Spine Summit 2017 is jointly provided by the Congress of Neurological Surgeons and the AANS/CNS Section on Disorders of the Spine and Peripheral Nerves.
CONGRATULATIONS to the 2017 Award Recipients!

Owoicho Adogwa  
J.A.N.E. Award

Daniel Yavin  
Mayfield Clinical Science Award

Saman Shabani  
Mayfield Basic Science

Thomas J. Wilson  
Kline Peripheral Nerve Top Abstract

Stephen S. Burks  
Kline Peripheral Nerve Research Award

CHARLES KUNTZ IV SCHOLARS

Vincent J. Alentado  
Michael Brendan Cloney

Doniel Drazin  
Benjamin D. Elder

George M. Ghobrial  
C. Rory Goodwin

Peter Grunert  
Daipayan Guha

Ibrahim Hussain  
Christian Iorio-Morin

Michael Karsy  
Evan J. Lytle

Allan R. Martin  
Meghan Murphy

Aria Nouri  
Vijay Ravindra

Ahilan Sivaganesan  
Vijay Yanamadala

Michael M.H. Yang  
Scott L. Zuckerman
On behalf of the Section on Disorders of the Spine and Peripheral Nerves Executive Committee and the Annual Meeting Committee, welcome to Spine Summit 2017 at the JW Marriott Resort & Spa in the exciting city of Las Vegas, Nevada!

We extend greetings to our partner societies: Korean Spinal Neurosurgery Society, AANS/CNS Joint Section on Neurotrauma and Critical Care, Scoliosis Research Society, Cervical Spine Research Society, and AO Spine-North America. We also welcome Honored Guests Iain Kalfas, Alexander Vaccaro, and Meritorious Member Award recipient Volker K. H. Sonntag.

This four-day event provides an outstanding opportunity for you to explore our theme, *Ahead of the Curve: Transformative Innovations in Spine Surgery*. We’re pleased to introduce a trauma CME course led by the Neurotrauma Section, and an ARPN/PA Course that is offered complimentary to PAs and RNs. This year, we’re providing more of the dynamic scientific sessions and head-to-head debates you’ve come to expect. Back for another round are the Cahill Controversies Sessions—get a good seat to watch experts debate the current hot-topic issues affecting our specialty. Don’t forget to check out a special guest talk with six-time Olympic gold medalist swimmer, Amy Van Dyken!

With more abstract submissions than ever before, we’re presenting over 300 two-minute oral abstract presentations, including our 2017 J.A.N.E. and Mayfield Award winners.

Be sure to swing by the exhibit hall for the *What’s New* Sessions during your beverage breaks and grab a complimentary lunch with exhibitors while you learn about the latest technology.

From Wednesday’s pre-meeting Lunch Seminar to Saturday’s Cahill Debates, we hope you take advantage of opportunities to learn and connect with your peers, all while enjoying everything Las Vegas has to offer.

Thank you again for joining us at Spine Summit 2017. We hope your meeting experience is nothing less than extraordinary.

Sincerely,

John J. Knightly, MD
Section Chair

Adam S. Kanter, MD
Annual Meeting Chair

Daniel J. Hoh, MD
Scientific Program Chair
Table of Contents

Chairman’s Biography .......................... 3
Meritorious Awards .......................... 4
Spine Societies Welcome ....................... 9
Meeting Agenda ............................... 11
Exhibitor Information ......................... 86
CME Information .............................. 90
General Information ......................... 92
Disclosure Information ......................... 96

SECTION ON DISORDERS OF THE SPINE AND PERIPHERAL NERVES MISSION STATEMENT

To advance spine and peripheral nerve patient care through education, research and advocacy.

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DSPN Chairman

John J. Knightly
Atlantic Neurosurgical Specialist
Director of Neurosurgery, Morristown Memorial Hospital
Vice Chairman of Atlantic Health Institute, Summit, New Jersey

John J. Knightly, MD, graduated from Franklin and Marshall College, Lancaster, Pennsylvania, and went on to receive his MD from the University of Medicine and Dentistry of New Jersey in Newark, New Jersey. His post-graduate and residency training were completed at the Bethesda Naval Hospital in Maryland. Dr. Knightly completed a research fellowship in the surgical neurology branch of the National Institutes of Health, in pediatric neurosurgery at the Children’s Hospital in Boston, and received advanced training in trauma at the Shock-Trauma Center in Baltimore. Dr. Knightly completed a fellowship in complex spine surgery under the mentorship of Dr. Volker Sonntag at the Barrow Neurological Institute. He achieved Board Certification in 1998 from the American Board of Neurological Surgeons.

Dr. Knightly serves as director of neurosurgery at Morristown Memorial Hospital and vice chairman of Atlantic Health Institute, where he is also the medical director of the neuro-spine team. His areas of clinical interest include complex spine surgery, minimally invasive spine surgery, stereotactic Cyberknife radiosurgery, tumors of the spine, deformity, and trauma. He is a leading proponent and developer of minimally invasive surgical techniques. In addition to his clinical expertise in spine surgery, he also has a strong interest in neurotrauma. He is a co-founder and director of the Concussion Center at the Atlantic Neuroscience Institute, and has served as an independent/unaffiliated neurotrauma consultant for the National Football League and the New York Jets.

