection for performance and/or referral of MR-guided laser ablation.

**COURSE DESCRIPTION:** This course is designed to provide attendees, from the time they finish residency till they are 100, with advice on what to do with the challenges of extended life, probable loss of Social Security, what to do in these challenging economic times, and in general developing a strategic plan for your future, which should be re-evaluated every five years and yearly with goals and strategies to accomplish those goals. Illness or accidents cannot be anticipated but must be faced and accommodated. Audience participation will be encouraged. Interesting speakers will be invited to provide their input. This will be an open exchange forum so that you can learn from others what they are thinking and doing. What you will learn is there is no one plan for everyone but that planning should start early, right out of residency. Learn from the wisdom of your colleagues, younger and older.

**LEARNING OBJECTIVES:** Upon completion of this course, participants will be able to:
- Discuss how to plan for and develop the multiple careers you will have in your future.
- Identify the steps needed to develop a strategic plan for your future.
- Evaluate if retirement is a healthy physiologic choice and what life will be like in the future.
- Review the present and upcoming economic crisis and its effect on medical and social advances.
- Identify your place in a dynamically changing life.

**COURSE DESCRIPTION:** This course will cover the most cutting-edge updates on how to limit contact during sports, extreme sports, and boxing. The long-term risks of chronic traumatic encephalopathy, latest evidence for return-to-play, and education and advocacy related to sports-related head injuries will be reviewed.

**LEARNING OBJECTIVES:** Upon completion of this course, participants will be able to:
- Advise patients, families, and other physicians about the latest evidence for return-to-play.
- Identify the risks of extreme sports and boxing, and how this relates to chronic traumatic encephalopathy.
- Review current education and advocacy efforts related to sports-related head injuries.
- Apply these lessons in their counseling of patients involved in contact activities.

**TU 12:30–4:00 pm** Fee: $450

**PC28 Surgical Neuroanatomy II (Infratentorial)**

**COURSE DIRECTOR:** Michael T. Lawton

**FACULTY:** Mustafa Kemal Baskaya, Paul A. Gardner, John G. Golfinos, Jacques J. Morcos, Philip V. Theodosopoulos

**COURSE DESCRIPTION:** The course will present surgical neuroanatomy as it relates to common neurosurgical procedures, covering the infratentorial space. The course will review anatomy encountered in the surgical approaches and surgical techniques used to treat vascular pathologies and skull base tumors. The content will be anatomy and clinical cases from expert neurosurgeons that demonstrate the application of anatomical knowledge needed to perform these operations skillfully.

**LEARNING OBJECTIVES:** Upon completion of this course, participants will be able to:
- Discuss the surgical anatomy of the pterional and orbitozygomatic exposures.
- Review the surgical anatomy of the far lateral exposure.
- Identify the surgical anatomy of the transtentorial exposures.
- Describe the surgical anatomy of the ventricles, interhemispheric fissure, and pineal region.
- Apply these approach techniques in their management of patients with cranial disease.

**TU 12:30–4:00 pm** Fee: $450

**NEW!**

**PC29 Planning for Your Future—From 35 to 100: Strategic Planning, Economics, Marriage, Family, Illness, and More. Should You Retire?**

**COURSE DIRECTOR:** James I. Ausman

**FACULTY:** Carolyn R. Ausman, Margaret R. Chambers, Shahin Etebar, James B. Mansfield, Karen Mansfield

**COURSE DESCRIPTION:** This course is designed to provide attendees, from the time they finish residency till they are 100, with advice on what to do with the challenges of extended life, probable loss of Social Security, what to do in these challenging economic times, and in general developing a strategic plan for your future, which should be re-evaluated every five years and yearly with goals and strategies to accomplish those goals. Illness or accidents cannot be anticipated but must be faced and accommodated. Audience participation will be encouraged. Interesting speakers will be invited to provide their input. This will be an open exchange forum so that you can learn from others what they are thinking and doing. What you will learn is there is no one plan for everyone but that planning should start early, right out of residency. Learn from the wisdom of your colleagues, younger and older.

**LEARNING OBJECTIVES:** Upon completion of this course, participants will be able to:
- Discuss the updated treatment of spine trauma and spinal cord injury in the cervical and thoracic spine, and amongst the pediatric, adult, and geriatric population.
- Review the current literature and updated guidelines for treatment of these conditions.
- Apply these guidelines in their own management of spinal trauma patients.

**TU 12:30–4:00 pm** Fee: $450
NEW! PC33  Surgery/SRS for Benign Tumors

COURSE DIRECTOR: Randy L. Jensen, Jason P. Sheehan

FACULTY: Aaron Cohen-Gadol, Franco DeMonte, Paul A. Gardner, Douglas Kondziolka, Michael J. Link, Edwin Mogere, Lynda Jun-San Yang

COURSE DESCRIPTION: This course will discuss the appropriate use of radiosurgery and surgery for benign central and peripheral nervous tumors.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:

• Discuss contemporary management of benign tumors by microsurgery and endoscopy.
• Review contemporary management of benign tumors by radiosurgery.
• Detail contemporary management of specific tumor histologies, including skull base meningiomas, pituitary adenomas, acoustic neuromas, chordomas, peripheral nerve tumors, and pediatric tumors.
• Apply these treatment strategies or refer appropriate patients in their practice for surgery or radiosurgery therapy.

1:00–3:00 pm CNS RESIDENT SANS CHALLENGE
Preliminary Round

The CNS has a long and distinctive heritage of supporting military neurosurgeons. To honor those who serve our country, the CNS is offering complimentary registration and limited free housing to US Active Duty Military members.

Free housing is limited to the first 10 Active Duty Military CNS members registered for the CNS Annual Meeting.

Here’s how to take advantage of these benefits:

CNS Members
When registering for the CNS Annual Meeting, please select Active Duty Military member on the online registration form at cns.org/2016.

If you are one of the first 10 Active Duty Military registrants, you will be contacted by the CNS staff to confirm housing arrangements.

Non-members
Please contact membership@cns.org to join the CNS and confirm that you qualify for these benefits.

CNS membership is complimentary to Active Duty Military neurosurgeons.

To see more great member benefits the CNS offers its Active Duty Military members visit cns.org/membership.
4:05–6:30 pm
PRESIDING OFFICER: Alan M. Scarrow
MODERATORS: Gerald A. Grant, Shekar N. Kurpad
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
● Discuss adaptions, advances, and achievements in the treatment of cerebral arteriovenous malformations.
● Apply advances in other leadership areas to neurosurgical practice.
● Discuss adaptions, advances, and achievements in the treatment of spinal deformity.
● Recognize the role of brain mapping in intracranial tumor surgery.
● Apply recent research in arteriovenous malformations, intracranial tumors, and spinal deformity to their management of these patients.

4:05–4:06 pm
Introductions and Disclosures
Gerald A. Grant

4:06–4:08 pm
Fellowship Award Presentations
Ricardo J. Komotar

4:08–4:11 pm
Executive Committee / Annual Meeting Committee Acknowledgements
Russell R. Lonser

4:11–4:15 pm
Presentation of Founder’s Laurel Award to Recipient H. Hunt Batjer
Nathan R. Selden

4:15–4:19 pm
Presentation of Founder’s Laurel Award to Recipient H. Hunt Batjer
Nathan R. Selden

4:19–4:21 pm
Introduction of CAANS President Graham A. G. Fieggen
Shekar N. Kurpad

4:21–4:31 pm
CAANS President Graham A. G. Fieggen

4:31–4:48 pm
AVM Treatment Advances, Adapting to ARUBA
Robert F. Spetzler

4:48–4:51 pm
Introduction of Admiral Shoemaker
Gregory D. Willard

4:51–5:11 pm
Special Lecture
Vice Admiral Mike Shoemaker

5:11–5:28 pm
Adapting Spinal Deformity Alignment Principles to Achieve Improved Outcomes for Many Degenerative Spine Conditions
Christopher I. Shaffrey

5:28–5:45 pm
GBM: Adapting with Precision and Achieving a Change in the Landscape of Treatment and Understanding of the Disease
Mitchel S. Berger

5:45–5:47 pm
Introduction of Michael L. J. Apuzzo Lecturer on Creativity and Innovation
Arun Amar

5:47–6:07 pm
Michael L. J. Apuzzo Lecture on Creativity and Innovation
Akhil Reed Amar

6:07–6:10 pm
Introduction of John Thompson History of Medicine Lecturer
Daniel James Brown
Richard G. Ellenbogen

6:10–6:30 pm
John Thompson History of Medicine Lecture
Daniel James Brown

YOU’RE INVITED!
Opening Reception
Sunday, September 25
6:30–8:30 pm

Gather with your friends and colleagues at the Marriott Marquis San Diego Marina hotel terrace for music, cocktails, and a delicious array of hors d’oeuvres. Kick off your Annual Meeting in west coast style with spectacular panoramic views of the San Diego Bay.

Daniel James Brown will be signing copies of his bestselling book, The Boys in the Boat.
8:40–9:00 AM
HONORED GUEST PRESENTATION
Cushing’s Disease: Lessons Learned from 1400 Cases
Edward H. Oldfield

11:00–11:30 AM
WALTER E. DANDY ORATION
iWoz: A Conversation with Steve Wozniak
Steve Wozniak

2:15–3:15 PM
GUIDELINES SESSION 1
Guidelines for the Management of Traumatic Brain Injury

2:15–3:15 PM
CLINICAL CONTROVERSIES SESSION 1
L4/5 Lumbar Spondylolisthesis

2:15–3:15 PM
OPERATIVE NEUROSURGERY 1
Live Neuroendovascular Surgery: Novel Devices and Treatment Controversies
PRESIDING OFFICER: Steven N. Kalkanis

MODERATORS: James S. Harrop, J. Bradley Elder

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:

- Discuss adaptations, advances, and achievements:
  - in the treatment of traumatic brain injury
  - in epilepsy surgery
  - in the treatment of medulloblastoma
  - in surgery for cerebral aneurysms
  - in the treatment of Cushing’s Disease
  - in the health care system

- Apply these research and practice advancements to their neurosurgical care of these patient groups.

7:00–11:30 am

Introductions and Disclosures
James S. Harrop
7:03–7:21 am
Paving the Way for a New Era in Traumatic Brain Injury
Geoffrey T. Manley
7:21–7:39 am
Recent Advances in Epilepsy Surgery: Achieving Best Outcomes with HFOs, DTIs, MEGs, FCDs, and IONM
James T. Rutka
7:39–7:44 am
K12 Introduction and Summary
Emad N. Eskandar
7:44–7:56 am
K12 Awardee Talk
Adapting the Field of Functional Neurosurgery to Achieve Bidirectional Control of Paralyzed Limbs
Timothy H. Lucas
7:56–8:01 am
Washington Committee Report
Shelly D. Timmons
8:01–8:17 am
Advances in Genomics Explain Medulloblastoma Behaviour at the Bedside
Michael D. Taylor
8:17–8:35 am
Advances in the Surgical Management of Paraclinoid Aneurysms: The 25th Anniversary of the Dallas Technique
H. Hunt Batjer
8:35–8:40 am
Introduction of Honored Guest Edward H. Oldfield
Russell R. Lonser
8:40–9:00 am
Honored Guest Presentation
Cushing’s Disease: Lessons Learned from 1400 Cases
Edward H. Oldfield
9:00–10:00 am
MORNING BEVERAGE BREAK
Visit the Exhibit Hall!
10:00–10:16 am
Growing Brains: How Adapting to Africa Advanced the Treatment of Infant Hydrocephalus
Benjamin C. Warf
10:16–10:32 am
Achieving Optimal Outcome for Grade I Lumbar Spondylolisthesis: SLIP Study Results
Zoher Ghogawala
10:32–10:37 am
Introduction of CNS President Russell R. Lonser
10:37–11:00 am
CNS Presidential Address
Russell R. Lonser
11:00–11:30 am
Walter E. Dandy Oration
iWoz: A Conversation with Steve Wozniak
Steve Wozniak

Register now at cns.org/2016
LEARNING OBJECTIVES:
Upon completion of this course, participants will be able to:
- Review innovative treatment strategies for spinal deformity.
- Discuss current controversies in spinal deformity surgery.
- Explain current indications and guidelines for spinal deformity surgery.
- Apply these guidelines in their own surgical management or referral of patients with spinal deformity.

Educational grant provided by DePuy Synthes Spine

M04 Controversies in Spinal Deformity Surgery
MODERATOR: Christopher I. Shaffrey
FACULTY: Eli M. Baron, Yaser El-Bana, Tyler R. Koski, John C. Liu, Nicholas Theodore
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Review innovative treatment strategies for spinal deformity.
- Discuss current controversies in spinal deformity surgery.
- Explain current indications and guidelines for spinal deformity surgery.
- Apply these guidelines in their own surgical management or referral of patients with spinal deformity.

M06 Peripheral Nerve Pain Syndromes: Diagnosis and Management
MODERATOR: Line Jacques
FACULTY: Shaun T. O’Leary, Konstantin V. Slavin, Gabriel C. Tender, Christopher J. Winfree
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Discuss clinical manifestations of peripheral nerve syndromes.
- List diagnostic approaches to peripheral nerve syndromes.
- Describe techniques to manage peripheral nerve syndromes.
- Apply these diagnostic tools in identifying patients in their own practice suffering from peripheral nerve pain syndromes and offer appropriate surgical management or referral.

M07 Non-functioning Pituitary Adenomas: Operative Nuances and Management
MODERATOR: Theodore H. Schwartz
FACULTY: Manish Kumar Aghi, Elfatih Bashir, James P. Chandler, John A. Jane Jr., Nelson M. Oyesiku
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Outline the roles of medical, radiation, and surgical treatment for non-secretory pituitary adenomas.
- Describe the medical, imaging, and laboratory evaluation for various pituitary adenomas.
- Explain the surgical nuances of pituitary adenoma resection.
- Apply these patient selection and surgical techniques in their management of pituitary adenomas.

M08 Challenging Pediatric Neurosurgery Cases: Interactive Case-based Discussion
MODERATOR: Jeffrey Leonard
FACULTY: Graham A. G. Fieggen, Mark D. Krieger, Samuila Sannousi, Nathan R. Selden, Mark M. Souweidane
LEARNING OBJECTIVES: Upon completion of
LEARNING OBJECTIVES:
FACULTY: Jonathan Miller, Alon Y. Mogilner, Andre Machado and M10

NEW!
M09 Brain Arteriovenous Malformation: Multi-disciplinary Approach
MODERATOR: Jacques J. Morcos
FACULTY: Daniel L. Barrow, Kevin M. Cockroft, Rafael Rodriguez, Allan Taylor, Patrick P. Youssef

NEW!
M10 Spinal Cord Stimulator for Back and Leg Pain: Show Me the Evidence
MODERATOR: Andre Machado
FACULTY: Jonathan Miller, Alon Y. Mogilner, Sean J. Nagel, Chengyuan Wu

NEW!
M11 Acoustic Neuroma: Current Management Strategies
MODERATOR: Frederick George Barker
FACULTY: Steven L. Giannotta, Carl B. Heilman, Douglas Kondziolka, Michael J. Link

NEW!
M12 Spinal Column Metastases Management
MODERATOR: Ziya L. Gokaslan
FACULTY: Mark H. Blisky, Mostafa M.W. Kotb, Ilya Laufer, Daniel M. Scibba, Claudio Esteves Tatsui

NEW!
M13 Low-grade Glioma: Current Management Strategies
MODERATOR: Mitchel S. Berger, Nader Sanai
FACULTY: Hugues Duffau, J. Bradley Elder, Frederick F. Lang, Ying Mao, Sujit S. Prabhuj

NEW!
M14 Functional Neurosurgery: Emerging Opportunities
MODERATOR: Peter Konrad
FACULTY: Aviva Abosch, Kelly D. Foote, Casey H. Halpern, Nader Pouratian

NEW!
M15 Cervical Radiculopathy: Anterior Versus Posterior Cervical
MODERATOR: R. John Hurlbert
FACULTY: Sherif Ezzat, Ali Abou Madawi, Praveen V. Mummaneni, Russ P. Nockels, Christopher E. Wolfla

Register now at cns.org/2016

NEW!
VISIT THE EXHIBIT HALL!

LEARNING OBJECTIVES:
Upon completion of this course, participants will be able to:
- Discuss the pathophysiology and etiology of low back pain and lumbar radiculopathy from spondylolisthesis.
- Review surgical approaches and advantages and disadvantages with each approach.
- Review clinical outcomes, measurements, and post-operative care.
- Apply these patient selection principles in their surgical management of patients with L4/5 lumbar spondylolisthesis.

2:15–2:27 pm
**MIS Decompression**
Domagoj Coric

2:27–2:39 pm
**Endoscopic Decompression**
Daniel Hwan Kim

2:39–2:51 pm
**XLIF**
Juan Uribe

2:51–3:03 pm
**TLIF**
John E. O’Toole

3:03–3:15 pm
**Open PLF**
Gerald E. Rodts

NEW!