He currently serves as chairman of the AANS/CNS Section on Disorders of the Spine and Peripheral Nerves. He has served as the chairman of the Quality Improvement Workforce for the Joint Washington Committee and is currently vice-chair of the Neurosurgical Quality Council. He chairs and serves on several committees with the American Association of Neurological Surgeons (AANS), the Congress of Neurological Surgeons (CNS), and the Neuropoint Alliance Quality Outcomes Database, pursuing his research interest in healthcare policy, clinical informatics, and quality improvement. Dr. Knightly has also been appointed to the Physician Quality Panel of the National Quality Forum. He is a member of the Joint Section on Neurotrauma and Critical Care, the Congress of Neurological Surgeons (CNS), The American Association of Neurological Surgeons (AANS), and the North American Spine Society (NASS).

Dr. Knightly was named one of the “20 Surgeon Leaders in Independent Spine & Neurosurgical Groups” by Becker’s Orthopedic, Spine & Pain Management Review. He is consistently listed as one of the Best Doctors in America and New Jersey, and is included in Who’s Who in America. Dr. Knightly has lectured frequently on spinal surgical techniques and quality in neurosurgery and has written and published on his research interests in quality improvement in neurosurgery.
Volker K. H. Sonntag
Vice Chairman Emeritus
Barrow Neurological Institute
Phoenix, Arizona

Volker K.H. Sonntag, MD, attended Arizona State University in Tempe, Arizona. He graduated in 1967 summa cum laude, receiving a Bachelor of Arts degree in Chemistry. In 1971, he graduated from the University of Arizona School of Medicine. He served as president of his graduating class and completed his internship there in 1972. Dr. Sonntag then went to Tufts-New England Medical Center Hospital in Boston, Massachusetts, where he trained as one of the first residents under Bennett M. Stein, MD, professor and chairman, Department of Neurosurgery. He completed his residency in 1977.

Since joining Barrow Neurological Institute (BNI) in 1983, he has served as vice-chairman of the Division of Neurological Surgery and chairman of the spine section from 1984 to 2009, director of the spine fellowship program from 1988 to 2009, and as director of the residency program from 1995 to 2009. In 2000, he assumed the endowed Alumni Chair for Spine Research at BNI.

For the past 30 years, Dr. Sonntag has been a leader in neurosurgery as a director on the American Board of Neurological Surgery 1998–2004, a member of the ACGME Residency Review Committee (RRC) 2005–2011, vice-president of the American Association of Neurological Surgeons in 2001, and as a member of the AANS Professional Conduct Committee 2008–2011. He was president of the North American Spine Society in 2000 and president of the American Academy of Neurological Surgeons (AANS) in 2004. In 2002, Dr. Sonntag was named Honored Guest of the Congress of Neurological Surgeons, the highest honor paid to a neurosurgeon by his peers.

Dr. Sonntag made significant contributions to the treatment and understanding of spinal disorders. He has co-edited five major books, made more than 950 presentations around the world, and written more than 105 textbook chapters and 460 papers. He is an editor on 10 neurosurgical journals. He is consistently recognized as one of the Best Doctors in America. Dr. Sonntag retired from practicing neurosurgery in January 2010, but remains at the BNI as vice-chairman emeritus.
Iain H. Kalfas, MD, graduated from the six-year BS/MD program at Northeastern Ohio Universities College of Medicine in 1982. He completed his residency in neurosurgery at the Cleveland Clinic in 1988. During his residency he also completed a fellowship in neurotrauma at Allegheny General Hospital in Pittsburgh, Pennsylvania. He completed a second fellowship in spinal surgery at the Barrow Neurological Institute in Phoenix, Arizona, under the guidance of Dr. Volker K.H. Sonntag.

Dr. Kalfas joined the professional staff at the Cleveland Clinic in 1989 and is currently a member of the Center for Spine Health and the Department of Neurosurgery. He served as chairman of the Department of Neurosurgery from 2004–2007. He is a recognized leader in the field of spinal surgery and specializes in the surgical management of both routine and complex adult spinal disorders. He was a pioneer in the development of intraoperative image-guided spinal navigation for spinal deformity surgery, receiving the EDI Innovation Award for his work in 1998. He has regularly been listed in Best Doctors and Top Doctors.

Dr. Kalfas has given more than 500 national and international presentations and has authored more than 100 peer-reviewed publications and book chapters. He is a co-author of the text “Innovations in Spinal Reconstruction.” He currently serves on the editorial board of The Journal of Clinical Spine Surgery. He is an active member in numerous professional associations including the Congress of Neurological Surgeons (CNS), American Association of Neurological Surgeons (AANS), American College of Surgeons, Joint Section on Disorders of the Spine and Peripheral Nerves, Neurosurgical Society of America, American Academy of Neurological Surgery, and the North American Spine Society. He has been vice-president of the Neurosurgical Society of America and recently served as a trustee for the AO Foundation.
Alexander R. Vaccaro, MD, attended Boston College where he was elected a member of Phi Beta Kappa, Alpha Epsilon Delta, and the Order of the Cross and Crown Arts and Sciences Honor Societies. He graduated summa cum laude in 1983 with a BS in Biology. He received his MD degree from Georgetown University School of Medicine where he was promoted with “Distinction” (top 15 percent of medical school class). He graduated with honors in 1987. He completed a year of surgical internship at Cedars-Sinai Medical Center in Los Angeles, and graduated from his orthopaedic surgery residency at Thomas Jefferson University in 1992. Dr. Vaccaro completed a spine fellowship at the University of San Diego. He became a member of the Department of Orthopaedic Surgery at Thomas Jefferson University in 1993. He earned a PhD in 2007 in the field of Spinal Trauma, and an MBA at the Fox School of Business at Temple University in 2015.

Dr. Vaccaro is the Richard H. Rothman professor and chairman of orthopaedic surgery and professor of neurosurgery at the Sidney Kimmel Medical College at Thomas Jefferson University in Philadelphia. He is a board-certified orthopaedic surgeon. His orthopaedic practice is limited to the management and treatment of disorders of the spine. Dr. Vaccaro is also the co-director of the Regional Spinal Cord Injury Center of the Delaware Valley, one of the largest tertiary referral centers for spinal cord injury in the nation.

He holds numerous society memberships including the American Academy of Orthopaedic Surgeons, the Philadelphia College of Surgeons, the Cervical Spine Research Society; the North American Spine Society; the Scoliosis Research Society; the American Orthopaedic Association; the American Association of Neurological Surgeons (AANS), and the International Society for the Study of the Lumbar Spine. He was a past chairman for the Journal of Neurosurgery Spine and is the past president of the American Spinal Injury Association.

He has done extensive research on a broad range of topics related to disorders of the spine, and has more than 640 peer reviewed and more than 200 non-peer reviewed publications. He has published over 330 book chapters, is the editor of more than 50 textbooks, co-editor of OKU–Spine I, and editor of OKU–8. His current research involves the timing of surgery after traumatic spinal cord injury, the use of minimally invasive computerized navigational techniques in spinal surgery, advanced management techniques of painful osteoporotic compression fractures, and the development of spinal implants for traumatic degenerative disorders of the spine. In addition to his numerous clinical academic responsibilities, Dr. Vaccaro is also the co–director of the spine fellowship program at Thomas Jefferson University Hospital, and instructs current fellows and residents in the diagnosis and treatment of various spinal problems and disorders.
Amy Van Dyken

Amy Van Dyken is an American former competitive swimmer, Olympic champion, former world record-holder, and national radio sports talk show co-host. She has won six Olympic gold medals in her career, four of which she won at the 1996 Summer Olympics, making her the first American woman to accomplish such a feat and the most successful athlete at the 1996 Summer Olympics. She won gold in the 50-meter freestyle, 100-meter butterfly, 4×100-meter freestyle relay, and 4×100-meter medley relay. She was named Swimming World's American Swimmer of the Year in 1995 and 1996. She was the only American swimmer to be inducted into the International Swimming Hall of Fame's Class of 2007. She was inducted to the Olympic Hall of Fame in July 2008.

Van Dyken retired from swimming after the 2000 Olympics, and has since toured nationally on a wide variety of speaking engagements. She has worked as a disc jockey on a sports radio show in Arizona, and served as the sideline reporter for the Seattle Seahawks and Denver Broncos football teams. She is also actively involved in a number of charities.

On June 6, 2014, Van Dyken was injured in a severe ATV accident that severed her spinal cord, leaving her paralyzed from the waist down. She is a nationally recognized advocate for those living with chronic spinal cord injury (SCI), and for advancing spinal cord injury research.

Michael Collins

Michael “Micky” Collins, PhD, is an internationally renowned expert in sports-related concussion. A leading clinicians and researcher, Dr. Collins serves as director and a founding member of the UPMC Sports Medicine Concussion Program. It is the largest research and clinical program focused on the assessment, treatment, rehabilitation, research and education of sports-related mild traumatic brain injury in athletes of all levels.

Dr. Collins has been instrumental in developing concussion-management policy in youth sports, state legislation on youth safety, the Centers for Disease Control's concussion toolkit, and for pioneering targeted treatment pathways for his patients. He is a co-founder of ImPACT (Immediate Post-Concussion Assessment and Cognitive Testing), the most widely used computerized sports-concussion evaluation system that has become a standard of care in nearly all organized sports at all levels. He advises and is a consultant to numerous professional athletic organizations and teams.

Dr. Collins also has been a lead author and investigator on numerous studies of high-school and college athletes published in JAMA, Neurosurgery, American Journal of Sports Medicine, and Pediatrics, among others. He is the lead author or co-author on more than 90 peer-reviewed research articles, and has delivered more than 350 presentations at national and international scientific meetings. He serves as associate editor of the Journal of Neurosurgery and the Journal of Sports Neurology. He has received numerous national and international honors over the past decade. An athlete himself, Dr. Collins played in the 1989 NCAA Baseball College World Series.
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TURNING BREAKTHROUGHS INTO MEANINGFUL INNOVATIONS

What’s New Session

Prestige LP™ Cervical Disc System: New Adjacent Two Level Approval

Thursday, March 9, 2:42 – 2:52 pm
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To learn more about the Prestige LP™ Cervical Disc System, please visit us at Booth 900.
WEDNESDAY MARCH 8, 2017

11:00–5:30 pm Grand Ballroom Foyer
Registration

COMPLIMENTARY FOR PAs and RNs

12:00-1:00 pm Murcia
APRN and PA Lunch Seminar:
Enhancing Perioperative Pain Management

Directors: Nathaniel P. Brooks, Andrea L. Strayer
Faculty: Dean Barone, Sara M. McEvoy, Sharad Rajpal, Carl W. Stopper, Suzanne A. Tharin

Course Description: This course will cover current strategies for optimizing perioperative pain management in spine surgical patients. With a particular focus for advance practice RNs and physician assistants, we will discuss novel multimodal approaches for improving quality of postoperative care.