GUIDELINES SESSION 1
Guidelines for the Management of Traumatic Brain Injury

MODERATORS: M. Ross Bullock, Guy L. Clifton, Geoffrey T. Manley

SPEAKERS: Randall Matthew Chesnut, Jamshid Ghajar, Odette Harris, Jamie S. Ullman, Jack E. Wilberger

LEARNING OBJECTIVES:
- Discuss the current management guidelines regarding ICP monitoring for severe traumatic brain injury.
- Review current management guidelines regarding hypothermia for severe traumatic brain injury.
- Discuss current management guidelines regarding thresholds for surgery for severe traumatic brain injury.
- Determine current management guidelines regarding DVT prophylaxis for severe traumatic brain injury.
- Apply these guidelines in their management of patients with traumatic brain injury.

2:15–2:27 pm
**Overview of Guidelines/Introduction and ICP Monitoring**
Jamshid Ghajar

2:27–2:39 pm
**Hypothermia / Nutrition**
Odette Harris

2:39–2:51 pm
**Ventilation / Blood Pressure**
Jack E. Wilberger

2:51–3:03 pm
**Thresholds**
Randall Matthew Chesnut

3:03–3:15 pm
**DVT**
Jamie S. Ullman

NEW!

OPERATIVE NEUROSURGERY
SESSION 1
Live Neuroendovascular Surgery: Novel Devices and Treatment Controversies

MODERATORS: Brian Lim Hoh, Henry H. Woo


LEARNING OBJECTIVES:
Upon completion of this course, participants will be able to:
- Discuss alternative treatment strategies for complex cerebrovascular cases.
- Discuss alternative treatment strategies using different novel devices, some not yet available in the United States, for complex cerebrovascular cases.
- Apply increased competence in the endovascular application of these new technologies within their own practice through live case demonstration.

2:15–2:35 pm
**Acute Ischemic Stroke**
J D. Mocco, Adnan H. Siddiqui

2:35–2:55 pm
**Basilar Tip Aneurysm**
Adam S. Arthur, Raymond D. Turner, Erol Veznedaroglu

2:55–3:15 pm
**Giant Ophthalmic Aneurysm**
Cameron G. McDougall, Ajay K. Wakhloo
3:15–4:45 pm

SECTION ON NEUROSURGICAL SOCIETIES

MODERATORS: Maya A. Babu, Gregory J. Murad

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Identify critical issues affecting neurosurgical graduate medical education.
- Identify five leadership skills important for neurosurgery.
- Discuss pipeline issues affecting neurological trainee selection.

3:15–4:03 pm

Leadership and Education in Neurosurgery

4:03–4:45 pm

Oral Presentations


SECTION ON CEREBROVASCULAR SURGERY

MODERATORS: Brian T. Jankowitz, Scott Douglas Simon

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Discuss three upcoming trials evaluating the utility and benefit of intracranial hemorrhage evacuation.
- Identify how the trials will differ from one another.
- Apply lessons from the ongoing trials in their management of spontaneous intracerebral hemorhage.

3:15–4:15 pm

Oral Presentations


SECTION ON PAIN

MODERATORS: Jason M. Schwalb, Mohammed F. Shamji

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Describe different stimulation paradigms of spinal cord stimulation for pain and their putative modes of action.
- List important areas for further knowledge development and research in the neurosurgical treatment of pain.
- Identify important ongoing clinical trials.

3:15–4:03 pm

Advances in Spinal Cord Stimulation

3:15–3:35 pm

Mechanisms of High Frequency SCS Examined with Computational Models

Scott Lemppa

3:35–3:55 pm

Burst and High Frequency
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Discuss the role of available treatment modalities for pediatric low-grade glioma, including the advantages and disadvantages of each, and their role in challenging cases.
- Identify current updates in clinical management of low-grade glioma using surgery, radiotherapy, and/or chemotherapy.
- Apply these management principles in their own treatment of low-grade gliomas in practice.

4:03–4:45 pm
Oral Presentations
See page 51 for Oral Papers 118–124.

SECTION ON PEDIATRIC NEUROLOGICAL SURGERY
MODERATORS: Lissa Baird, Lilliana Goumnerova
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Discuss the role of available treatment modalities for pediatric low-grade glioma, including the advantages and disadvantages of each, and their role in challenging cases.
- Identify current updates in clinical management of low-grade glioma using surgery, radiotherapy, and/or chemotherapy.
- Apply these management principles in their own treatment of low-grade gliomas in practice.

3:15–4:03 pm
Pediatric Low-grade Gliomas: Treatment Updates and Case Discussion
MODERATORS: Lissa C. Baird, Lilliana Goumnerova
3:15–3:17 pm
Introduction
Lissa C. Baird
3:17–3:29 pm
The Role of Surgery
Jeffrey R. Leonard
3:29–3:41 pm
The Role of Radiotherapy
Kevin Murphy
3:41–3:53 pm
The Role of Chemotherapy
Kellie Nazemi
3:53–4:03 pm
Challenging Cases and Discussion Panel
4:03–4:45 pm
Oral Presentations

SECTION ON STEREOTACTIC AND FUNCTIONAL NEUROSURGERY
MODERATORS: Emad Eskandar, Parag Patil
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Describe a novel technology to animate paralyzed limbs through neurosurgery.
- Describe recent advances in functional neurosurgical research.
- Apply these research advancements in their own selection of patients for this therapy.

3:15–4:03 pm
New Frontiers in Functional Neurosurgery
3:15–3:35 pm
Memory Aid for the Human Brain
Itzhak Fried
3:35–3:55 pm
Reanimating the Paralyzed Limbs: New Developments in FES and Brain Computer Interface
Jonathan Miller
3:55–4:03 pm
Discussion and Questions
4:03–4:45 pm
Oral Presentations

4:45–6:15 pm
SECTION POSTER VIEWING SESSION
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Discuss the findings of novel neurosurgical studies.
- Describe important areas for further research.
- Identify the most important ongoing clinical trials.

4:45–6:15 pm
Clinical Trials Update: Year in Review—What Every Neurosurgeon Should Know
MODERATORS: Brian Lim Hoh, Ganesh Rao
COURSE DESCRIPTION: In the rapidly changing world of evidence-based medicine, every neurosurgeon needs to know the results of the important clinical trials which will influence the management and treatment decision-making of patients. In this high-impact educational session, the results of major clinical trials reported over the past year, or important trials soon to be completed, will be presented by the principal investigators of the trials. Each trial will be evaluated by an expert to provide perspective.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Discuss the major findings of important clinical trials in the treatment of brain tumors.
- Review the major findings of important clinical trials in the treatment of spinal disorders.
- Discuss the major findings of important clinical trials in the treatment of cerebrovascular conditions.
- Identify the major findings of important clinical trials in the treatment of traumatic brain injury.
- Apply these clinical trial findings to their management of these patient groups.
Dinner Seminar 02

Complimentary shuttle service will be provided for all dinner seminars. Shuttles will depart from the Marriott Marquis San Diego Marina Hotel.

Monday, September 26 • 7:00–9:30 pm • Fee: $190

**DIN02**

**NEW!**

**New CPT Codes, ICD-10, MIPS, and Bundling: What These Challenges Mean to Your Bottom Line**

**MODERATORS:** John K. Ratliff, Henry H. Woo

**SPEAKERS:** Clemens M. Schirmer, Philip W. Tally, Luis M. Tumialan

**LEARNING OBJECTIVES:** Upon completion of this course, participants will be able to:

- Discuss the impact of ICD-10 implementation.
- Identify resources for ICD-10 implementation.
- Analyze the cost of ICD-10 implementation.
- Apply these lessons to the implementation of ICD-10 in their own practices.

**BiCE**

Located in the Gaslamp District, BiCE combines the comforts of true Italian hospitality and the fresh, wholesome ingredients of a real Italian marketplace. Innovative cuisine offers complex flavor combinations that will entice even the most ambitious connoisseur. Winner of the 2011, 2012, and 2014 Gold Medallion for “Best Italian Fine Dining” by the California Restaurant Association.

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Dinner Seminar 03

Complimentary shuttle service will be provided for all dinner seminars. Shuttles will depart from the Marriott Marquis San Diego Marina Hotel.

Monday, September 26 • 7:00–9:30 pm • Fee: $190

**DIN03**

**NEW!**

**Management of Meningiomas (Asymptomatic to Atypical)**

**MODERATORS:** Randy L. Jensen

**SPEAKERS:** Ossama Al-Mefty, William T. Curry, Laligam N. Sekhar, Jason P. Sheehan

**LEARNING OBJECTIVES:** Upon completion of this course, participants will be able to:

- Identify risk factors for meningioma progression.
- Describe management in the setting of gross total and subtotal meningioma resection.
- Apply existing evidence for adjuvant radiation and chemotherapy for meningiomas.
- Apply these data to counseling patients with asymptomatic or atypical meningiomas.

**Salvatore’s Cucina Italiana**

One of San Diego’s fine premier dining spots, Salvatore’s uses carefully sourced, fresh ingredients to create a refined, authentic Italian dining experience unlike any other. Founder and Executive Chef Raffaella Morelli, born and educated in Italy, has a philosophy of “hospitality over pretension,” and all guests are treated like family.

Register now at cns.org/2016
TUESDAY, SEPTEMBER 27

8:40–9:00 AM
FEATURED SPEAKER
Big Data’s Impact on Medicine
Viktor Mayer-Schönberger

10:55–11:30 AM
NEUROSURGERY LECTURER
Moneyball: The Art of Winning an Unfair Game
Billy Beane

2:15–3:15 PM
OPERATIVE NEUROSURGERY SESSION 2
Live Endoscopic Endonasal Resection of Nonsecretory Pituitary Macroadenoma

1:45–3:15 PM
CNS RESIDENT SANS CHALLENGE CHAMPIONSHIP ROUND

4:45–5:15 PM
RAPID-EXCHANGE ORAL PRESENTATION SESSIONS
TUESDAY, SEPTEMBER 27

GENERAL SCIENTIFIC SESSION III

7:00–11:30 am

PRESIDING OFFICER: Michael P. Steinmetz

MODERATORS: Brian Lim Hoh, Krystal Lynne Tomei

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:

● Discuss adaptations, advances, and achievements in the treatment of peripheral nerve diseases
  - in radiosurgery
  - in functional neurosurgery
  - in neurovascular surgery
● Apply these changes across neurosurgical subspecialties to their own practice

7:00–7:02 am
Introductions
Brian Lim Hoh

7:02–7:32 am
Best of the Best Oral Abstract Presentations

7:32–7:47 am
Adapting Findings from Rare Peripheral Nerve Diseases Can Lead to Broad Applications in Neurosurgery
Robert J. Spinner

7:47–8:02 am
Stereotactic Radiosurgery: The Revolutionary Advance in the Treatment of Spine Metastases
Mark H. Bilsky

8:02–8:07 am
AANS President
Frederick A. Boop

8:07–8:17 am
Neurosurgery Update
Nelson M. Oyesiku

8:17–8:37 am
Honored Guest Presentation
Pathogenesis of Chiari I—Pathophysiology of Syringomyelia: Implications for Therapy
Edward H. Oldfield

8:40–9:00 am
Featured Speaker
Big Data's Impact on Medicine
Viktor Mayer-Schönberger

9:00–10:00 am
MORNING BEVERAGE BREAK
Visit the Exhibit Hall!

9:15–9:45 am
LIVE SURGERY in the Exhibit Hall

10:00–10:17 am
Advancing Beyond DBS, New Avenues in Functional Neurosurgery: Adapting Endoventricular Near Infrared Illumination to Neuroprotection in Parkinson’s Disease, and Achieving a Brain Driven Exoskeleton for Tetraplegic Patient
Alim-Louis Benabid

10:17–10:34 am
Advances in Disruptive Innovation in Neurovascular Surgery
Robert H. Rosenwasser

10:34–10:51 am
Adapting to the Rapid Transformation in Health Care: Can We Make Patient Care Safer
Alexander Vaccaro

10:51–10:55 am
Introduction of Neurosurgery Lecturer
Billy Beane
Nelson M. Oyesiku

10:55–11:30 am
Neurosurgery Lecturer
Moneyball: The Art of Winning an Unfair Game
Billy Beane

Register now at cns.org/2016

39
T16 Seven Aneurysms
MODERATOR: Michael T. Lawton
FACULTY: Daniel L. Barrow, Evandro De Oliveira, Rohen Harrichandparsad, Ali F. Krisht
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Discuss the epidemiology and natural history of ruptured and unruptured aneurysms.
- Outline treatment strategies for different aneurysms.
- Describe the most important concepts of aneurysm microsurgery.
- Apply these techniques in their counseling of patients and surgical management of aneurysms.

T17 Trigeminal Neuralgia Management Update
MODERATOR: Kim J. Burchiel
FACULTY: Abdessamad El Ouahabi, Anil Nanda, Jean Regis, Charles Teo
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Incorporate surgical, percutaneous, radiosurgical, and neuromodulation options for trigeminal neuralgia and facial pain syndromes into practice.
- Recognize the complications and outcomes with each treatment strategy.
- Summarize ongoing clinical studies which may impact future practice.

T18 Cervical Arthroplasty: Is There a Role?
MODERATOR: Michael Y. Wang
FACULTY: Domagoj Coric, Regis W. Haid, Matthew McDonald
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Identify the indications for cervical arthroplasty.
- Summarize important literature regarding cervical arthroplasty.
- Describe the surgical techniques for cervical arthroplasty.
- Review the advantages and disadvantages of cervical arthroplasty compared to cervical fusion.

T19 Radiosurgery for Brain Metastases: Update and Controversies
MODERATOR: Douglas Kondziolka
FACULTY: Gene H. Barnett, William A. Friedman, Ajay Niranjan
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Describe the expanded indications and new approaches for brain metastasis radiosurgery.
- List the various imaging tools used to assess radiosurgery responses.
- Discuss the advantages and disadvantages of various radiosurgery techniques.

T20 Managing Complications in Spine Surgery
MODERATOR: Gregory R. Trost
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Identify operative events dictating the need for intraoperative salvage techniques in spinal surgery.
- Discuss the specific techniques necessary to rectify intraoperative difficulties.
- Summarize intraoperative complications rates and variables impacting these statistics associated with spinal surgery.

T21 Guidelines for Neurocritical Care Management
MODERATOR: Shelly D. Timmons
FACULTY: Kevin J. Gibbons, Robert E. Harbaugh, Leon Levi, Muhammad Raji Mahmud, Joshua E. Medow, Joseph C. Zacco
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Outline their strategies for managing traumatic brain injury.
- Assess current practice standards and practical issues surrounding management.
- Identify the unique challenges facing patients with traumatic brain injury.
- Apply these guidelines in their own neurocritical care practice.

T22 Perioperative Complications: An Update
MODERATOR: Carl A. Kallmes
FACULTY: L. Kevin Lanzino, Darin H. Singhal, Atul K. Kanwar
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Discuss the importance of developing a team-based approach in managing perioperative complications.
- Describe the various techniques that can be utilized to manage perioperative complications.
- Create a multidisciplinary approach to dealing with perioperative complications.

T23 Mapping for Eloquent Tumors
MODERATOR: Alfredo Quinones-Hinojosa
FACULTY: William T. Curry, Mohamed E. El-Fiki, Nader Sanai, Jeffrey S. Weinberg
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Outline the indications for preoperative and intraoperative mapping for eloquent tumors.
- Describe the various mapping techniques used for patients with eloquent tumors.
- Summarize the impact of mapping on surgical outcomes and overall survival in patients with eloquent tumors.
- Introduce the operative room infrastructure required to support eloquent tumor mapping into their own practice.

T24 Malignant Glioma: Advances in Surgery and Adjuvant Therapy
MODERATOR: E. Antonio Chiocca
FACULTY: Jeffrey N. Bruce, Linda M. Liau, Emmy Nikusi, Ian F. Parney, Michael A. Vogelbaum
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Describe multidisciplinary approaches to treating malignant gliomas.
- Discuss recent guidelines for managing malignant gliomas.
- Outline patient specific approaches to treating malignant gliomas.
- Apply these approaches in their respective practice.
T25 Pediatric and Adult Moyamoya Disease
MODERATOR: Gary K. Steinberg
FACULTY: Mohammad Ali Aziz-Sultan, R. Michael Scott, John E. Wanebo
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Define the epidemiology of Moyamoya disease in adults and children.
• Describe diagnostic workup for suspected Moyamoya.
• Summarize the surgical techniques used to treat Moyamoya.
• Apply these patient selection and surgical techniques in their own management or appropriate referral of Moyamoya patients.

T26 Meningioma: Management Strategies
Moderator: Michael William McDermott
FACULTY: Ossama Al-Mefty, Ian F. Dunn, Randy L. Jensen, Mark E. Linskey
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Describe the treatment strategies and techniques for patients with meningioma.
• Discuss the epidemiology and natural history of meningioma.
• Summarize the differences in treatment strategy based on anatomic location.
• Apply these treatment strategies in their own management of patients with meningiomas based on the enumerated selection criteria and surgical options.

T27 Managing Degenerative Thoracic Spine Disease
MODERATOR: Mark N. Hadley
FACULTY: Andrew T. Dailey, Mark E. Oppenlander, John Pollina, Abdel Hafiz Shehabuldin, Simcha Weller
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Discuss the diagnostic workup for patients with degenerative thoracic spine disease.
• Describe the role of a multidisciplinary approach for patients with thoracic spine degenerative disease.
• Summarize current guidelines related to surgical management of degenerative thoracic spine disease.
• Apply these guidelines in the management of patients in practice with thoracic spine disease.