Learning Objectives: Upon completion of this course, participants will be able to:

- Discuss the role of federal regulations in opiate management for chronic pain.
- Compare different pharmacologic strategies for perioperative pain management.
- Discuss the role of multimodal approaches for postoperative pain.

12:00–12:10 pm
Opioid Use in an Era of Federal Scrutiny
Carl W. Stopper

12:10–12:20 pm
Don't Forget NSAIDs
Dean Barone

12:20–12:30 pm
Neuromodulators and Preemptive Analgesia
Sharad Rajpal

12:30–12:40 pm
PCA Versus Oral Analgesics
Sara M. McEvoy

12:40–12:50 pm
Novel Approaches for the Chronic Pain Patient—Multimodal Management Principles
Suzanne A. Tharin

12:50–1:00 pm
Panel Discussion and Case-based Presentations
Non-CME Pre-meeting Lunch Seminar

Be sure to enjoy your complimentary lunch at the Pre-meeting Lunch Seminar prior to attending a Special Course!

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**SPECIAL COURSE 1**

**1:30–5:30 pm**

**Marquis Ballroom Salons 1/2**

**Hands-on Spinal Navigation**

**$200**

**Directors:** Roger Hartl, J. Patrick Johnson, Bernhard Meyer

**Speakers:** Dean Chou, Doniel Drazin, Roger Hartl, Robert E. Isaacs, J. Patrick Johnson, Iain H. Kalfas, Terrence T. Kim, Bernhard Meyer, Jean-Pierre Mobasser, Eric A. Potts, Michael P. Steinmetz, Nicholas Theodore, Michael Y. Wang

**Course Description:** This course will cover the latest advances in spine navigation in trauma, deformity, infection, and tumor as well as revision cases. The premise of the course is to maximize accuracy in using navigation and enhance patient outcomes in spine surgery. We will cover essential topics such as positioning, optimal frame placement, registration, calibration, and frame-less versus frame-based systems available. The course will also review strategies for complex cases and complication avoidance.

**Learning Objectives:** Upon completion of this course, participants will be able to:

- Discuss current evidence supporting the use of spinal navigation.
- Describe navigation techniques for minimally invasive, trauma, tumor, and spinal deformity surgery.
- Discuss indications and outcome for spinal navigation and complication avoidance.

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**1:30–1:45 pm**

Introduction & Navigation—Rationale and Evidence

Bernhard Meyer

---

**1:45–1:55 pm**

Navigation—MIS TLIF Step-by-Step

Jean–Pierre Mobasser

---

**1:55–2:05 pm**

Navigation—Thoracolumbar Trauma Step-by-Step

Nicholas Theodore

---

**2:05–2:15 pm**

Navigation—Spinal Tumor Step-by-Step

Dean Chou
2:15–2:25 pm
Navigation—Spinal Deformity Step-by-Step
Terrence T. Kim

2:25–2:50 pm
Hands-on Workshop

2:50–3:05 pm
Navigation Technology: History and Future Directions
Iain H. Kalfas

3:05–3:20 pm
Accuracy of Navigation: Identifying Anomalies and Pitfalls
Doniel Drazin

3:20–3:30 pm
Cost Effectiveness of Navigation
Eric A. Potts

3:30–3:45 pm
Radiation Exposure and Converting to “Total Navigation”
Roger Hartl

3:45–4:00 pm
Are Indications Needed or Just Navigate Everything
J. Patrick Johnson

4:00–4:20 pm
Beverage Break

4:20–4:30 pm
New Technology: Robot Assisted Pedicle Screw Placement
Michael Y. Wang

4:30–4:40 pm
New Technology: Image Guidance Assisted Rod Contouring
Robert E. Isaacs

4:40–4:50 pm
How to Advocate for New Technology at Your Hospital
Michael P. Steinmetz

4:50–5:20 pm
Hands-on Workshop

5:20–5:30 pm
Questions and Discussion

Educational Grant Provided By:
Brainlab & Stryker
SPECIAL COURSE 2

1:30–5:30 pm Cataluna A/B
Spinal Deformity Surgical Planning Practical $200

Directors: Shay Bess, Kai-Ming G. Fu, Praveen V. Mummaneni
Faculty: Christopher P. Ames, Sigurd Berven, Munish C. Gupta, Virginie Lafage, Pierce D. Nunley, Frank Schwab, Daniel M. Sciubba, Christopher I. Shaffrey, Justin S. Smith

Course Description: This course will explore current concepts regarding evaluation and treatment of adult spinal deformity patients, including up-to-date research findings on clinical assessment, patient reported outcomes, appropriate surgical treatment, and management of complications. Opportunities will be provided for attendees to discuss cases with faculty with hands-on preoperative planning workshops.