T28 Guidelines for Management of ICH and IVH
MODERATOR: Gregory J. Zipfel
FACULTY: E. Sander Connolly, Neil A. Martin, G. Edward Yates, Mario Zuccarello
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Discuss natural history of intracerebral hemorrhage.
• Identify traditional surgical and new minimally invasive options for management of intracerebral hemorrhage.
• Interpret indications, outcomes, and complications from these approaches.
• Identify cases in practice that may benefit from surgical management or CSF diversion.

T29 Managing Intracranial Pressure in the Trauma Patient
MODERATOR: Geoffrey T. Manley
FACULTY: Randall M. Chesnut, Jack Jallo, Llewellyn Padayachy, Martina Stippler, Phillip B. Storm, Eve C. Tsai
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Identify techniques for monitoring intracranial pressure.
• Describe current guidelines regarding intracranial pressure management in the trauma patient.
• Discuss the importance of a team-based approach to trauma patients and intracranial pressure management.
• Apply intracranial pressure monitoring and management principles in their neurosurgical practice.

T30 Carotid Disease Management
MODERATOR: Robert E. Harbaugh
FACULTY: Fady T. Charbel, Edward A.M. Duckworth, Peter Kan, Byron Gregory Thompson
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Discuss the epidemiology and natural history of carotid artery disease.
• Outline clinical variables that impact treatment strategies.
• Describe the treatment strategies for carotid disease and summarize potential complications.
• Apply patient selection strategies regarding conservative management, CEA or carotid stenting in their treatment of patients with asymptomatic and symptomatic carotid disease.
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Discuss current management guidelines regarding whole brain radiation and management of multiple brain metastases.
- Review current management guidelines regarding surgical resection of brain metastases.
- Interpret current management guidelines regarding retreatment and emerging therapies for brain metastases.
- Discuss current management guidelines regarding chemotherapy, prophylactic anticonvulsants, and steroid use for brain metastases.
- Evaluate current management guidelines regarding stereotactic radiation for brain metastases.
- Implement existing clinical guidelines in their treatment of brain metastases patients.

2:15–2:27 pm
Whole Brain Radiation/ Multiple Brain Mets
Steven N. Kalkanis

2:27–2:39 pm
Surgical Resection
Brian V. Nahed

2:39–2:51 pm
Retreatment/Emerging Therapy
Jeffrey J. Olson

2:51–3:03 pm
Chemotherapy/Prophylactic Anticonvulsants/Steroid Use
Timothy C. Ryken

3:03–3:15 pm
Stereotactic Radiation/ Radiation Necrosis
Andrew E. Sloan

GUIDELINES SESSION 2
Guidelines for the Management of Brain Metastases
MODERATORS: Gene H. Barnett, Mark L. Rosenblum, Raymond Sawaya
SPEAKERS: Steven N. Kalkanis, Brian V. Nahed, Jeffrey J. Olson, Timothy C. Ryken, Andrew E. Sloan

NEW!

COURSE DESCRIPTION: New updates on the Guidelines for the Management of Brain Metastases will be published soon. All neurosurgeons should be knowledgeable of these updates. Authors will present key elements in order to equip you with what you need to know, and a panel of experts will comment on the guidelines for further perspective. Don't miss out on this chance to get an essential summary and expert perspective of these guidelines.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Discuss current management guidelines regarding whole brain radiation and management of multiple brain metastases.
- Review current management guidelines regarding surgical resection of brain metastases.
- Interpret current management guidelines regarding retreatment and emerging therapies for brain metastases.
- Discuss current management guidelines regarding chemotherapy, prophylactic anticonvulsants, and steroid use for brain metastases.
- Evaluate current management guidelines regarding stereotactic radiation for brain metastases.
- Implement existing clinical guidelines in their treatment of brain metastases patients.

NEW!

OPERATIVE NEUROSURGERY SESSION 2
Live Endoscopic Endonasal Resection of Nonsecretory Pituitary Macroadenoma
MODERATORS: Paul A. Gardner, Gerald A. Grant, Gabriel Zada
SPEAKERS: James Evans, Marc Rosen

NEW!

COURSE DESCRIPTION: This session will include live endoscopic endonasal surgery for resection of a large pituitary adenoma. The live surgery and moderating will be performed by Dr. James Evans (neurosurgery) and Dr. Marc Rosen (otolaryngology) from Thomas Jefferson University in Philadelphia. This session will cover the endonasal endoscopic surgical approach, tumor resection, reconstruction techniques, and methods to maximize efficiency of the neurosurgery and otolaryngology team during concurrent surgery. Particular emphasis will be placed on techniques for the preservation of normal sinonasal strutures and function, while achieving maximal tumor resection.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Describe the steps for endoscopic endonasal resection of pituitary adenomas.
- Review techniques for the preservation of normal sinonasal strutures and function.
- Identify methods of maximizing efficiency when performing endonasal surgery concurrently with a neurosurgery and otolaryngology team.
3:15–4:45 pm

55 COUNCIL OF STATE NEUROSURGICAL SOCIETIES
MODERATORS: Robert F. Heary, Cara L. Sedney
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Identify several state-based malpractice models.
• Discuss tail coverage versus umbrella liability coverage.
• Define what constitutes a defensive practice.
• Apply lessons from malpractice in practice planning within their local environments.
3:15–3:57 pm
Malpractice and Defensive Practices
3:57–4:45 pm
Oral Presentations

35 SECTION ON CEREBROVASCULAR SURGERY
MODERATORS: Ramesh Grandhi, Brian T. Jankowitz, Scott Douglas Simon, Stavropoula I. Tjoumakaris
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Discuss the optimal endovascular neurosurgical team.
• List important areas for further knowledge development and research.
• Identify important ongoing clinical trials.
• Apply recent research in their treatment of cerebrovascular disease.
3:15–3:57 pm
Oral Presentations
See page 53 for Oral Papers 154-158.
3:45–4:15 pm
Creating the Optimal Neurovascular Team
Brian T. Jankowitz, Scott L. Simon
3:45–3:55 pm
Accreditation/CAST Update
Adnan H. Siddiqui
3:55–4:15 pm
Perspective from Providers
Sepideh Amin-Hanjani, Tudor Jovin, Sean D. Lavine, Adnan H. Siddiqui, Aquilla S. Turk
4:15–4:45 pm
Intracerebral Hemorrhage Trial Updates
Ramesh Grandhi, Stavropoula I. Tjoumakaris
4:15–4:25 pm
ENRICH Update
Daniel L. Barrow
4:25–4:35 pm
MISTIE III Update
Mario Zuccarello
4:35–4:45 pm
INVEST Update
Adam S. Arthur

55 SECTION ON DISORDERS OF THE SPINE AND PERIPHERAL NERVES
Oral Presentations
MODERATORS: Domagoj Coric, John J. Knightly
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Analyze the findings of novel neurosurgical studies; critique the design and methodology of these studies.
• List important areas for further knowledge development and research.
• Identify important ongoing clinical trials.
• Apply lessons from areas of active clinical research to their management of spinal disease patients.
See pages 53–54 for Oral Papers 159-173

55 SECTION ON NEUROTRAUMA AND CRITICAL CARE
Oral Presentations
MODERATORS: Kathryn M. Beauchamp, Sharon W. Webb
LEARNING OBJECTIVES: Upon completion of this course, participants should be able to:
• Analyze the findings of novel neurosurgical studies; critique the design and methodology of these studies.
• List important areas for further knowledge development and research.
• Identify important ongoing clinical trials.
• Apply lessons from areas of active clinical research to their management of trauma patients.
See pages 54–55 for Oral Papers 174-188

52 SECTION ON PAIN
MODERATORS: Jonathan Miller, Ahmed M. Raslan
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Describe potential modes of action of spinal cord stimulation.
• Analyze the findings of novel neurosurgical studies in the treatment of pain; critique the design and methodology of these studies.
• List important areas for further knowledge development and research.
• Apply patient selection criteria to inform their offering or referral for spinal cord stimulation.
3:15–3:57 pm
New Frontiers and Mechanisms in Spinal Cord Stimulation
3:15–3:36 pm
Functional Imaging in Spinal Cord Stimulation
Milind Deogaonkar
3:36–3:57 pm
Intradural Spinal Cord Stimulation
Matthew A. Howard
3:57–4:45 pm
Oral Presentations
See page 55 for Oral Papers 189–196.

PE SECTION ON PEDIATRIC NEUROLOGICAL SURGERY
MODERATORS: Joshua Chern, Jorge Gonzalez-Martinez
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Identify suitable epilepsy surgery candidates for various modalities of invasive monitoring.
• Discuss the concepts and technical details of stereotactic EEG and seizure grid placement.
3:15–3:57 pm
Stereo-EEG versus Subdural Grids in Medically Intractable Pediatric Epilepsy
3:15–3:26 pm
Extra-operative Invasive Monitoring in Children: Matching Types of Epilepsy with the Adequate Exploratory Method
Juan Bulacio
3:26–3:37 pm
The SEEG Concept: The Anatomoelectroclinical Correlation Principle
Patrick Chauvel
3:37–3:48 pm
Technical Nuances of the Subdural Grid Method in Children
Gerald Grant MD
3:48–3:57 pm
The SEEG Methodology Applied to Children: Technical Aspects, Morbidity and Results
Jorge Gonzalez-Martinez.
3:57–4:45 pm
Oral Presentations
See pages 55-56 for Oral Papers 197-204.
SECTION ON STEREOTACTIC AND FUNCTIONAL NEUROSURGERY
MODERATORS: Aviva Abosch, Jason Schwalb
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Describe the economic factors that impact upon functional neurosurgery today.
• Describe the current characteristics of compensation and workload in functional neurosurgery.
• Describe recent advances in functional neurosurgical research.
• Apply these lessons to the development of a functional neurosurgery practice and inform the care of patients with movement disorders or pain syndromes.

3:15–3:57 pm
The Socioeconomics of Functional Neurosurgery

3:15–3:36 pm
Financial Challenges and Opportunities in Functional Neurosurgery
Andres Machado

3:36–3:57 pm
Compensation and Workload of Functional Neurosurgeons: A National Survey
Joshua Rosenow

3:57–4:45 pm
Oral Presentations
See page 56 for Oral Papers 205–212.

SECTION ON TUMORS
MODERATORS: Costas G. Hadjipanayis, Ian Yu Lee, Uzma Samadani
SPEAKERS: Linda M. Liau, Michael Lim, Ian F. Parney
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Describe experimental viral treatments for GBM.
• Describe new vaccine treatments for GBM which enhance the host immune response.
• Review new chemotherapies and antibody based treatments which represent a new immunological strategy for treating GBM.

3:15–3:57 pm
Immunotherapies for GBM
MODERATOR: Ian Yu Lee

3:15–3:29 pm
Viral Treatments
Ian F. Parney

3:29–3:43 pm
Vaccine Therapies
Linda M. Liau

3:43–3:57 pm
Checkpoint Inhibitors and Antibody-based Treatments
Michael Lim

3:57–4:45 pm
Oral Presentations
MODERATORS: Costas G. Hadjipanayis, Uzma Samadani

RAPID-EXCHANGE ORAL PRESENTATION SESSIONS
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Analyze the findings of novel neurological studies; critique the design and methodology.
• List important areas for further knowledge development and research.
• Identify important ongoing clinical trials.
• Apply lessons of ongoing research to neurological care of patients.

5:15–6:15 pm
SECTION POSTER VIEWING SESSION
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Discuss the findings of novel neurological studies.
• Describe important areas for further research.
• Identify important ongoing clinical trials.
• Apply lessons of ongoing research to neurological care of patients.

RESIDENT RECRUITMENT SOCIAL
Come build relationships at this relaxed and informal networking event. If you are within 2-3 years of completing your residency, this event is perfect for you! Establish a network of contacts with recruiters and practicing physicians who are looking to add to their practice.
Dinner Seminar 04

Complimentary shuttle service will be provided for all dinner seminars. Shuttles will depart from the Marriott Marquis San Diego Marina Hotel.

Tuesday, September 27 • 7:00–9:30 pm • Fee: $190

**TR DIN04**

**NEW!**

**Concussion: Diagnosis, Management, and Outcomes**

**MODERATOR:** Shelly D. Timmons

**SPEAKERS:** Tanvvr Choudri, James M. Johnston, Krystal Lynne Tomei, Jamie S. Ullman, Alex B. Valadka

**LEARNING OBJECTIVES:** Upon completion of this course, participants will be able to:

- Recognize signs and symptoms of concussion.
- Manage progressive return to play after concussion.
- Identify risks factors for repeated concussion.
- Describe outcomes after concussion.
- Use these data to inform counseling of patients suffering from concussion.

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**Seasons 52**

Seasons 52 is a celebration of what’s good now. In this casually sophisticated setting, a seasonally inspired menu features ingredients at their peak of freshness, and rustic cooking techniques like brick oven roasting and open-fire grilling bring out natural flavors. Named one of San Diego’s best spots for wine pairings.
PROGRAM HIGHLIGHTS

WEDNESDAY, SEPTEMBER 28

7:03–7:51 AM
TOP LATE-BREAKING SCIENCE AND TOP 5 RAPID-EXCHANGE ORAL PRESENTATIONS

8:16–8:32 AM
HONORED GUEST PRESENTATION
Spinal Dural Arteriovenous Fistulas: 40 Years of Progress—Unanswered Issues
Edward H. Oldfield

2:15–3:15 PM
CLINICAL CONTROVERSIES SESSION 3
Epilepsy Associated Cavernomas

3:15–3:45 PM
RAPID-EXCHANGE ORAL PRESENTATION SESSIONS
7:00–11:30 am

PRESIDING OFFICER: Ganesh Rao

MODERATORS: Bernard R. Bendok, Nader Pouratian

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:

● Discuss adaptations, advances, and achievements:
  - in the treatment of spinal dural arteriovenous fistulas
  - in the treatment of spinal cord injury
  - in neuroendoscopy
  - in the future of cranial neurosurgery

● Apply presented advancements across these subspecialties to their neurosurgical practice.

7:00–7:03 am
Introduction and Disclosures
Bernard R. Bendok

7:03–7:51 am
Top 3 Late Breaking Abstracts/Top 5 Rapid-exchange Oral Presentations

7:51–7:54 am
Announcement of Top Posters
James S. Harrop

7:54–8:06 am
2015 Getch Award Winner Presentation
Akash J. Patel

8:06–8:16 am
CNS Resident Award Presentation
Differential Gender Response to Aspirin in Decreasing Aneurysm Rupture in Humans and Mice
Nohra Chalouhi

8:16–8:32 am
Honored Guest Presentation
Spinal Dural Arteriovenous Fistulas: 40 Years of Progress—Unanswered Issues
Edward H. Oldfield

8:32–8:48 am
Translational Advances in the Management of Acute Spinal Cord Injury: What is New? What is Hot?"
Michael G. Fehlings

8:48–8:50 am
Introduction of Japanese CNS President
Shekar N. Kurpad

8:50–9:00 am
Japanese CNS Presidential Address
Shinichi Yoshimura

9:00–10:00 am
MORNING BEVERAGE BREAK
Visit the Exhibit Hall!

10:00–10:15 am
Advancing the Neuroscience of Human Memory Through Neurosurgery
Kareem A. Zaghloul

10:15–10:30 am
IDH Mutation and Glioma Surgery: Advances in Surgical Strategy
Daniel P. Cahill

10:30–10:45 am
Neuroendoscopy to Achieve Superior Glioma Resection Outcomes
Charles Teo

10:45–11:05 am
Redefining the Second Opinion: There’s an App for that. An mCase Expert Panel Forum
Roger Hartl, Praveen Mummaneni, Mark E. Oppenlander, Paul Park, Nicholas Theodore

11:05–11:30 am
The Future of Cranial Neurosurgery—Adapting New Approaches
Ricardo Jorge Komotar

11:05–11:07 am
Introduction
Ricardo Jorge Komotar

11:07–11:17 am
Lasar Ablation
Shabbar F. Danish

11:12–11:17 am
Brainpath
John Diaz Day

11:17–11:22 am
MR Focused Ultrasound
Gelareh Zadeh

11:22–11:30 am
Illustrative Case Examples
Ricardo Jorge Komotar

Register now at cns.org/2016
LEARNING OBJECTIVES:

W31 Guidelines for Acute Cervical Spine and Cord Injuries
MODERATOR: Mark N. Hadley
FACULTY: Bizhan Aarabi, Francis Farhadi, R. John Hurbert, Nicholas Theodore, Ian Vlok
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Identify advances in the medical treatment of traumatic spinal cord injury.
• Determine state-of-the-art surgical management of cervical spine trauma and spinal cord injury.
• Write protocols for identifying and assessing cervical spine injury in the comatose patient.
• Apply these protocols and data to the care of cervical spine injured patients in their practice.

W32 Lessons Learned: Avoidance and Management of Complications of Aneurysm Surgery
MODERATOR: Giuseppe Lanzino
FACULTY: David J. Chalif, Hasan Kocaeli, Ali F. Krish, Christopher S. Ogilvy,
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Discuss the common complications in aneurysm surgery.
• Describe management of complications occurring during aneurysm surgery.
• List the different techniques available to manage complications with adjunctive technologies.
• Apply management strategies for complication avoidance in their surgical treatment of aneurysms.

W33 Skull Base Endoscopy: Utility and Limitations
MODERATOR: Charles Teo
FACULTY: Paul A. Gardner, Fred Gentili, G. Michael Lemos, Zachary N. Litvack, Daniel M. Prevedello
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Identify potential complications associated with endoscopic skull base surgery.
• Discuss factors influencing the surgical strategy in patients with skull base lesions.
• Describe the current state-of-the-art in endoscopic skull base surgery.
• Apply these surgical management strategies in the care of skull base lesions.

W34 Hematology and Coagulation for Neurosurgeons: Dangers and Solutions
MODERATOR: R. Loch Macdonald
FACULTY: David M. Hasan, Alan S. Hoffer, Pascal Jabbour, Shahid Mehdi Nimjee
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Recognize that neurosurgeons commonly face acute perioperative and intraoperative decisions regarding the diagnosis and management of coagulopathy that are crucial to patient safety and excellent outcomes.
• Explain important coagulation mechanisms, parameters, indications, and clinical pearls to their current strategy.
• List important screening guidelines and define the key points of emergency and intraoperative coagulation management.
• Apply these guidelines in their management of coagulopathic patients and reversal of pharmacological agents in the setting of neurosurgical pathology.

W35 Chiari Malformation
MODERATOR: Jeffrey R. Leonard
FACULTY: Richard C. E. Anderson, Souad Bakhti, John D. Heiss, David D. Limbrick, Karin M. Muraszko
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Outline management strategies for patients with Chiari malformation.
• Describe the natural history of Chiari disease and review the prognosis after surgery.
• Summarize the radiographic criteria and clinical findings for Chiari malformation.
• Apply these patient selection principles in the management of Chiari patients in their practice.

W36 Neurovascular Emergencies: Case-based Discussion
MODERATOR: E. Sander Connolly
FACULTY: Sepideh Amin-Hanjani, Nicholas C. Bambakidis, Bernard R. Bendok, Peter Nakaji, Shinichiro Yoshimura
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Discuss the incidence of various types of neurovascular emergencies.
• Outline management strategies for neurovascular emergencies.
• Describe common complications and methods for avoidance.
• Recognize these neurovascular emergencies in their practice and apply the presented management strategies in patient care.

W37 Guidelines for Managing the Aging Spine
MODERATOR: Michael G. Fehlings
FACULTY: Paul M. Arnold, Andrew T. Dailey, John J. Knightly, Marjorie Wang, Christopher E. Wolf, Ahmed Yehia
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Discuss the natural history of spinal degenerative disease.
• Review indications for surgical treatment for elderly patients with spinal disease.
• Describe current practice standards and long-term management strategies for degenerative spinal disease.

W38 Pediatric Head Trauma and Sports
MODERATOR: Michael L. Levy
FACULTY: Eri Anthan, Eric M. Jackson, James M. Johnston, Eve C. Tsai
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Identify unique challenges in pediatric patients who suffer sports-related head injuries.
• Outline the strategies for managing pediatric head trauma.
• Assess current practice standards and practical issues surrounding management.
• Apply these management strategies in the pediatric patient with head injury.

W39 Minimally Invasive Deformity: New Frontiers
MODERATORS: Adam Kanter, Praveen V. Mummaneni
FACULTY: David O. Okonkwo, Paul Park, Mohammed F. Shamji, Khoi Duc Than
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
• Describe the epidemiology and natural history of spinal deformity.
• Discuss current concepts in minimally invasive spinal deformity surgery.
• Strategize how to identify and avoid complications in minimally invasive spinal deformity surgery.
• Apply MIS strategies in the treatment of patients with spinal deformity.

W40 From Residency to Practice: Getting the Job You Want and What to Ask For
MODERATOR: Clemens M. Schirmer
FACULTY: Daniel J. Hoh, Alexander Arash Khalesi, Shahid Mehdi Nimjee, Nader Sanai
LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Identify factors important to consider when beginning a job search.
- Discuss pitfalls to avoid when evaluating job prospects.
- Describe the key elements of negotiating your first contract.
- Apply these strategies in retaining neurosurgical employment.

NEW!

W41 Hemorrhagic Stroke for Neurosurgeons
MODERATOR: Sean D. Lavine
FACULTY: Mohammad Ali Aziz-Sultan, Aman B. Patel, Adnan Hussain Siddiqui, Henry H. Woo

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Summarize guidelines and indications for treatment of intracerebral hematoma.
- Describe novel devices used to treat intracerebral hematoma.
- Discuss current literature and recent clinical trials on hemorrhagic stroke.
- Apply these guidelines in the management of ICH and recognize opportunities to introduce novel endoscopic techniques into their practice.

NEW!

W42 Epilepsy: Current and Emerging Treatment Strategies
MODERATOR: Guy M. McKhann II
FACULTY: Warren W. Boling, Edward F. Chang, Jeffrey G. Ojemann, Jason M. Schwab, Kareem A. Zaghloul

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Incorporate emerging treatment strategies for epilepsy into your practice.
- Discuss the importance of a multimodality approach to epilepsy patients.
- Summarize the current guidelines regarding epilepsy treatment.

NEW!

W43 Women in Neurosurgery: Becoming a Neurosurgery Leader: Mentorship
MODERATORS: Isabelle Germano, Stacey Quintero Wolfe
FACULTY: Judy Huang, Anne-Marie Flannery, Yoko Kato, Linda Liu, Shelly Timmons

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Interface with mentors and create a personalized strategy for career leadership development.
- Improve one’s efficacy as both a mentee and mentor.
- Identify the evidence-based impact of mentoring on residents and faculty careers.
- Develop knowledge on mentoring platforms and their significance on leadership.

LEARNING OBJECTIVES: Upon completion of this course, participants will be able to:
- Discuss the management guidelines regarding medical management of traumatic thoracic and lumbar spine fractures.
- Evaluate the management guidelines regarding operative versus non-operative treatment for traumatic thoracic and lumbar spine fractures.
- Assess the management guidelines regarding timing of surgical intervention for traumatic thoracic and lumbar spine fractures.
- Discuss the management guidelines regarding surgical approaches for the management of traumatic thoracic and lumbar fractures.
- Review the management guidelines regarding surgical strategies for traumatic thoracic and lumbar spine fractures.
- Discuss pitfalls to avoid when beginning a job search.
- Identify important areas for further knowledge development and research.
- Identify the most important ongoing clinical trials.

4:03–4:09 pm  
**101** Medicare Expenditures for Elderly Patients Undergoing Surgical Clipping or Endovascular Intervention for Subarachnoid Hemorrhage  
Kimon Bekerlis, Dan Gottlieb, Todd MacKenzie, Giuseppe Lanzino, Michael T. Lawton, Stavropoula I. Tjoumakaris, Pascal Jabbour

4:09–4:15 pm  
**102** Patient Safety in Neurosurgical Practice: Physician Factors that Contribute to Patient Injury  
Christopher L. Taylor, Darrell Ranum

4:15–4:21 pm  
**103** Insurance Status Predicts Patient Safety and Care Quality in the Lumbar Spine Fusion Population  
Joseph E. Tanzenbaum, Vincent J. Alentado, Jacob A. Miller, Daniel Lubelski, Edward C. Benzel, Thomas E. Mroz

4:21–4:27 pm  
**104** The Effect of Surgical Start Time and Day of the Week on Morbidity and Mortality for Neurological Surgeries  
Joseph Raynor Linzey, M. Amr Sabbagh, Aditya S. Pandey

4:27–4:33 pm  
**105** The Effect of Socioeconomic Status on Gross Total Resection, Radiation Therapy, and Overall Survival in Patients With Gliomas  
Sayantan Deb, Arjun Vivek Pendlharkar, Sean Altekruse, John K. Ratliff, Atman Desai

4:33–4:39 pm  
**JULIUS GOODMAN RESIDENT AWARD**  
**106** Effect of Complications Within 90-days on Cost-utility Following Elective Surgery for Degenerative Lumbar Spine Disease  
Silky Chotai, Ahilan Sivaganesan, Scott L. Parker, Joseph Wick, David P. Stonko, Matthew J. McGirt, Clinton J. Devin

4:39–4:45 pm  
**107** Evaluating the Costs of Follow-up Imaging Protocol for Endovascularly Treated Unruptured Intracranial Aneurysms: A Multicenter Study  
Raghav Gupta, Christoph Johannes Griessenauer, Nimer Adeeb, Justin M. Moore, Apar S. Patel, Michelle Hui Juan Chua, Ajith J. Thomas, Christopher S. Ogilvy

3:21–3:27 pm  
**GALBRAITH AWARD**  
**109** Multimodal Endovascular Endoscopy in Carotid Atherosclerotic Disease  

3:27–3:33 pm  
**110** Non-inferiority of a Direct Aspiration First-pass Technique Versus Stent Retriever Thrombectomy in Emergent Large-vessel Intracranial Occlusions  
Christopher J. Stapleton, Collin M. Torok, Aman B. Patel

3:33–3:39 pm  
**111** Predictors of Complications After Clipping of Unruptured Intracranial Aneurysms: A National Surgical Quality Improvement Program Analysis  

3:39–3:45 pm  
**112** Stereotactic Radiosurgery for Intracranial Arteriovenous Malformations With Intralinal and Prenidal Arterial Aneurysms  
Dale Ding, Zhiyuan Xu, Robert M. Starke, Chun-Po Yen, Han-Hsun Shih, Thomas Buell, Jason P. Sheehan

3:45–3:51 pm  
**113** Initial Experience With an Image-guided Robotically Positioned Optical Platform for Aneurysm Surgery  
Amin B. Kassam, Srikant S. Chakravarthi, Juanita Celix, Melanie Fukui, Jonathan Jennings, Sarika Walia, Richard A. Rovin

3:51–3:57 pm  
**114** Treatment of Bifurcation Aneurysms Using Single Stent-coiling with Relation to Aneurysm Configuration: A Cohort Study of Two Academic Institutions in the United States  
Nimer Adeeb, Apar S. Patel, Christoph Johannes Griessenauer, Justin M. Moore, Paul M. Foreman, Raghav Gupta, Mark R. Harrigan, Christopher S. Ogilvy, Ajith J. Thomas

3:57–4:03 pm  
**115** The Southwestern Aneurysm Scoring Index (SASI) Prediction of Outcomes at One Year in Ruptured Aneurysms Treated With Microsurgery  

4:03–4:09 pm  
**116** Effect of Annual Hospital Procedure Volume on Outcomes After Mechanical Thrombectomy in Acute Ischemic Stroke Patients: An Analysis of 13,502 Procedures  
Vishal B. Jani, Chiu Yuen To, Achint Patel, Prashant S. Kelkar, Boyd Richards, Richard D. Fessler, II
4:09–4:15 pm

117 Quantitative CT Ventriculography for Assessment and Monitoring of Hydrocephalus: A Pilot Study and Description of Method in Subarachnoid Hemorrhage (SAH)
Eric Karl Oermann, Jasjit Multani, Justin Robert Mascitelli, Branko Skovrlj, Margaret Pain, Kelly Nicole, Joseph Titano, Anthony Costa, Raj K. Shrivastava

4:09–4:15 pm

126 Anatomy of Cerebellar Mutism: Reduced Fractional Anisotropy in the Superior Cerebellar Peduncle
Sean D. McEvoy, Amy Lee, Jeffrey G. Ojemann, Christine MacDonald

4:15–4:21 pm

127 Multimodality Word-finding Distinctions in Pediatric Cortical Stimulation Mapping
Naomi D. Chou, Sandra Serafini, Gerald A. Grant, Merlise Clyde, Jordan Komisarow, Carrie R. Muh

4:27–4:33 pm

129 Using MRI to Establish Patency Between Adjacent CSF Compartments
Matt Borzage, Edward F. Melamed, Skorn Ponrartana, Stefan Blumli, Eisha Christian, J. Gordon McComb

4:39–4:45 pm

Chima Olugbbo, Matthew Sacino, John S. Myseros, Suresh N. Magge, William Gaillard, Robert F. Keating

4:03–4:09 pm

RONALD R. TASKER YOUNG INVESTIGATOR AWARD

118 Use of Spinal Cord Diffusion Tensor Imaging to Quantify Neural Ablation and Evaluate Outcome After Percutaneous Cordotomy for Intractable Cancer Pain
Aditya Vedantam, Ping Hou, Linda Chi, Patrick M. Dougherty, Ashwin Viswanathan

4:09–4:15 pm

120 Effects of Subthalamic Deep Brain Stimulation with Duloxetine on Mechanical and Thermal Thresholds in GOHDA-Lesioned Rats
Ian Thomas Walling, Brian C. Kaszuba, Lucy Gee, Damian Shin, Julie G. Piiltsis

4:15–4:21 pm

121 Rate of Peri-operative Neurological Complications After Surgery for Cervical Spinal Cord Stimulation
Andrew Kai-Hong Chan, Ethan A. Winkler, Line Jacques

4:21–4:27 pm

122 Pulse Modulation of the Occipital Nerve Using Focused High-intensity Ultrasound Improves Mechanical Thresholds in a Chronic Migraine Rat Model
Ian Thomas Walling, Lucy Gee, Paul Neubauer, Lance Frith, Emery Williams, Clif Burdette, Julie G. Piiltsis

4:27–4:33 pm

123 Patient Perspectives Regarding Ethics of Neuromodulators in the Treatment of Persistent Postoperative Neuropathic Pain
Nardin Samuel, Suneil Kumar Kalia, Mark A. Bernstein, Mohammed F. Shamji

4:33–4:39 pm

124 Low Back Pain Relief With a New 32-Contact Surgical Lead and Neural Targeting Algorithm
Julie G. Piiltsis, Giancarlo Barolat, Joshua M. Rosenow, James J. Brennan, Alexander S. Bailey, Jeffrey M. Epstein, Blake Hammond, Clark Metzger, Dat Huynh, Kristen Lechleiter, Nitzan Mekel-Bobrov

4:03–4:09 pm

SECTION ON PEDIATRIC NEUROLOGICAL SURGERY ORAL PRESENTATIONS

125 Transorbital Ultrasound Measurement as a Non-invasive Marker of Intracranial Pressure (ICP)
Llewellyn Padayachy, Graham A. G. Fieggen

4:09–4:15 pm

130 Skull Base Chordomas in Children and Young Adults
M. Maher Hulou, Marcio S. Rossi, Kaith Almefty, Wenyi Linda Bi, Ian F. Dunn, Timothy R. Smith, Ossama Al-Mefty

4:39–4:45 pm

SECTION ON STEREOTACTIC AND FUNCTIONAL NEUROSURGERY ORAL PRESENTATIONS

132 A Randomized, Sham-controlled Trial of Transcranial MR Guided Focused Ultrasound Thalamotomy Trial for the Treatment of Tremor-dominant, Idiopathic Parkinson’s Disease
Aaron E. Bond, Robert Dallapiazza, Diane Huss, Amy L. Warren, Scott sperling, Ryder Gwinn, Binit B. Shah, W. Jeffrey Elias

4:15–4:21 pm

134 VANTAGE Trial: Three Year Outcomes of a Prospective, Multi-center Trial Evaluating Deep Brain Stimulation with a New Multiple-source, Constant-current Rechargeable System in Parkinson’s Disease
Lars Timmermann, Roshini Jain, Lily Chen, Thomas Brucke, Fernando Seijo, Esther Suarez San Martin, Claire Haegelen, Marc Verin, Veerle Visser-Vandewalle, Michael T. Barbe, Steven Gill, Alan Whone, Mauro Porta, Domenico Servello, François Alesch

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4:21–4:27 pm

François Alesch, Roshini Jain, Lily Chen, Thomas Bucke, Fernando Seijo, Esther Suarez San Martin, Claire Haegelen, Marc Verin, Mohammed Maarouf, Michael T. Barbe, Steven Gill, Alan Whone, Mauro Porta, Domenico Servello, Lars Timmermann

4:27–4:33 pm

136 Field-steering Rescue Lead Therapy for Patients With Essential Tremor Refractory to VIM DBS
Vishad Sukul, David A. Isaacs, Srivatsan Pallavaram, William Rodriguez, Jonathan Butler, Hong Yu, Joseph Samir Neimat, Peter Konrad

4:33–4:39 pm

137 An Easily Implemented, Open Access Semi-Automated Pipeline for Intracranial Electrode Localization
Timothy G. Oyster, Yagna Pathak, Elliot Smith, Sameer A. Sheth

4:39–4:45 pm

138 Delayed Scalp Erosion After DBS Surgery: Incidence, Treatment, Outcomes and Prevention
Justin T. Hilliard, Alberto Bona, Sasha Vaziri, Roger Walz, Michael S. Okun, Kelly D. Foote

4:09–4:15 pm

BRAINLAB NEUROSURGERY AWARD

140 Genome-wide CRISPR/cas9 Knock-out Screens in Human Glioblastoma Identify Genetic Vulnerabilities
Imran Noorani

4:15–4:21 pm

JOURNAL OF NEURO-ONCOLOGY AWARD

141 Phase I Trial of Genetically Modified Hematopoietic Progenitor Cells (HPC) Facilitate Bone Marrow Chemoprotection and Enabling TMZ/O6BG Dose Escalation Resulting in Improved Survival
Andrew E. Sloan, Hua Fung, Jane Reese, Lisa R. Rogers, Christopher Murphy, Hillard Lazrus, Boro Dropulic, Stan L. Gerson