Learning Objectives: Upon completion of this course, participants will be able to:
1. Clinically and radiographically evaluate patients with adult spinal deformity and predictors of clinical outcome.
2. Identify adult spinal deformity patients appropriate for surgical treatment and create an appropriate surgical treatment plan.
3. Discuss risks for intraoperative and postoperative complications and overview complication management.

1:30–1:35 pm
Introduction

1:35–1:50 pm
New Advances in Spino-Pelvic Alignment: Age-adjusted Parameters
Virginie Lafage

1:50–2:05 pm
Basic Techniques to Maximize Lumbar Lordosis Restoration: TLIF, ALIF, and LIF
Christopher I. Shaffrey

2:05–2:20 pm
Advanced Techniques to Optimize Spinal Alignment: Osteotomies and Anterior Release
Sigurd Berven

2:20–2:35 pm
Cervical Alignment: Similarities and Differences to the Thoracolumbar Spine
Christopher P. Ames

2:35–2:50 pm
Surgical Planning: A Methodological Five-step Approach
Shay Bess

2:50–3:05 pm
Surgical Planning for Degenerative Lumbar Pathologies
Daniel M. Sciubba
3:05–3:20 pm
Surgical Planning for Adult Spinal Deformity
Munish C. Gupta

3:20–3:35 pm
Beverage Break

3:35–4:00 pm
Workshop: Case Studies, Practical on Measuring Regional Parameters in the Cervical and Open TL Spine
Kai–Ming G. Fu, Frank Schwab, Virginie Lafage

4:00–4:15 pm
MIS Surgery and Sagittal Spinopelvic Alignment
Praveen V. Mummaneni

4:15–4:30 pm
MIS Surgical Techniques for Correcting Deformity: Lateral and Anterior Psoas Nuances
Pierce D. Nunley

4:30–4:45 pm
Issues and Considerations with MIS Approaches for Adult Spinal Deformity
Justin S. Smith

4:45–5:10 pm
Thoracolumbar Spinal Deformity Case Discussion: Open Versus MIS
Kai–Ming G. Fu, Pierce D. Nunley

5:10–5:30 pm
Conclusions and Discussion

SPECIAL COURSE 3
1:30–5:30 pm
Marquis Ballroom Salon 3
Innovation in Neurotrauma—Special Trauma CME Course led by AANS/CNS Section on Neurotrauma and Critical Care $200

Directors: Tanvir Choudhri, Uzma Samadani
Speakers: Michael W. Collins, Gregory Hawryluk, Frederick Korley, Jeffrey Kucher, Russell R. Lonser, Christina L. Master, Uzma Samadani, Martina Stippler

Course Description: This course will explore current concepts regarding the evaluation and treatment of concussion and sports-related injuries, including up-to-date research on clinical assessment, management, and outcomes.

Learning Objectives: Upon completion of this course, participants will be able to:
- Discuss treatment strategies for children with concussion.
- Compare potential risk versus benefit of contact sports with respect to head injury and long term neurodegeneration.
- Describe current and ongoing clinical research with regards to traumatic brain injury monitoring and treatment.
1:30–2:40 pm  
Part 1: Concussion

1:30–1:50 pm  
Technological Innovations in the Neurocritical Care Unit  
Gregory Hawryluk

1:50–2:10 pm  
Assessment of Concussion in Children  
Christina L. Master

2:10–2:30 pm  
Concussion is Treatable: A Statement from the TEAM Approaches to Managing Concussion  
Michael W. Collins

2:30–2:40 pm  
Discussion and Questions

2:40–3:05 pm  
Beverage Break

3:05–4:40 pm  
Part 2: Risks of Injury in Sports Medicine

3:05–3:25 pm  
Research and Innovation for TBI Prevention in Sports  
Russell R. Lonser

3:25–3:45 pm  
Contact Sports—Risks and Benefits  
Uzma Samadani

3:45–4:05 pm  
Risks of Neurodegeneration After Sports Play  
Jeffrey Kutcher

4:05–4:15 pm  
Discussion and Questions

4:15–4:40 pm  
Beverage Break

4:40–5:30 pm  
Part 3: Update on Brain Injury Management

4:40–5:00 pm  
Can a Blood Test Tell Us Who Will Need a Craniotomy  
Frederick Korley

5:00–5:20 pm  
In the Wake of the BEST-TRIP, DECRA and Eurotherm Trials, Why Are We Still Monitoring ICP?  
Martina Stippler

5:20–5:30 pm  
Discussion and Questions
SPECIAL COURSE 4

1:30–5:30 pm Murcia
Transformative Spine Care for 2020: Innovative Business Solutions $200

Course Directors: Domagoj Coric, Luis M. Tumialan

Course Description: This course will explore ongoing changes in healthcare policy, and discuss strategies for enhancing your business practice to stay ahead. Concepts related to coding, reimbursement and how patient satisfaction and quality measures impact spine practice will be reviewed.

Learning Objectives: Upon completion of this course, participants will be able to:
1. Analyze individual practices with a greater understanding of co-management agreements with hospitals.
2. Review bundled payments, payer interests, and approaches for engaging the hospital in the bundled and risk-sharing payment model.
3. Describe strategies for succeeding in the changing socioeconomic climate of a value-based payment system.