4:21–4:27 pm

142 Genetic and Non-genetic Determinants of Cellular Architecture in IDH1-mutant Oligodendrogliomas and Astrocytomas Using Single Cell Transcriptome Analysis
Andrew Sean Venteicher, Itay Tiros, Christine Hebert, Leah Escalante, Robert L. Martuza, Brian V. Nahed, William T. Curry, Jr., Daniel P. Cahill, Bradley Bernstein, David N. Louis, Aviv Regev, Mario Suva

4:27–4:33 pm

AMERICAN BRAIN TUMOR ASSOCIATION YOUNG INVESTIGATOR AWARD

143 Identification of Neoantigen-specific CD8+ T Cells in Two Murine Orthotopic Glioblastoma Models Using Cancer Immunogenomics
Tanner M. Johanns, Jeffrey Ward, Courtney Wilson, Dale K. Kobayashi, Diane Bender, Yujie Fu, Anton Alexandrov, Maxim N. Artyomov, Chris A. Miller, Elaine R. Mardis, Gavin P. Dunn

4:33–4:39 pm

PREUSS AWARD

144 GPR133 Promotes Glioblastoma Growth in Hypoxia

4:39–4:45 pm

STRYKER NEURO-ONCOLOGY AWARD

145 Unplanned Reoperation After Craniotomy for Tumor: A National Surgical Quality Improvement Program Analysis
Hormuzdiyar H. Densenbrock, Sandra C. Yan, Vamsidhar Chavakula, William B. Gormley, Timothy R. Smith, Elizabeth Claus, Ian F. Dunn

4:03–4:09 pm

NATIONAL BRAIN TUMOR SOCIETY MAHALEY CLINICAL RESEARCH AWARD

139 Clinically Applicable and Biologically Validated MRI Radiomic Test Method Predicts Glioblastoma Genomic Landscape and Survival

3:57–4:03 pm

146 Routine Outpatient Imaging Follow-up for Subdural Hematomas Provides Limited Clinical Benefit
Thomas Gianaris, Shaheryar Ansari, Richard B. Rodgers

4:03–4:09 pm

147 Patient Perceptions About Quality of Care in Spinal Disorders
Cheerag D. Upadhyaya, Kate Wan-Chu Chang, Shawn Brown, Tara Beach, Shawn L. Hervey-Jumper, Aditya S. Pandey, Paul Park, Lynda Jun-San Yang

4:09–4:15 pm

STRYKER NEURO-ONCOLOGY AWARD

148 Predictive Model for Return to Work After Elective Surgery for Lumbar Degenerative Disease: An Analysis from National Neurosurgery Quality Outcomes Database Registry
Anthony L. Asher, Silky Chotai, Clinton J. Devlin, Kristen Archer-Swygert, Scott L. Parker, Mohamad Bydon, Nian Hui, Frank Harrell, Theodore Speroff, Robert Dittus, Sharon Philips, Christopher I. Shaffrey, Kevin T. Foley, Matthew J. McGirt, N2QOD Investigative Group
4:15–4:21 pm
**SAMUEL HASSENBUSCH YOUNG NEUROSURGEON AWARD**

**149 Does Ranking of Surgeons in a Publicly Available Online Platform Correlate With Objective Outcomes?**

Kimon Bekelis, Symeon Missios, Shannon Michael Coy, Jeremiah N. Johnson

4:21–4:27 pm

**150 Providing Video Recordings of Neurosurgical Clinical Visits Does Not Increase Provider Risk and May Lower Costs and Save Office Time: Experience of 6,112 Cases**

Andrew J. Meuesen, Randall W. Porter

4:27–4:33 pm

**151 Race and Insurance Status are Associated with Higher Charges in Patients Having Pituitary Tumor Surgery in New York State**

Edward Yates, Amy Lalonde, Charles Lee, Kristopher T. Kimmell, Laura Calvi, Tanzy Love, Matthew C. Miller

4:33–4:39 pm

**152 A Prospective Controlled Trial of the Effect of Surgeon Cost Scorecards on Operating Room Surgical Cost Reduction (OR SCORE)**

Corinna Clio Zygourakis, Victoria Valencia, Chris Moriates, Christy Boscardin, Sereina Catschegn, Andrew Goldberg, Kevin Bozic, Kent Soo Hoo, Rosanna Wustrack, Lawrence H. Pitts, Adams Dudley, Ralph Gonzales, Michael T. Lawton

4:39–4:45 pm

**153 Significant Inter-Hospital Variation in Cranial Surgery Costs Using the Nationwide Inpatient Sample (NIS) Database**

Corinna Clio Zygourakis, Caterina Liu, Philip V. Theodosopoulos, Michael T. Lawton, Adams Dudley, Ralph Gonzales

3:33–3:39 pm

**157 Open and Endovascular Treatment of Spinal Dural Arteriovenous Fistulae: A 10-year Experience**


3:39–3:45 pm

**158 Morphological Parameters for Anterior Communicating Artery Aneurysm Rupture Risk Assessment**

Tanmoy Kumar Maiti, Shyamal C. Bir, Devi Prasad Patra, Hugo Cuellar, Anil Nanda

3:15–3:21 pm

**159 Neurological Outcomes of Two-level TDR Versus ACDF: Seven-year Results from a Prospective, Randomized, Multicenter Trial**

Robert Jackson, Darin Eric Johnson

3:21–3:27 pm

**160 Outpatient Surgery for Herniated Cervical Disc and Fusion is Feasible and Safe, a Consecutive Single-center Series of 759 Patients**

Bjarne Lied, Oystein Helseth, Kare Ekseth, Ben Heskestad, Eirik Helseth

3:27–3:33 pm

**161 Patient-reported Outcomes After Epidural Steroid Injections Versus Surgery for Degenerative Lumbar Disease: A Prospective, Matched Cohort Study**

Ahilan Sivaganesan, Silky Chotai, Scott L. Parker, Matthew J. McGirt, Clinton J. Devin

3:33–3:39 pm

**162 Tobacco Smoking and Outcomes of Surgical Decompression in Patients with Symptomatic Degenerative Cervical Spondylotic Myelopathy**

Paul M. Arnold, Branko Kopjar, Lindsay Tetreault, Hiroaki Nakashima, Michael G. Fehlings

3:39–3:45 pm

**163 Microstructural MRI Quantifies Tract-specific Injury and Correlates with Global Disability and Focal Neurological Deficits in Degenerative Cervical Myelopathy**

Allan R. Martin, Benjamin De Leener, Julien Cohen-Adad, Izabela Aleksanderek, David W. Cadotte, Sukhvinder Kalsi-Ryan, Lindsay Tetreault, Adrian Crawley, Howard J. Ginsberg, Michael G. Fehlings

3:45–3:51 pm

**164 Failure Rates and Complications of Interspinous Process Decompression Devices: A European Multicenter Study**

Marcelo Galarza y Vicentini, Roberto Gazzeri, Pedro De la Rosa, Claudio Piqueras

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3:51–3:57 pm

165 What is the Effect of Open Versus Percutaneous Screws on Complications Among Patients Undergoing Lateral Interbody Fusion for Adult Spinal Deformity?
Khoi Duc Than, Stacie Nguyen, Paul Park, Dean Chou, Frank La Marca, Juan S. Uribe, Todd Douglas Vogel, Pierce D. Nunley, Robert Eastlack, Neel Anand, Adam S. Kanter, Praveen V. Mummaneni, Gregory M. Mundis, Jr., International Spine Study Group

3:57–4:03 pm

166 Predictive Modeling of Length of Hospital Stay (LOS) Following Adult Spinal Deformity (ASD) Correction: Analysis of 653 Patients with an Accuracy of 75% Within Two Days

4:03–4:09 pm

167 Reducing Radiation an Order of Magnitude During Fluoroscopic-guided Kyphoplasty
Isaac O. Karikari, Chris Brown, D. Gregg Anderson, Debbie Chi

4:09–4:15 pm

168 Impact of Initial Clinical and Imaging Parameters on Long-term Neurological Outcomes in Acute Traumatic Cervical Spinal Cord Injury
Sunil Kukreja, Jan Schwab, Francis Farhadi

4:15–4:21 pm

169 Laminoplasty Versus Laminectomy with Posterior Spinal Fusion for Multilevel Cervical Spondylotic Myelopathy: Matched Cohorts of Regional Sagittal Balance
Darryl Lau, Ethan A. Winkler, Khoi Duc Than, Dean Chou, Praveen V. Mummaneni

4:21–4:27 pm

170 The Accuracy of Multimodality Intraoperative Neuroradiographic monitoring to Predict Postoperative Neurological Deficits Following Cervical Laminoplasty
John Frederick Burke, Junichi Ohya, Todd Douglas Vogel, Michael Virk, Dean Chou, Praveen V. Mummaneni

4:27–4:33 pm

171 Resurgery in Craniovertebral Junction Abnormalities

4:33–4:39 pm

Erik Curtis, Brandon C. Gabel, Martin Marsala, Joseph D. Ciacci

4:39–4:45 pm

173 A Clinical and Radiographic Score to Assess Malignant Potential of Peripheral Nerve Sheath Tumors
Jonathan Yun, Christopher J. Winfree

3:51–3:57 pm

174 Mechanisms of Injury as a Diagnostic Predictor of Sport Related Concussion Severity in Football, Basketball, and Soccer: Results from a Regional Concussion Registry
Scott L. Zuckerman, Doug Totten, Kolin Rubel, Andrew W. Kuhn, Aaron M. Yengo-Kahn, Gary Solomon, Allen K. Sills, Jr.

3:21–3:27 pm

175 Safety of Anticoagulation for the Treatment of Cerebral Venous Sinus Thrombosis in Adult Trauma Patients
David S. Hersh, Erik Hayman, Bizhan Aarabi, Deborah Stein, Cara Diaz, Jennifer Massetti, Gary Thomas Schwartzbauer

3:27–3:33 pm

176 Andexanet Alfa, an Investigational Universal Antidote for Reversal of Anticoagulation of Factor Xa Inhibitors in Healthy Human Volunteers
Florie Mor, Mark Crowther, Alex Gold, Genmin Lu, Janet Leeds, Brian Wiens, Vandana Mathur, Janice Castillo, Pamela Conley, Stuart Connolly, John Curnutte

3:33–3:39 pm

177 Largest Series of Mild-Moderate MVA Associated Thoracolumbar Compression Fractures: Prognosis and Outcome
Hesham M. Soliman, Ha Nguyen, Frank A. Pintar, Narayan Yoganandan, Shekar N. Kurpad, Dennis J. Maiman

3:39–3:45 pm

178 High AIS Grade Conversion Rate Following Neuro-Spinal Scaffold Implantation in Acute Thoracic Complete AIS A Spinal Cord Injury (SCI): Potential Mechanisms
Nicholas Theodore, Kee Duk Kim, Patrick C. Hsieh, Wilson Zachary Ray, Maureen Barry, Rick Layer, Simon W. Moore, Domagoj Coric

3:45–3:51 pm

179 Chemogenetic Stimulation of the Lumbar Locomotor Network Enhances Motor Function Following Experimental Cervical Spinal Cord Injury: Translational Relevance for a Novel Therapeutic Strategy
Spyridon K. Karadimas, Kajana Satkunendrarajah, Michael G. Fehlings

3:51–3:57 pm

180 Early DVT Chemoprophylaxis in Traumatic Brain Injury
Fabio Frisoli, Paul P. Huang, Spiros Frangos

3:57–4:03 pm

181 Guidelines for the Management of Patients with Spinal Cord Injury: The Optimal Timing of Decompression
4:03–4:09 pm
DEPUY SYNTHES AWARD FOR RESIDENT RESEARCH ON SPINAL CORD AND SPINAL CORD INJURY

182 Ultra-early (<12 Hours) Decompression Improves Recovery After Spinal Cord Injury (SCI) Compared to Early (12-24 Hours) Decompression
John Frederick Burke, John K. Yue, Laura Benjamin Ngwenya, Ethan A. Winkler, Jason Talbott, Jonathan Pan, Adam Ferguson, Michael Beattie, Jacqueline Bresnahan, Jenny Haefeli, William Whetstone, Catherine Suen, Michael C. Huang, Geoffrey T. Manley, Phiroz E. Tarapore, Sanjay S. Dhall

4:09–4:15 pm
A Clinical Risk Score for Managing Children with GCS 13-15 Head Injuries and Intracranial Injury
Jacob K. Greenberg, Yan Yan, Christopher Carpenter, Angela Lumba-Brown, Martin S. Keller, Jose A. Pineda, Ross C. Brownson, David D. Limbrick, Jr.

4:15–4:21 pm
184 Interrelationships Among Neuroimaging Biomarkers, Neuropsychological Test Data, and Symptom Reporting in a Cohort of Retired National Football League (NFL) Players
Andrew W. Kuhn, Scott L. Zuckerman, Gary Solomon, Ira Casson

4:21–4:27 pm
DEPUY SYNTHES AWARD FOR RESIDENT RESEARCH ON BRAIN AND CRANIOFACIAL INJURY

185 The Utility of Thromboelastography for Predicting the Risk of Progression of Intracranial Hemorrhage in Traumatic Brain Injury Patients
Abigail J. Rao, Amber Laurie, Cole Hilliard, Rochelle Fu, Tori Lennox, Ronald Barbosa, Martin Schreiber, Susan Rowell

4:27–4:33 pm
186 Deferoxamine Accelerates Hemorrhage Absorption for Patients with Traumatic Intracerebral Hematoma: A Prospective Randomized Controlled Trial
Jian Yu

4:33–4:39 pm
187 Prospective Study of Fulte Care in the Neuroscience Intensive Care Unit
Simon Buttrick, Kristy O’Phelan, Kenneth Goodman, Ronald Jay Benveniste

4:39–4:45 pm
188 Morbidity and Mortality Associated with Operative Management of Traumatic C2 Fractures in Octogenarians
Ethan A. Winkler, John K. Yue, John Frederick Burke, Praveen V. Murmaneni, Geoffrey T. Manley, Phiroz E. Tarapore, Sanjay S. Dhall

4:45–4:51 pm
189 Comparison of Efficacy of Tonic and Burst Occipital Nerve Stimulation in Treating Trigeminal Allodynia: Chronic Result
Shannon Wang Clark, Lalit Venkatesan, David Boorman, Nathan Fried, Michael Oshinsky, Ashwini Dayal Sharan, Melanie Elliott

4:51–4:57 pm
SESSION ON PEDIATRIC NEUROLOGICAL SURGERY SESSION 2 ORAL PRESENTATIONS

3:57–4:03 pm
197 Considerations in Relationship to the Approach for the Treatment of Lateralized Posterior Fossa Tumors in Children
Mark Calayag, Brandon C. Gabel, David S. Hong, Dustin Hafehi, David D. Gonda, Hal S. Meltzer, Michael L. Levy

4:03–4:09 pm
198 Effectiveness of Surgical Revascularization for Stroke Prevention in Pediatric Patients with Sickle Cell Disease(SCD) and Moyamoya Syndrome(MMS)
Wuyang Yang, Jose Luis Porras, Jr., Risheng Xu, Tomas Garzon-Muvdi, Justin M. Caplan, Geoffrey P. Colby, Alexander Lewis Coon, Rafael J. Tamargo, Judy Huang, Edward Sanghoon Ahn
4:09–4:15 pm
**199 Multiple Concussions in Young Athletes: Identifying Patients at Risk for Repeat Injury**
Meghan Murphy, Brandon A. McCutcheon, Panagiotis Kerezoudis, Lorenzo Rinaldo, Daniel Levi Shepherd, Patrick R. Maloney, Marcus J. Gates, Mohamad Bydon

4:15–4:21 pm
**208 Connectivity-based Functional Parcellation and Localization of the Human Supplementary Motor Area Based on Rest-fMRI and Its Utility in Brain Tumor Surgery**
Fengping Zhu, Dongxiao Zhuang, Qiang Luo, Tianming Qui, Jinsong Wu, Jianfeng Feng, Ying Mao

4:21–4:27 pm
**209 Movement-related Dynamics of Beta Band Causal Interactions Between STN and Sensorimotor Cortex Revealed Through Intraoperative Recordings in Parkinson’s Disease**
Ahmad Alhourani, Anna Korzeniewska, Thomas A. Wozny, Efstathios Kondylis, Witold J. Lipski, Donald Crammond, R. Mark Richardson

4:27–4:33 pm
**210 Human Sensorimotor Electroecorticography: Spectral Dynamics and Network Connectivity During a Simple Motor Task**
Vivek Buch, John Frederick Burke, Ashwin G. Ramayya, Cameron Brandon, Eric Hudgins, Andrew Richardson, Timothy H. Lucas, II

4:33–4:39 pm
**211 Cortical Oscillations During Memory Encoding are Reinstated on a Faster Time Scale During Memory Recall**
Ammar Shaikhouni, Robert Yaffe, Sara Inati, Kareem A. Zaghloul

4:39–4:45 pm
**212 A Distributed Network for Emotional and Non-emotional Conflict Processing**
Matthew Kamal Mian, Emad N. Eskandar