1:30–1:50 pm
The Law of Unintended Consequences: Spine Surgery and the Affordable Care Act
Luis M. Tumialan

1:50–2:10 pm
The Future Direction of Spine Registries
Erica Fay Bisson

2:10–2:20 pm
Discussion and Questions

2:20–2:40 pm
The Future of ASCs/Co-management, Gain-sharing and the Imminent Spine Bundle
Domagoj Coric

2:40–3:00 pm
Defining Quality and Value of Your Care Through Practice Data Collection
Scott A. Meyer

3:00–3:10 pm
Discussion and Questions

3:10–3:30 pm
Beverage Break
3:30–3:50 pm
Patient Satisfaction: What Really Drives Patient Perception
Todd D. Vogel

3:50–4:10 pm
Practice Management in the Age of the Affordable Care Act, Meaningful Use and ICD-10
John Kinna

4:10–4:20 pm
Discussion and Questions

4:20–4:40 pm
Hospital Efficiencies
Daniel Refai

4:40–5:00 pm
The Single Vendor Model: Should We or Should We Not
Mark E. Shaffrey

5:00–5:20 pm
CPT Update for 2017
John K. Ratliff

5:20–5:30 pm
Discussion and Questions

OPENING RECEPTION
6:30–8:00 pm
Poolside at the JW Marriott Las Vegas Resort and Spa

Network with old friends and new colleagues over a delicious array of food while you admire an incredible performance by masters of acrobatics and fire-breathing, Cirque du Soleil!
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THURSDAY MARCH 9, 2017

6:30 am–6:00 pm Grand Ballroom Foyer
Registration

6:30–7:30 am Marquis Ballroom Foyer
Complimentary Continental Breakfast

7:00–7:45 am Marquis Ballroom Salons 4/5
Challenging Cases 1
Speakers: Cheerag D. Upadhyaya, Rishi K. Wadhwa

7:45–8:00 am Marquis Ballroom Salons 4/5
Welcome to Spine Summit 2017: Ahead of the Curve—Transformative Innovations in Spine Surgery
Speaker: Daniel J. Hoh

SCIENTIFIC SESSION 1

8:00–9:30 am Marquis Ballroom Salons 4/5
Sports-related Neurotrauma

Moderators: Allan D. Levi, David O. Okonkwo, Luis M. Tumialan

Learning Objectives: Upon completion of this course, participants will be able to:

- Discuss current challenges for those living with chronic spinal cord injury, and identify priorities for future research.
- Describe recent advances in basic and clinical spinal cord injury research.
- Evaluate return-to-play after spinal injury and surgery.
- Discuss advanced treatment models for concussion and traumatic brain injury.

8:00–8:10 am Introduction of Amy Van Dyken
Luis M. Tumialan

8:10–8:35 am Special Lecture
Amy Van Dyken

8:35–8:50 am Questions and Answer with Amy Van Dyken
Allan D. Levi, David O. Okonkwo, Luis M. Tumialan

8:50–9:00 am Advances in SCI: From Injury to Rehabilitation and Recovery
Michael G. Fehlings
9:00–9:10 am
Return to Play After Cervical Neuropraxia
Vincent Miele

9:10–9:20 am
Return to Play After Spinal Fusion
Richard G. Fessler

9:20–9:30 am
Moving Toward a Targeted Approach to Concussion Assessment and Active Rehabilitation: Clinical Profiles Treatment Model
Michael W. Collins

9:00 am–4:30 pm Grand Ballroom
Exhibit Hall Open
Visit for the latest product and technology information!

BEVERAGE BREAK AND WHAT’S NEW SESSION 1

9:30–10:15 am Grand Ballroom
Moderators: Ali A. Baaj, Justin Slavin

9:30–9:40 am
A Novel Technology to Reduce Radiation Exposure in Spine Surgery
David Vincent
Sponsored by:

9:42–10:02 am
Innovations in Expandable Interbody Technology—Posterior and Lateral Approaches (9:42–9:52)
Domagoj Coric

Advances in Posterior Cervical Fusion Technologies and Techniques (9:52–10:02)
Paul Arnold
Sponsored by:

10:04–10:14 am
Achieving ALIF Principles Through a TLIF Approach with Luna 3D Multi-expandable Interbody Fusion System
Richard G. Fessler
Sponsored by:
SCIENTIFIC SESSION 2
10:15 am–12:00 pm    Marquis Ballroom
Innovation in Spine Surgery
Salons 4/5

Modulators: R. John Hurlbert, Marjorie C. Wang

Learning Objectives: Upon completion of this course, participants will be able to:
1. Analyze the findings of novel neurosurgical studies, critique the design and methodology of these studies.
2. List important areas for further knowledge development and research.
3. Describe past and current innovations that are transforming spine surgery today.

10:15–10:17 am
Introduction of J.A.N.E. Award, Mayfield Award Winners, and Kline Peripheral Nerve Research Award Winner
Daniel C. Lu

10:17–10:22 am
J.A.N.E. Award Presentation
100 Geriatric Co-Management Reduces Peri-Operative Complications and Shortens Duration of Hospital Stay After Lumbar Spine Surgery: A Prospective Single Institutional Experience
Owoicho Adogwa, Aladine A. Elsamadicy, Victoria Vuong, Jessica Rose Moreno, Joseph S. Cheng, Isaac O. Karikari, Carlos Antonio Bagley

The J.A.N.E. Award honors the legacy of Dr. John Anthony Jane Sr., 1931–2015. Dr. Jane was a world-renowned neurosurgeon, scientist, and teacher. Exceptionally influential in neurosurgery, he held leadership positions in the ABNS and the Senior Society, and served as editor of the Journal of Neurosurgery for more than 20 years.

10:22–10:27 am
J.A.N.E. Award Discussion
Adam S. Kanter

10:27–10:32 am
Mayfield Basic Science Award Presentation
101 Comparison of Pre-Operation DTI, T2SI Versus T2SI Plus DTI in a Large Series of CSM Patients for Assessment of Disease Severity and Prognostication of Recovery
Saman Shabani, Ha Nguyen, Shekar N. Kurpad
10:32–10:37 am
Mayfield Basic Science Award Discussion
Zoher Ghogawala

10:37–10:42 am
Mayfield Clinical Science Award Presentation
102 Intrathecal Morphine Following Lumbar Fusion: A Randomized, Placebo-controlled Trial
Daniel Yavin, Perry Pawandeep Singh Dhaliwal, Tara Whittaker, Geoffrey S. Hawboldt, Gordon Jewett, Steven Casha, Stephan Jean du Plessis

10:42–10:47 am
Mayfield Clinical Science Award Discussion
Michael Groff

10:47–10:55 am
Korean Spinal Neurosurgery Society Address
Yong Eun Cho

10:55–11:03 am
Introduction of DSPN Chairman
Nicholas Theodore

11:03–11:18 am
DSPN Chairman’s Address
John J. Knightly

11:18–11:23 am
Introduction of Meritorious Award Recipient—Neurosurgery, Iain Kalfas
Gregory R. Trost

11:23–11:31 am
Meritorious Award Recipient—Neurosurgery
Iain H. Kalfas

11:31–11:36 am
Introduction of Meritorious Award Recipient—Orthopedics, Alexander Vaccaro
James S. Harrop

11:36–11:44 am
Meritorious Award Recipient—Orthopedics
Alexander R. Vaccaro

11:44–11:49 am
Introduction of Meritorious Member Award Recipient, Volker K.H. Sonntag
Allan D. Levi

11:49–11:57 am
Meritorious Member Award Recipient
Volker K. H. Sonntag

11:57 am–12:00 pm
Top Abstract Recipients Photo with Honored Guests
Adam S. Kanter, Daniel C. Lu
COMPLIMENTARY LUNCH IN THE EXHIBIT HALL
12:00–1:00 pm  Grand Ballroom
No ticket required. Please enjoy lunch with the exhibitors.

NON-CME SPONSORED LUNCH SYMPOSIA

Marquis Ballroom Salons 1/2
Paradigm Shifts in Spinal Deformity Treatment: Case Examples: Collaboration Between Orthopaedic and Neurological Spine Surgeons
Munish C. Gupta, Ali A. Baaj

Marquis Ballroom Salons 7/8
Management of Poor Bone Quality in the Metastatic Spinal Tumor Patient
Daniel Sciubba, Ilya Laufer

Cataluna A/B
Concepts of Correction: Featuring Expandable Technology
Michael Steinmetz, Joseph O’Brien, Victor Chang

SCIENTIFIC SESSION 3
1:00–2:30 pm  Marquis Ballroom Salons 4/5
SRS–Adult Spinal Deformity in the Quality Era

Moderators: Steven D. Glassman, Praveen V. Mummaneni, Daniel M. Sciubba
Speakers: Todd Albert, Sigurd Berven, Kenneth Cheung, John R. Dimar, Steven D. Glassman, Munish C. Gupta, Bhiken Naik, David W. Polly, Christopher I. Shaffrey, Juan S. Uribe

Learning Objectives: Upon completion of this course, participants will be able to:
1. Discuss different treatment options for patients with degenerative spinal deformity.
2. Describe strategies for optimizing perioperative management and complication avoidance for spinal deformity surgery.
3. Discuss strategies for improving patient satisfaction and quality for adult spinal deformity care.

1:00–1:05 pm  Case Presentation: From Degenerative Disease to Deformity
Munish C. Gupta
1:05–1:12 pm
Avoiding Iatrogenic Deformity with MIS Techniques
Juan S. Uribe

1:12–1:19 pm
All Lumbar Fusion Cases are Deformity Cases
Todd Albert

1:19–1:26 pm
Isthmic Spondylolisthesis is Always a Deformity Case
John R. Dimar

1:26–1:34 pm
Discussion

1:34–1:42 pm
Building a Data-driven Approach to Patient Selection-Risk Stratification
Sigurd Berven

1:42–1:50 pm
Optimizing Perioperative Medical Management
Bhiken Naik

1:50–1:58 pm
Principles to Remember When Things Go Really Wrong
Christopher I. Shaffrey

1:58–2:06 pm
Perioperative Complications—Learning From the Scoli-Risk 1 Study
Kenneth Cheung

2:06–2:14 pm
Patient Reported Outcomes for Spinal Deformity—Is this the Right Measure?
Steven D. Glassman