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**SECTION ON TUMORS ORAL PRESENTATIONS**

3:57–4:03 pm
**213 HDAC Inhibitor Vorinostat is a Novel, Promising Treatment for Cushing’s Disease**
Prashant Chittiboina, Jie Lu, Xiang Wang, Martin G. Piazza, Zhengping Zhuang

4:03–4:09 pm
**214 Fractal Structure in Volumetric Contrast Enhancement of Malignant Gliomas Correlates with Oxidative Metabolic Pathway Gene Expression**
Kai Miller, Sharon Berendsen, Tatjana Seute, Kristen Yeom, Melanie Gephart Hayden, Gerald A. Grant, Pierre Robe

4:09–4:15 pm
**215 Post-operative Stereotactic Radiosurgery Versus Observation for Completely Resected Brain Metastases: Results of a Prospective Randomized Study**
Ganesh Rao, Salmaan Ahmed, Kenneth Hess, Anita Mahajan

4:15–4:21 pm
**216 Human Fat-derived Mesenchymal Stem Cells Bioengineered to Secrete BMP4 are Non-Onecogenic, Suppress Glioma, and Prolong Survival**
Sara Ganaha, Rawan Al-Kharboosh, Alejandro Ruiz-Valls, Hugo Guerrero-Cazares, Alfredo Quinones-Hinojosa
4:21–4:27 pm
**217** YAP is Ready to Rac and Rho: Elucidation of a Novel YAP-driven Network That Potentiates Brain Cancer Cell Dispersal and Confers Poor Survival in Patients
Sagar R. Shah, Nathaniel Tippens, JinSeok Park, Ahmed Mohyeldin, Guillermo Vela, Juan Carlos Martinez-Gutierrez, Seth S. Margolis, Susanne Schmidt, Andre Levchenko, Alfredo Quinones-Hinojosa

4:27–4:33 pm
**218** Meningioma Driver Mutations Determine Their Anatomical Site of Origin
Murat Gunel, Yale-Bonn-Cologne Brain Tumor Genetics Study Group

4:33–4:39 pm
**219** Liquid Biopsy Can Distinguish Recurrent GBM from Pseudoprogression and Radiation Necrosis After Concurrent Radiochemotherapy
Andrew E. Sloan, David Soler, Anne B. Young, Kelvin D. Cooper, Thomas McCormic

4:39–4:45 pm
**SYNTHES SKULL BASE SURGERY AWARD**
**220** Expanded Anterior Petrosectomy Through the Transcranial Middle Fossa and Extended Endoscopic Transphenoidal-Transclival Approaches: Qualitative and Quantitative Anatomic Analysis
Aurel Hasanbelliu, Norberto O. Andaluz, Alberto Di Somma, Jeffrey T. Keller, Lee Zimmer, Myles L. Pensak, Ravi Samy, Mario Zuccarello

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**M08:** SANS Challenging Pediatric Neurosurgery Cases: Interactive Case-based Discussion

**M11:** SANS Acoustic Neuroma: Current Management Strategies

**M14:** SANS Functional Neurosurgery: Emerging Opportunities

**M15:** SANS Cervical Radiculopathy: Anterior Versus Posterior Cervical

**T16:** SANS Seven Aneurysms

**T22:** SANS Peripheral Nerve Board Review

**T24:** SANS Malignant Glioma: Advances in Surgery and Adjuvant Therapy

Each exam is only $15 and any Annual Meeting attendee can purchase one or all of the exams, regardless of attendance at the live course.
4:45–4:48 pm

**302 Vessel Wall Enhancement on MRI After Stent-retriever Thrombectomy**
Peter Abraham, Vincent J. Cheung, Roland Lee, Jeffrey Scott Pannell, Mihir Gupta, Robert Rennett, Alexander Arash Khalessi

4:48–4:51 pm

**303 Aneurysmal Subarachnoid Hemorrhage Patients’ Risk Assessment for Shunting (aSAH-PARAS): An International Collaborative Study and Initiation of a Consortium**
Hadie Adams, Vin Shen Ban, Ville Leinonen, Salah G. Aoun, Jukka Huttunen, Taavi Saavalainen, Antti Lindgren, Juhana Froseen, Mikael Fraunberg, Timo Sakari Koivisto, Juha Antero Hernesniemi, Babu Guai Welch, Juha Jaaskelainen, Terhi J Huttunen

4:51–4:54 pm

**304 The Contribution of Whole Platelet Aggregometry to the Endovascular Management of Unruptured Aneurysms: An Institutional Experience**

4:54–4:57 pm

**305 The INVEST Trial: A Randomized, Controlled Trial to Investigate the Safety and Efficacy of image-guided Minimally Invasive Endoscopic Surgery with Apollo Versus Best Medical Management for Supratentorial Intracerebral Hemorrhage**
David Fiorella, Adam S. Arthur, J D. Mocco

4:57–5:00 pm

**306 Worse Stereotactic Radiosurgery Outcomes for Intracranial Arteriovenous Malformations After Repeat Versus Initial Treatment: A Matched Cohort Study**
Dale Ding, Zhiyuan Xu, Han-Hsun Shih, Robert M. Starke, Chun-Po Yen, Or Cohen-Inbar, Jason P. Sheehan

5:00–5:03 pm

**307 Is Catheter Diagnostic Cerebral Angiography Still Essential for Patients with Spontaneous Perimesencephalic Subarachnoid Hemorrhage and Negative CT Angiogram?**
Ahmed Galal, Tarek H. ElSerry, Mohamed Mostafa Aziz

5:03–5:06 pm

**308 High-resolution MRI Findings Following Trigeminal Rhizotomy**
C. Rory Goodwin, Benjamin Northcutt, Daniel Seegub, Jaehoon Shin, Debebe Theodros, Nancy A Abu-Bonsrah, Daniel Herzka, Nafi Aygun, Ari M Blitz, Michael Lim

5:06–5:09 pm

**309 Middle Fossa Approach to Lateralized Pontine Cavernomas in Children**
Mark Calayag, Reid Hoshide, David D. Gonda, Hal S. Meltzer, Takanori Fukushima, Michael L. Levy

5:09–5:12 pm

**310 Predictors of Preoperative Developmental Delay in Nonsyndromic Sagittal Craniosynostosis**
Eisha Christian, Thomas Imahiyerobo, Alexis Johns, Pedro Sanchez, Mark D. Krieger, J. Gordon McComb, Mark Urrata

4:45–4:48 pm

**311 Smith-Robinson Procedure with an Autologous Iliac Crest Bone Graft with and without Caspar Plating as a Treatment for Soft Cervical Disc Herniation—Report of 122 Patients with an Average Follow-up of 25 years**
Benedikt W. Burkhardt, Moritz Brielmeier, Karsten Schwerdtfeger, Joachim M.K. Oertel

4:48–4:51 pm

**312 Risk Factors and Clinical Outcomes of Dysphagia After Anterior Cervical Surgery in Patients with Degenerative Cervical Myelopathy: Results from the AO spine International and North America Studies**
Lindsay Tetreault, Narihito Nagoshi, Hiroaki Nakashima, Paul M. Arnold, Giuseppe Barbagallo, Branko Kopjar, Michael G. Fehlings

4:51–4:54 pm

**313 Impact of Intra-operative Steroids on Post-operative Infection Rates and Length of Hospital Stay: A Study of 1200 Spine Surgery Patients**
Aladine A. Elsamadicy, Timothy Y. Wang, Isaac O. Karikari, Oren N. Gottfried

4:54–4:57 pm

**314 Minimally Invasive Oblique Lateral Interbody Fusion for L4-5: Clinical Outcomes and Peri-operative Complications**
Jin-Sung Kim, Won Suh Choi, Ji Hoon Sung

4:57–5:00 pm

**315 Race as a Predictor of Postoperative Hospital Readmission After Spine Surgery**
Joel Martin, Timothy Y. Wang, Daniel B. Loriaux, Rupen Desai, Owoicho Adogwa, Maragatha Kuchibhatla, Isaac O. Karikari, Carlos Antonio Bagley, Oren N. Gottfried

5:00–5:03 pm

**316 MRI Analysis of the Combined AO Spine North America and International Studies, Part I: The Prevalence and Spectrum of Pathologies in a Global Cohort of Patients with Degenerative Cervical Myelopathy**
Aria Nouri, Allan R. Martin, Lindsay Tetreault, Anick Nater, So Kato, Hiroaki Nakashima, Narihito Nagoshi, Hamed Reihani-Kermani, Michael G. Fehlings

5:03–5:06 pm

**317 Clinical Outcome of Transspinal Approach in Comparison with Conventional Laminctomy for Lumbar Degenerative Stenosis**
Aysegul Ozdemir Ovialioglu, Erhan Emel, Emre Taciyildiz, Cem Ovialioglu, Muslin Gunes, Levent Uysal, Aysegul Esen Aydin

**RAPID-EXCHANGE ORAL PRESENTATIONS SESSION 1**
**MODERATORS:** Robert F. James, Elias Boulos Rizk

**RAPID-EXCHANGE ORAL PRESENTATIONS SESSION 2**
**MODERATOR:** Kevin S. Cahill
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<th>Authors</th>
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<td>5:06–5:09 pm</td>
<td><strong>318</strong> Lumbar Disc Surgery: Clinical Outcome of 85 Patients with a Mean Follow-up of 32 Years</td>
<td>Benedikt W. Burkhardt, Marietta Grimm, Karsten Schwerdtfeger, Joachim M.K. Oertel</td>
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<td><strong>319</strong> Predictive Value of Intraoperative Neurophysiological Monitoring During Spine Surgery: A Prospective Analysis of 4489 Consecutive Patients</td>
<td>Matthew Pease, Gurpreet Surinder Gandhoke, Jaspreet Kaur, Parthasarthy Thirumala, Jeffrey Balzer, Donald Crammond, David O. Okonkwo, Adam S. Kanter</td>
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<td>5:12–5:15 pm</td>
<td><strong>320</strong> Association Between Hemoglobin A1c and Reoperation Following Spine Surgery</td>
<td>Jacob A. Miller, Matthew Richard Webb, Edward C. Benzel, Thomas Mroz, Eric Mayer</td>
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<td></td>
<td><strong>27</strong> RAPID-EXCHANGE ORAL PRESENTATIONS SESSION 3 MODERATORS: Kathryn M. Beauchamp, Uzma Samadani, Sameer A. Sheth</td>
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<tr>
<td>4:45–4:48 pm</td>
<td><strong>321</strong> Development of Intrathecal Riluzole (itRIL): A New Route of Administration for the Treatment of Amyotrophic Lateral Sclerosis (ALS) Patients</td>
<td>Juanmarco Gutierrez, Thais Federici, Bethany Peterson, Ray Bartus, Alexandre Betourne, Nicholas M. Boulis</td>
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<tr>
<td>4:48–4:51 pm</td>
<td><strong>322</strong> High-resolution Small Vessel Imaging with Rotational Angiography CT for Stereotactic EEG Trajectory Planning</td>
<td>Michael J. Lang, Chengyuan Wu, Pascal Jabbour, Ashwin Dayal Sharan</td>
</tr>
<tr>
<td>4:54–4:57 pm</td>
<td><strong>324</strong> Neurosurgical Cost Containment Via Improved Physician Awareness</td>
<td>Nitin Agarwal, Prateek Agarwal, Anna Mazurkiewicz, Daniel A. Wecht, Robert M. Friedlander</td>
</tr>
<tr>
<td>4:57–5:00 pm</td>
<td><strong>325</strong> Maintenance of Certification and the Aging Neurosurgeon</td>
<td>Maya A. Babu, Linda M. Liau, Robert J. Spinner, Fredric B. Meyer</td>
</tr>
<tr>
<td>5:00–5:03 pm</td>
<td><strong>326</strong> Cerebral Contusions: Catalysts and Counteractants</td>
<td>Joseph Carnevale, David J. Segar, Benjamin Drapcho, Cody Doberstein, John F. Morrison, Wael Aasaad</td>
</tr>
<tr>
<td></td>
<td><strong>27</strong> RAPID-EXCHANGE ORAL PRESENTATIONS SESSION 4 MODERATORS: Jennifer A. Moliterno Gunel, Nader Sanai</td>
<td></td>
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<tr>
<td>4:45–4:48 pm</td>
<td><strong>331</strong> Association Between Radiation Necrosis and Tumor Biology Following Stereotactic Radiosurgery for Brain Metastasis</td>
<td>Jacob A. Miller, Elizabeth Emily Bennett, Roy Xiao, Rupesh Kotecha, Samuel T. Chao, Michael A. Vogelbaum, Gene H. Barnett, Lillyana Angelov, Erin Murphy, Jennifer Yu, Manmeet Ahluwalia, John H. Suh, Alireza M. Mohammadi</td>
</tr>
<tr>
<td>4:48–4:51 pm</td>
<td><strong>332</strong> Molecular Characteristics of Tumor infiltrating Front in Glioblastoma: Insights into Molecular Heterogeneity and Implications on Targeted Therapy</td>
<td>Arivazhagan Arimappamagan, B.S. Kruthika, Dawn B. Rose, Kondaiah Paturu, Vani Santosh</td>
</tr>
<tr>
<td>4:51–4:54 pm</td>
<td><strong>333</strong> Obtaining the Genetic Fingerprint of Resistance to Glioblastoma Through a Novel Multigenerational Xenograft Model</td>
<td>Arman Jahangiri, William Chen, Garima Yagnik, Michael De Lay, Jeffrey Wagner, Maxim Sidorov, Patrick Michael Flanigan, Manish Kumar Aghi</td>
</tr>
<tr>
<td>4:54–4:57 pm</td>
<td><strong>334</strong> A Functional Screen identifies miRs that Induce Radioresistance in Glioblastomas</td>
<td>Clark C. Chen, Patryk Moskwa, Pascal O. Zinn, Brian R Hirshman, Young Eun Choi, Sachet A. Shukla, Wojciech Fendler, Jun Lu, Todd R. Golub, Anita Hjelmeland, Dipanjani Chowdhury</td>
</tr>
</tbody>
</table>
RAPID-EXCHANGE ORAL PRESENTATIONS

4:57–5:00 pm
335 A Modular, Multi-modality Integrative Pipeline for Neurosurgery Simulation and Visualization
Anthony Beardsworth Costa, Joshua B. Bederson

5:00–5:03 pm
336 Small RNA Sequencing of Glioblastoma Multiforme Extracellular Vesicles
Tristan de Mooij, Brandon A. McCutcheon, Alexey A Leonovitch, Ian F. Parney

5:03–5:06 pm
337 Expansion of Dendritic Cells Using FLT3 Ligand to Treat Glioblastoma: A Preclinical Study
Tomas Garzon-Mudri, Antonella Mangraviti, Debebe Theodros, Eileen Kim, Michael Jay Yellin, Henry Marsh, Michael Lim

5:06–5:09 pm
338 Molecular Mechanisms Underlying Malignant Progression of Low-grade IDH1 Mutant Meningiomas
Murat Gunel, Yale-Bonn-Cologne-MSKCC-Acibadem Brain Tumor Genetics Study Group

5:09–5:12 pm
339 Comparative Prognostic Value of the Cumulative Intracranial Tumor Volume (CITV) and Score Index for Radiosurgery (SIR) in Brain Metastasis
Brian R Hirshman, Bayard Wilson, Proudfoot A. James, Takao Koiso, Osamu Nagano, Bob S. Carter, Toru Serizawa, Masaaki Yamamoto, Clark C. Chen

5:12–5:15 pm
340 c-Met/ß1 Integrin: A Receptor Complex Driving Invasive Glioblastoma Resistance to Anti-angiogenic Therapy
Maxim Sidorov, Arman Jahangiri, Sung-Won Han, Michael De Lay, Jeffrey Wagner, Brandy Castro, Patrick Michael Flanigan, Brandon S. Imber, William A. Weiss, Manish Kumar Aghi

3:24–3:27 pm
344 Effects of Discontinuance of Preoperative Anti-platelet Medication in Multi-level Thoracolumbar Spine Surgery
Dong Wuk Son, Geun Sung Song

3:27–3:30 pm
345 Elective Anterior Cervical Disectomy and Fusion (ACDF) Versus Cervical Artificial Disc Replacement (C-ADR): A Comparison of Perioperative Morbidity and Early Outcomes
Pavan S. Upadhayula, John K. Yue, Reid Hoshide, Erik Curtis, Joseph D. Ciacci

3:30–3:33 pm
346 Temporary Inferior Vena Cava Filter to Prevent Pulmonary Embolism in Thrombophilic Neurosurgery Patients
Scott A. Shapiro, Ian Kainoa White

3:33–3:36 pm
347 Clinical Outcomes Following Spinal Fusion Using an Intraoperative Computed Tomographic Three-dimensional Imaging System
Roy Xiao, Jacob A. Miller, Navin C. Sabharwal, Daniel Lubelski, Vincent J. Alentado, Andrew Torre Healy, Thomas Mroz, Edward C. Benzel

3:36–3:39 pm
348 Pain Control by Coaptation Procedure C3 and C4 Anterior Rami to Brachial Plexus
Shokei Yamada, Russell R. Lonser, Daniel J. Won, Bryan E. Tsao

3:39–3:42 pm
349 Safety of the Sitting Cervical Position for Elective Spine Surgery

3:42–3:45 pm
350 Mini-open Transpedicular Corpectomy and Percutaneous Instrumentation Without Fusion: Reoperation Rates for Implant Failure and Pseudarthrosis
Darryl Lau, Dean Chou

3:15–3:18 pm
341 Diabetes Mellitus and Back Pain: Markers of Diabetes Disease Progression are Associated with Chronic Back Pain
Lorenzo Rinaldo, Brandon A. McCutcheon, Hannah Gilder, Panagiotis Kerezoudis, Meghan Murphy, Patrick R. Maloney, Ahmed Hassoon, Mohamad Bydon

3:18–3:21 pm
342 Lumbar Total Disc Replacement by the Lateral Approach—Up to 10-year Follow-up
Luiz Pimenta, Luis Marchi, Rodrigo Augusto Amaral, Leonardo Oliveira, Joes Nogueira-Neto, Rubens Jensen, Etevaldo Coutinho

3:21–3:24 pm
343 Results of the 2015 SRS Survey on Single Versus Two Attending Surgeon Approach for Adult Spinal Deformity (ASD) Surgery
Justin K. Scheer, Lloyd Hey, Michael LaGrone, Michael Daubs, Christopher P. Ames

3:15–3:18 pm
351 Do Rehabilitation Therapies Affect Patient Outcomes After Chiari I Decompression Surgery? Grace M. Deyo, Danielle N. Ryan, Stephen P. Sales, Lance S. Governae

3:18–3:21 pm
352 Robot-assisted Endoscopic Third Ventriculostomy
Reid Hoshide, Mark Calayag, Hal S. Meltzer, Michael L. Levy, David D. Gonda
3:21–3:24 pm

353 High Intensity Ultrasound for the Treatment of Vincristine Induced Neuropathic Pain
Youngwon Youn, Ian Thomas Walling, Lucy Gee, Paul Neubauer, Lance Frith, Emery Williams, Clif Burdette, Julie G. Pilitsis

3:24–3:27 pm

354 Diagnostic Utility of Cerebral Biopsy Following Suggestive Cerebral Angiogram in the Workup of CNS Vasculitis
James Monroe Wright, III, Berje Haroutouon Shammassian, Jeffrey Tait Nelson, Christina Huang Wright

3:27–3:30 pm

355 Endovascular Management of Cervical Carotid and Vertebral Artery Dissection: Indications, Techniques, and Outcomes from a 20-year Experience
Karam Moon, Felipe Albuquerque, Tyler Scott Cole, Bradley A. Gross, Cameron G. McDougall

3:30–3:33 pm

356 Microsurgical Anatomy of the Brainstem Safe Entry Zones: A Cadaveric Study with High-resolution Magnetic Resonance Imaging and Fiber Tracking
Debraj Mukherjee, Veyesl Antar, Bora Gurer, Ulas Cikla, Gabriel Neves, Mehmet Ekici, Tomer Hananya, Aaron S. Field, Shahriar M. Salamat, Mustafa Kemal Baskaya

3:33–3:36 pm

357 Gamma Knife Stereotactic Radiosurgery in the Management of Large Cerebral AVMs
Mannmohan Singh, Deepak Aggarwal, Shashank Sharad Kale

3:36–3:39 pm

358 Adoption of a “Radial First” Approach for Diagnostic Cerebral Angiography: A Feasibility Study
Samir Sur, Brian Michael Snelling, Dileep Yavagal, Eric C. Peterson

3:39–3:42 pm

359 Delayed Treatment of Ruptured AVMs: Is It Ok to Wait?

3:42–3:45 pm

360 Relationship of A1 Segment Hypoplasia to Anterior Communicating Artery Aneurysm Morphology and Risk Factors for Rupture
Lorenzo Rinaldo, Brandon A. McCutcheon, Meghan Murphy, Mohamad Bydon, Alejandro A. Rabinstein, Giuseppe Lanzino

3:18–3:21 pm

362 Priming of the Brain Tumor Microenvironment Enables Improved Nanomedicine Delivery
Yuanxin Chen, Wen Jiang, Yaqing Qie, Xiujie Liu, Christina von Roemeling, Kevin Shih, Robert E. Wharen, Betty Y.S. Kim

3:21–3:24 pm

363 Cortical Plasticity of Motor-eloquent Areas Measured by Navigated Transcranial Magnetic Stimulation in Glioma Patients
Neal Conway, Noriko Tanigawa, Bernhard Meyer, Sandro M. Krieg

3:24–3:27 pm

364 Creation of a Dual-labeled Cancer-targeting Alkylphosphocholine Analog for Dual Modality Quantitative PET and Intraoperative Tumor Visualization
John S. Kuo, Ray R. Zhang, Anatoly N. Pinchuk, Justin Jeffrey, Paul A. Clark, Jamey P. Weichert

3:27–3:30 pm

365 Epigenetic Profiling Reveals a Unique Histone Code in Chordoma

3:30–3:33 pm

366 Predictive Factors for Survival in Surgical Series of Symptomatic Metastatic Epidural Spinal Cord Compression: A Prospective North American Multi-Centre Study in 142 Patients
Michael G. Fehlings, Anick Nater

3:33–3:36 pm

367 Autocrine/Paracrine Erythropoietin Signaling Associated with Symptomatic von Hippel-Lindau Hemangioblastomas
Saman Sizdahkhani, Xiang Wang, Nancy A. Edwards, Zhengping Zhuang, Russell R. Lonser, Edward H. Oldfield, Prashant Chittiboina

3:36–3:39 pm

368 Anatomy and White Matter Connections of the Orbitofrontal Gyrus
Joshua Dee Burks, Phillip A. Bonney, Andrew K.P. Conner, Chad A. Glenn, Robert G. Briggs Lillian B. Boettcher, Daniel L. O’Donoghue, Dee H. Wu, Michael Edward Sughrue

3:39–3:42 pm

369 CARs Deficient in Lck Signaling Require 4-1BB Costimulation to Expand in Vivo, Resist Regulatory T-cell Suppression, and Treat Solid Tumors in Immune-intact Hosts
Carter M. Suryadevara, Rupen Desai, Samuel Harrison Farber, Patrick C. Gedeon, Adam Swartz, David Snyder, James Herndon, Patrick Healy, Bryan D. Choi, Peter Edward Pecci, Luis Sanchez-Perez, John H. Sampson

3:42–3:45 pm

370 MR-guided Focused Ultrasound Delivery of Polymeric Brain-penetrating Nanoparticle MicroRNA Conjugates in Glioblastoma
Rafael A. Vega, Ying Zhang, Colleen Curley, Richard L. Price, Roger Abounader
3:15–3:18 pm  
**371 How Does Case Type, Length of Stay, and Comorbidities Affect Medicare DRG Reimbursement for Minimally Invasive Surgery (MIS) for Deformity?**  

3:18–3:21 pm  
**372 Profound Lack Non-clinical Healthcare Aptitude Across a Range of Healthcare Providers and Students**  
Gary R. Simonds

3:21–3:24 pm  
**373 Is SEEG safe? A Systematic Review and Meta-Analysis of Stereo-electroencephalography Related Complications**  
Jeffrey Paul Mullin, Michael Shriver, Soha Abdu Alomar, Imad Najm, Jorge Alvaro Gonzalez-Martinez

3:24–3:27 pm  
**374 Modeling the Effects of Current Steering with Directional Leads**  
Tushar Krishnan, Richard Mustakos, G. Karl Steinke

3:27–3:30 pm  
**375 DIRECT DBS: A Prospective, Multi-center Clinical Trial with Blinding for a Directional DBS Lead**  
Jens Volkman, Stephan Chabardes, G. Karl Steinke, Stephen Carcieri

3:30–3:33 pm  
**376 The Salt Versus Sugar Debate: Urinary Sodium Losses Following Hypertonic Saline Administration Curtails its Superior Osmolar Effect in Comparison to Mannitol in Severe Traumatic Brain Injury**  
Aniruddha Tekkattte Jagannatha, Sriganesh Kamath, Indira Devi, Umamaheswaru G.S. Rao

3:33–3:36 pm  
**377 Craniectomy Versus Cranietomy in Traumatic Brain Injury: A Propensity-matched Analysis of Long-term Functional and Quality of Life Outcomes**  
Michael L. Kelly, Berje Harouton Shammassian, Mary Joan Roach, Charles Thomas, Amy K. Wagner

3:36–3:39 pm  
Asif Maknojia, Shane M. Sprague, Manuel Riquelme, Sumin Gu, Pamela Reed, Viktor Bartanusz, Jean Jiang, Naomi Sayre

3:39–3:42 pm  
**379 Communicating a Traumatic Brain Injury Patient’s Potential Need for Operative Intervention: The Surgical Intervention for Traumatic Injury Scale**  
Eric Anthony Sribnick, Junxin Shi, Michael P. Lunney, Sanjay S. Dhall, Jason W. Allen, David W. Wright, Krista Wheeler, Huiyun Xiang

3:42–3:45 pm  
**380 Effects and Clinical Characteristics of Intracranial Pressure Monitoring-targeted Management for Subsets of Traumatic Brain Injury: An Observational Multicenter Study**  
Qiang Yuan, Xing Wu, Jin Hu, Jian Yu, Yirui Sun, Zhiqi Li, Zhuoying Du, Ying Mao, Liangfu Zhou
Congress of Neurological Surgeons 2016 Annual Meeting Objectives

The Congress of Neurological Surgeons exists to enhance health and improve lives worldwide through the advancement of education and scientific exchange in the field of neurosurgery. The CNS Continuing Medical Education (CME) program provides participants with various learning formats to keep current in the field and to improve skills and enhance professional performance to provide the best possible care for their patients.

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 2016 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 Practical Courses, Luncheon Seminars, Dinner Seminars, and Symposia which are available for an additional fee.

Practical Courses and Symposia
Didactic and hands-on courses with expert neurosurgical educators demonstrating clinical techniques and applications via technology and models. Hands-on Practical Courses provide an opportunity to improve surgical skills by applying and demonstrating learned techniques. Practical Courses also provide an opportunity to review case-based complex issues and discuss potential solutions.

- Practical Courses are offered Saturday, September 24, and Sunday, September 25.

General Scientific Sessions, Section Sessions, Clinical Controversy Sessions, Guideline Sessions, Operative Neurosurgery Sessions, Luncheon Seminars, and Dinner Seminars
Expert lecturers present research, best scientific evidence and associated outcomes demonstrating 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. They will present basic skills and information you can apply in your daily practice and professional life.

- General Scientific Sessions, Section Sessions, Clinical Controversy Sessions, Guideline Sessions, and Operative Neurosurgery Sessions are offered Sunday, September 25, through Wednesday, September 28.
- Luncheon Seminars are offered Monday, September 26, through Wednesday, September 28.
- Dinner Seminars are offered on Saturday, September 24; Monday, September 26; and Tuesday, September 27.

Case-based Education
Challenging neurosurgical cases will be reviewed and discussed in a variety of innovative formats including Live Surgery via Telemedicine and Panel Discussions.

- Live Surgery via Telemedicine in the Exhibit Hall will take place Monday, September 26, through Wednesday, September 28. 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 and CNS Poster viewing will take place on Monday, September 26, and Tuesday, September 27.
- Rapid-exchange Presentations by subspecialty will take place on Tuesday, September 27, and Wednesday, September 28.
- Late Breaking Abstracts will be presented on Wednesday, September 28.

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 46.75 AMA PRA Category 1 Credits™. Physicians should only claim credit commensurate with the extent of their participation in the activity.
“A maximum of 22.25 AMA PRA Category 1 Credits™ may be earned for general sessions only.

Advanced Practice Provider: For credit that may be acceptable to state medical associations, specialty societies, or state boards for medical licensure, please contact those organizations directly.

Additional CME Credits can be earned by attending the following:

Practical Courses
Attendees will receive a maximum of three-and-a-quarter (3.25) AMA PRA Category 1 Credits™ for each Saturday half-day Practical Course, a maximum of seven (7) AMA PRA Category 1 Credits™ for each eligible Saturday full-day Practical Course or Symposium, a maximum of three-and-a-quarter (3.25) AMA PRA Category 1 Credits™ for each eligible Sunday half-day Practical Course, and a maximum of seven (7) AMA PRA Category 1 Credits™ for each eligible Sunday full-day Practical Course. Attendees will receive a maximum of six-and-a-half (6.5) AMA PRA Category 1 Credits™ for the Saturday Symposium, and a maximum of seven (7) AMA PRA Category 1 Credits™ for the Sunday Symposium. Physicians should only claim credit commensurate with the extent of their participation in the activity.

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.

Posters
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 AMA PRA Category 2 Credits™ for viewing scientific posters. Physicians should self-claim credit on their AMA PRA certificate application form. Please visit the AMA web site for details at www.ama-assn.org.

Claiming CME Credit
CME credits can be claimed through the online CME system at 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 Diego, 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, re-selling 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 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.

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 devices 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.
Active Duty Military Member Benefits
Complimentary registration and limited free housing is available to US Active CNS members who are Active Duty Military. Free housing is limited to the first 10 Active Duty Military CNS members registered for the Annual Meeting. CNS Members may take advantage of these benefits in the following way: When registering for the CNS Annual Meeting, please select Active Duty Military member on the online registration form at cns.org/2016. If you are one of the first 10 Active Duty Military registrants, you will be contacted by the CNS staff to confirm housing arrangements. Non-members should contact membership@cns.org to join the CNS and confirm that you qualify for these benefits. CNS membership is complimentary to Active Duty Military neurosurgeons.

Airport
The CNS Annual Meeting hotels and the San Diego Convention Center are located approximately four miles from the San Diego International Airport (SAN). Taxis are readily available at the Transportation Plazas in front of Terminal 1 and 2 at the San Diego International Airport.

Americans with Disabilities Act
Wheelchairs, scooters, information booths, designated parking, TDD telephones, and other services are available for visitors with disabilities. For wheelchair or electric scooter rental, please contact Scootaround at 1-888-441-7575. Scootaround strongly suggests that you make your reservation in advance of your arrival.

Please let us know if, under the ADA, you require special accommodations or services in order to attend the 2016 CNS Annual Meeting. We want to ensure that no individual with a disability is excluded because of the absence of auxiliary aids and services. Your requirements should be sent directly to the CNS Annual Meeting Registration and Housing Center at: cns@wynhdajade.com or by calling 1-800-931-9543. Please provide any requests at least 30 days prior to the Annual Meeting to allow adequate time to accommodate your request.

Attire
Professional attire is appropriate at the Annual Meeting and in the Exhibit Hall. Some San Diego restaurants require coats and ties for gentlemen. Please check each restaurant’s policy when making reservations.

Spouse Hospitality Suite
All registered CNS Annual Meeting spouses and guests are invited to visit the CNS Spouse Hospitality Suite at the Marriott Marquis San Diego Marina, Monday through Wednesday from 8:00-10:30 am for continental breakfast. Please note that admittance to the Spouse Hospitality Suite is by spouse/guest badge only.

Children
Children over the age of 12 should register at the guest registration fee. (Please note that children under the age of 18 are not allowed in the 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 or these services. This information is provided solely to assist participants in identifying possible sources for childcare.

Climate
September temperatures in San Diego average a high of 75°F and a low of 64°F.

Course Agendas 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 Exhibit Hall, and can be searched by author, topic, or keyword.

Disclaimer
The material presented at the 2016 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 or procedure 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.

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 of the views presented, the products used, or the materials exhibited by the CNS or by its Committees or Affiliates.

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 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, September 26 9:00 am–3:00 pm
Tuesday, September 27 9:00 am–3:00 pm
Wednesday, September 28 9:00 am–2:15 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.

Future Meetings

2017 Boston, Massachusetts, October 7-11
2018 Houston, Texas, October 6-10
2019 San Francisco, CA, October 19-23

Hotel Information

See pages 69–71.

Registration Information

Items included in registration fee:

- One ticket to the Opening Reception on Sunday, September 25
- Admission to General Scientific Sessions, Sunday through Wednesday
- Original Science Program to include Oral Presentations, Rapid-exchange Oral Presentations, Section Poster Viewing Sessions, and Digital Posters.
- Live Surgeries
- Clinical Controversies, Guidelines, Operative Neurosurgery, and Clinical Trial Update Sessions
- Section Sessions
- Exhibit Hall Access, Monday through Wednesday

Member Services Booth

The CNS Member Services booth is located in the Exhibit Hall. Staff members will be available to assist you and answer any questions you may have about the CNS or your CNS membership.

Press Room

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/press or by calling 1-847-805-4493. Once onsite, media are required to check in at the CNS registration area and then proceed to the Press Room to pick up their press badges.

Registration Information and Hours:

Saturday, September 24 7:00 am–5:30 pm
Sunday, September 25 7:00 am–7:00 pm
Monday, September 26 6:30 am–6:30 pm
Tuesday, September 27 6:30 am–6:30 pm
Wednesday, September 28 6:30 am–3:30 pm

Shuttle Services

Shuttle service to the San Diego Convention Center will be available beginning Saturday, September 24, from select CNS Hotels as indicated in Hotel Information on pages 70–71. A shuttle schedule will be posted at the hotels and convention center.

Smoking

The San Diego Convention Center and official CNS hotels are non-smoking facilities.

Speaker Ready Room

All speakers and abstract oral presenters should visit the Speaker Ready Room at the San Diego Convention Center prior to their presentations.

Saturday, September 24 7:00 am–4:30 pm
Sunday, September 25 7:00 am–6:00 pm
Monday, September 26 6:30 am–3:45 pm
Tuesday, September 27 6:30 am–3:45 pm
Wednesday, September 28 6:30 am–2:00 pm

Visa Information

The State Department of the United States encourages international participants to apply for their visas as early as possible—at least three months before the meeting. Some consulates may have backlogs in scheduling visa interviews so applicants should first contact the consulate to find out how long the wait is for an interview. Visa wait times are available at: http://travel.state.gov/content/visas/en/general/wait-times.html.

For information on the visa process, please visit http://www.nationalacademies.org/visas.

The U.S. State Department’s visa site contains the official information on the visa application process: http://travel.state.gov/content/visas/en.html.

Wi-Fi Service

For your convenience, complimentary Wi-Fi service is provided by the CNS throughout the San Diego Convention Center (with the exception of the Exhibit Hall) and the Marriott Marquis San Diego Marina wherever CNS events are being held.
REGISTRATION METHODS
For your convenience, you can register and reserve your hotel room via these four methods:

ONLINE
cns.org/2016

PHONE*  
800-931-9543 US & Canada  
972-349-5539 International  
8:00 am–6:30 pm CST

FAX*  
972-349-7715

MAIL*  
CNS Annual Meeting  
CNS Registration and Housing Center  
6100 West Plano Parkway, Suite 3500  
Plano, TX 75093

*Allow five business days for registration and housing confirmation. The CNS Registration and Housing Center is not responsible for faxes not received due to mechanical failure or circumstances beyond our control.

Credit Card Payments
• US dollars and drawn on a US bank  
• Visa  
• MasterCard  
• American Express

Check Payments
• US dollars and drawn on a US bank  
• Full payment must accompany your registration form  
• Any checks received from an overseas bank will be returned  
• Any checks returned for insufficient funds are subject to additional charges

Materials Pick-Up
All materials should be picked up on-site at the San Diego Convention Center.

REGISTRATION RATES

<table>
<thead>
<tr>
<th>Member Registrant</th>
<th>ADVANCE REGISTRATION</th>
<th>AFTER AUGUST 25, 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active (Domestic &amp; International)</td>
<td>$ 750</td>
<td>$ 950</td>
</tr>
<tr>
<td>International Vista</td>
<td>$ 750</td>
<td>$ 950</td>
</tr>
<tr>
<td>Associate***</td>
<td>$ 750</td>
<td>$ 950</td>
</tr>
<tr>
<td>Active Duty Military</td>
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<tr>
<td>Armed Forces (Guard/Reserve/Retiree)</td>
<td>$ 475</td>
<td>$ 675</td>
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<tr>
<td>Transitional</td>
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<td>$ 950</td>
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<tr>
<td>Resident (Domestic &amp; International)</td>
<td>$ 150</td>
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<tr>
<td>Fellow (Domestic &amp; International)</td>
<td>$ 200</td>
<td>$ 300</td>
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<tr>
<td>Senior</td>
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<td>$ 650</td>
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<tr>
<td>Medical Student</td>
<td>$ 0</td>
<td>$ 200</td>
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<tr>
<td>Affiliate*</td>
<td>$ 350</td>
<td>$ 550</td>
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<table>
<thead>
<tr>
<th>Non-Member Registrant</th>
<th></th>
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<tbody>
<tr>
<td>Neurosurgeon</td>
<td>$1000</td>
</tr>
<tr>
<td>Physician (MD, DO, etc.)</td>
<td>$1000</td>
</tr>
<tr>
<td>Non-physician (Clinical Researcher/Scientist) ††</td>
<td>$1000</td>
</tr>
<tr>
<td>Neurosurgeon (Faculty)</td>
<td>$ 850</td>
</tr>
<tr>
<td>Resident*</td>
<td>$ 400</td>
</tr>
<tr>
<td>Fellow**</td>
<td>$ 450</td>
</tr>
<tr>
<td>Medical Student</td>
<td>$ 250</td>
</tr>
<tr>
<td>PA/Physician Extender/Nurse/Nurse Practitioner</td>
<td>$ 600</td>
</tr>
<tr>
<td>Corporate Representative†††</td>
<td>$1250</td>
</tr>
</tbody>
</table>

Non-member registration categories are open to domestic and international registrants.

REGISTRATION RATES

* All non-member residents must have their Program Director sign registration form. If registering online, a letter from your Program Director certifying that you are a resident in a neurosurgical training program must be faxed to 972-349-7715 or e-mailed to cns@wyndhamjade.com within one week of completing registration.

†† All non-member fellows must attach a letter from their Chief of Service verifying fellow status within one week of completing registration.

** Associate category includes physicians and/or scientists who are not neurological surgeons but have shown distinction in a neurosurgically related discipline.

* Affiliate category includes allied health professionals involved in neurosurgical related patient care, teaching or research, such as physician assistant, physician extender, nurse, nurse practitioner and non-nurse.

†† Corporate representatives attend for education only. They must not conduct sales activities in the meeting space, nor influence content in any way. Solicitation of medical attendees is strictly prohibited.

IMPORTANT DATES TO REMEMBER

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 25</td>
<td>Advance registration discount and housing deadline</td>
</tr>
<tr>
<td>September 1</td>
<td>Last day to cancel registration in order to receive a full refund, less a $100 processing fee</td>
</tr>
<tr>
<td>September 11</td>
<td>Last day to make any hotel changes or cancellations through the CNS Housing provider; Email: <a href="mailto:cns@wyndhamjade.com">cns@wyndhamjade.com</a>; Phone: 800-931-9543; International: 972-349-5539</td>
</tr>
<tr>
<td>September 12</td>
<td>Any hotel changes or cancellations must be made directly with the hotel after September 12. Individual hotel cancellation policies can be found on your original housing confirmation.</td>
</tr>
</tbody>
</table>

Registration Change/Cancellation Information
Full registration refunds, less a $100 processing fee, will be granted if written requests for cancellation are received by 5:00 pm CST on September 1, 2016. Course, seminar, and event tickets will be refunded in full until September 1, 2016. No refunds of any kind will be given after this date, regardless of cause. Refunds will not be given for no-shows.

Cancellation requests accepted via:

E-mail: cns@wyndhamjade.com
Fax: 972-349-7715

CNS Annual Meeting  
CNS Registration and Housing Center  
6100 West Plano Parkway, Suite 3500  
Plano, TX 75093
Hotel Information

Contact the official CNS Annual Meeting Registration and Housing Center to reserve your guest rooms. Hotels will not accept reservations from CNS meeting attendees directly. Reservations can be made online or via fax, phone, or mail.

Visit cns.org/2016 to make your reservation today! Be sure to complete the entire housing section on the reservation form.

Hotel Reservation Deadlines
Reserve your room by August 25, 2016. (Rooms are subject to availability.)

Deposit
A deposit of one night’s room and tax is due at the time your hotel reservation is made. This payment must be submitted with your registration fee and will be charged to the credit card provided. Please make checks payable to: CNS Registration and Housing Center at 6100 W. Plano Parkway, Suite 3500, Plano, TX 75093. All rooms are subject to applicable state and local taxes. A small portion of your room rate will be used to help defray the cost of registration and housing services. Hotel reservations requested without deposit will not be processed.

Hotel Change/Cancellation Policy
The deadline date for new reservations is September 11. The hotel requires a deposit of one night’s room and tax to reserve your room. Please make any changes or cancellations through the CNS housing bureau, Wyndham Jade, through September 11. Beginning September 12 and up to 72 hours prior to your arrival, changes and cancellations must be made directly with your reserved hotel.

Beginning September 12, 2016

• All changes, cancellations, or questions regarding your reservation must be made directly with the hotel.
• If cancellation notice is not received according to the hotel policy, the deposit will be forfeited. Your individual hotel’s cancellation policy can be found in your emailed confirmation.

Complimentary Housing for CNS Resident Member Attendees
Complimentary housing at the CNS Annual Meeting is available to a limited number of CNS Resident members on a first-come, first-served basis.

To be considered for this program, CNS Resident members must:

• Complete and submit the CNS Resident member housing application by July 1, 2016. Completed applications may be submitted by email: meetings@cns.org, fax: 847-240-0804, or mail: Congress of Neurological Surgeons, 10 North Martingale Rd., Suite 190, Schaumburg, IL 60173.
• Register for the CNS 2016 Annual Meeting by July 1, 2016.
• All residents enrolled in ACGME approved programs have been automatically given complimentary CNS Resident membership.
• If you are not a CNS Resident member, complete your application by May 31, 2016.

Residents who choose to reserve a room through the CNS Annual Meeting Registration and Housing Center and are later accepted into the CNS Resident Housing Program are responsible for cancelling their original reservation.

For complete resident housing application guidelines, please visit cns.org/2016/residents.

Thank You for Your Continued Support of the CNS!
The CNS thanks you for your support in reserving your guest room through the official CNS Housing and Registration Center. The CNS, in negotiating contracts with convention centers and hotels, must commit to a minimum number of guest rooms. This commitment helps guarantee the availability of meeting space and helps control the cost of the meeting. A history of high utilization of our room block enables the CNS to negotiate better room rates for future meetings.

HOTEL ROOM RATES
(All CNS hotels include complimentary guest room internet)

<table>
<thead>
<tr>
<th>Hotel Name</th>
<th>Single/Double (Excludes local/state tax and fees*)</th>
<th>Single/Double (Includes local/state tax and fees*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marriott Marquis San Diego Marina—Headquarter Hotel (City View)</td>
<td>$306</td>
<td>$344.25 **</td>
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<tr>
<td>Marriott Marquis San Diego Marina—Headquarter Hotel (Bay View)</td>
<td>$326</td>
<td>$366.75 **</td>
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<tr>
<td>Embassy Suites San Diego Downtown</td>
<td>$285</td>
<td>$321.34</td>
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<tr>
<td>Hard Rock Hotel San Diego</td>
<td>$259</td>
<td>$291.38 **</td>
</tr>
<tr>
<td>Hilton San Diego Gaslamp Quarter</td>
<td>$279</td>
<td>$314.43</td>
</tr>
<tr>
<td>Omni San Diego Hotel</td>
<td>$279</td>
<td>$315.49</td>
</tr>
<tr>
<td>The US Grant Hotel San Diego</td>
<td>$259</td>
<td>$292.07</td>
</tr>
<tr>
<td>The Westin San Diego Gaslamp Quarter</td>
<td>$249</td>
<td>$280.80</td>
</tr>
</tbody>
</table>

* Local taxes and fees subject to change.
** An additional daily CA Tourism Fee ranging from $0.44–$0.77 per room night will be charged on site by the hotel and is not included in the 1st night’s room and tax deposit.

Register now at cns.org/2016 69
**MARRIOTT MARQUIS SAN DIEGO MARINA**
**HEADQUARTERS HOTEL**
333 West Harbor Drive, San Diego, CA 92101
Next to San Diego Convention Center

*Headquarters hotel is adjacent to the convention center. Shuttle service only provided to and from dinner seminars and social events as applicable.*

**Amenities Include:**
- High-speed Internet (complimentary to CNS guests)
- Fitness center (complimentary to CNS guests)
- Coffee/tea in room
- Two outdoor pools
- Full service spa
- Business center
- On-site restaurants
- Valet dry cleaning
- Cash and carry food available 24 hours

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**EMBASSY SUITES SAN DIEGO BAY DOWNTOWN**
601 Pacific Highway, San Diego, CA 92101
0.8 miles to San Diego Convention Center

*Complimentary shuttle service provided starting Saturday, September 24, 2016*

**Amenities Include:**
- High-speed Internet (complimentary to CNS guests)
- Fitness center (complimentary to CNS guests)
- Complimentary breakfast
- Complimentary evening reception w/light appetizers
- All suites property
- Business center
- Pool
- Laundry/valet service
- Room service

---

**HARD ROCK SAN DIEGO HOTEL**
207 5th Ave. San Diego, CA 92101
0.1 miles to San Diego Convention Center

*Due to hotel proximity, shuttle service is not provided*

**Amenities Include:**
- On-site restaurants
- Full service spa
- Valet service
- All-access pass, $23 per day value (complimentary to CNS guests)

**Pass includes:**
- High-speed Internet
- Fitness center
- Bike rental
- Business center
- And more

---

**HILTON SAN DIEGO GASLAMP QUARTER**
401 K Street, San Diego, CA 92101
0.2 miles to San Diego Convention Center

*Due to hotel proximity, shuttle service is not provided*

**Amenities Include:**
- High-speed Internet (complimentary to CNS guests)
- Fitness center (complimentary to CNS guests)
- Pool
- Business center
- Laundry/valet service
- Room service
OMNI SAN DIEGO HOTEL
675 L Street, San Diego, CA 92101
0.2 miles to San Diego Convention Center
Due to hotel proximity, shuttle service is not provided
Amenities Include:
• High-speed Internet (complimentary to CNS guests)
• Fitness center (complimentary to CNS guests)
• Spa services
• Pool
• Business center
• On-site restaurant
• Laundry/dry cleaning service
• Childcare services
• Room service
• Pet friendly

THE US GRANT
326 Broadway, San Diego, CA 92101
0.9 miles to the San Diego Convention Center
Complimentary shuttle service provided starting Saturday, September 24, 2016
Amenities Include:
• High-speed Internet (complimentary to CNS guests)
• Fitness center (complimentary to CNS guests)
• Business center
• On-site restaurant
• One-cup coffee maker in room
• Childcare services
• Pet friendly

WESTIN SAN DIEGO GASLAMP QUARTER
910 Broadway Circle, San Diego, CA 92101
1.2 miles to the San Diego Convention Center
Complimentary shuttle service provided starting Saturday, September 24, 2016
Amenities Include:
• High-speed Internet (complimentary to CNS guests)
• Fitness center (complimentary to CNS guests)
• One-cup coffee maker in room
• Business center
• Room service
• Childcare services
• Pet friendly

Register now at cns.org/2016
<table>
<thead>
<tr>
<th>Exhibitor Name</th>
<th>Exhibitor Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>7D Surgical</td>
<td>Pfizer</td>
</tr>
<tr>
<td>Accuray</td>
<td>PMT Corporation</td>
</tr>
<tr>
<td>Ad-Tech Medical Instrument Corp.</td>
<td>Portola Pharmaceuticals, Inc.</td>
</tr>
<tr>
<td>AIS PainCare</td>
<td>pro med instruments, Inc.</td>
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<tr>
<td>Alevio</td>
<td>Renishaw, Inc.</td>
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<tr>
<td>Alpha Omega Co. USA</td>
<td>Rose Micro Solutions</td>
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<tr>
<td>Alphatec Spine, Inc.</td>
<td>RosmanSearch</td>
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<tr>
<td>American Association of Neurological Surgeans</td>
<td>RTI Surgical</td>
</tr>
<tr>
<td>Anatom-e</td>
<td>Samsung</td>
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<td>Anatomage</td>
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<tr>
<td>Apex Medical, Inc.</td>
<td>Scanlan International, Inc.</td>
</tr>
<tr>
<td>Arbor Pharmaceuticals, Inc.</td>
<td>SeaSpine</td>
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<td>Arbor Pharmaceuticals, Inc.</td>
<td>Shukla Medical</td>
</tr>
<tr>
<td>Arkis BioSciences</td>
<td>Siemens Healthcare</td>
</tr>
<tr>
<td>Baylor Scott &amp; White Health</td>
<td>Sophysa USA</td>
</tr>
<tr>
<td>Bien-Air Surgery</td>
<td>Soring, Inc.</td>
</tr>
<tr>
<td>BiO2 Medical</td>
<td>SpecialtyCare</td>
</tr>
<tr>
<td>BioD, LLC</td>
<td>Spinal Simplicity</td>
</tr>
<tr>
<td>Boss Instruments</td>
<td>Spine Wave</td>
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<tr>
<td>Boston Scientific</td>
<td>Spineology</td>
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<tr>
<td>Brain Aneurysm Foundation</td>
<td>St. Jude Medical</td>
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<tr>
<td>Carl Zeiss Meditec, Inc.</td>
<td>Stryker</td>
</tr>
<tr>
<td>CMF Medical Surgical Inc.</td>
<td>Surgical Theater</td>
</tr>
<tr>
<td>Codman Neuro DePuy Synthes</td>
<td>SurgiTel</td>
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<td>Collagen Matrix, Inc.</td>
<td>Synaptive Medical</td>
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<tr>
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<td>TeDan Surgical Innovations</td>
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<tr>
<td>CoreLink</td>
<td>Thieme Medical Publishers</td>
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<tr>
<td>Cosman Medical</td>
<td>ThinkFirst National Injury Prevention Foundation</td>
</tr>
<tr>
<td>Designs For Vision, Inc.</td>
<td>Thompson Surgical Instruments</td>
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<td>DJO Global, Inc.</td>
<td>TMG Coins</td>
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<tr>
<td>Edge Therapeutics</td>
<td>UF Health Neuromedicine</td>
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*as of 4/15/16*