2:14–2:22 pm
Improving Quality on Adult Deformity Care—Future Directions
David W. Polly

2:22–2:30 pm
Discussion
BEVERAGE BREAK AND WHAT’S NEW SESSION 2

2:30–3:15 pm  Grand Ballroom

Moderators: Bryan D. Bolinger, Victor Chang,
Christoph P. Hofstetter

2:30-2:40 pm  Laminar Plating System
Ardavan Aslie
Sponsored By:

2:42-3:02 pm  Prestige LP™ Cervical Disc: New Adjacent Two Level Approval (2:42 - 2:52 pm)
Vincent Traynelis
Clinical Experience with the Navigated Stealth-Midas Drill (2:52 - 3:02 pm)
Mike MacMillan
Sponsored By:

3:04-3:14 pm  Helping to Improve Sagittal Alignment Through Expandable Technology
David M. Ibrahimi
Sponsored By:

PERIPHERAL NERVE COURSE:
CASE-BASED APPROACHES TO PERIPHERAL NERVE TRAUMA AND OTHER CONDITIONS

2:30–5:30 pm  Murcia

Directors: Holly Gilmer, Robert J. Spinner
Speakers: Zarina S. Ali, Allan J. Belzberg, Angad S. Hanna,
Marie-Noelle Hebert-Blouin, Line Jacques, Mark Alexander Mahan,
Rajiv Midha, Gregory R. Trost, Christopher Winfree, Eric L. Zager

Course Description: This course will cover management of various peripheral nerve disorders. Using a case–based format, faculty will review indications, timing of intervention, and surgical approaches. Relevant anatomy, clinical presentation, and outcomes will be discussed. This course additionally is an excellent review for oral board and maintenance of certification.

Learning Objectives: Upon completion of this course, participants will be able to:
1. Describe a systematic approach to patients with a wide range of peripheral nerve disorders.
2. Develop a non-operative or operative management strategy for these conditions.
3. Discuss advantages and disadvantages and expected outcomes of various surgical approaches.
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<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Speaker(s)</th>
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<tbody>
<tr>
<td>2:30–2:45 pm</td>
<td>Introduction—Peripheral Nerve History and</td>
<td>Holly Gilmer</td>
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<td></td>
<td>Physical Exam</td>
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<tr>
<td>2:45–3:00 pm</td>
<td>Introduction—Fundamentals of Nerve Injury and</td>
<td>Rajiv Midha</td>
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<td>Regeneration</td>
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<td>3:00–3:15 pm</td>
<td>Brachial Plexus Trauma</td>
<td>Gregory R. Trost</td>
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<tr>
<td>3:15–3:30 pm</td>
<td>Upper Extremity Nerve Trauma</td>
<td>Eric L. Zager</td>
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<tr>
<td>3:30–3:45 pm</td>
<td>Lower Extremity Nerve Trauma</td>
<td>Mark A. Mahan</td>
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<td>3:45–4:10 pm</td>
<td>Beverage Break and Discussion</td>
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<tr>
<td>4:10–4:25 pm</td>
<td>Upper Extremity Entrapment</td>
<td>Amgad S. Hanna</td>
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<td>4:25–4:40 pm</td>
<td>Lower Extremity Entrapment</td>
<td>Marie-Noelle Hebert-Blouin</td>
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<tr>
<td>4:40–4:55 pm</td>
<td>Nerve Tumors</td>
<td>Zarina S. Ali</td>
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<td>4:55–5:10 pm</td>
<td>Neuropathic Pain Management</td>
<td>Line Jacques</td>
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<tr>
<td>5:10–5:30 pm</td>
<td>Case Presentations and Discussion</td>
<td>Allan J. Belzberg</td>
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</tbody>
</table>
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 the most important ongoing clinical trials.

KUNTZ SCHOLARS - TOP ABSTRACTS
CONCURRENT SESSION 1

3:15–4:25 pm Marquis Ballroom Salons 1/2

Moderators: Faiz U. Ahmad, Asdrubal Falavigna

3:15–3:20 pm
103 Prediction Algorithm for Surgical Intervention in Neonatal Brachial Plexus Palsy
Thomas J. Wilson, Kate Chang, Lynda J. Yang

3:20–3:25 pm
Discussant: Line G. Jacques

3:25–3:30 pm
104 Minimally Effective Dose of Bone Morphogenetic Protein (BMP) in Minimally Invasive (MIS) Lumbar Interbody Fusions 757 Patients in a Dose-finding Statistical Modeling Cohort Study
Evan Joseph Lytle, Doris Tong, Lisa Govila, Roger F. Gonda, John Nofar, Clifford Michael Houseman, Teck-Mun Soo

3:30–3:35 pm
Discussant: Paul Park

3:35–3:40 pm
105 Vitamin D in Multi-level Anterior Cervical Fusion: Interim Results from a Multi-center Comparative Effectiveness Study

3:40–3:45 pm
Discussant: Praveen V. Mummaneni

3:45–3:50 pm
106 The Inescapability of Variation in Outcomes After Lumbar Spine Surgery: Insights from the National Neurosurgery Quality and Outcomes Database
Ahilan Sivaganesan, Silky Chotai, Matthew J. McGirt, Anthony L. Asher, Clinton J. Devin
3:50–3:55 pm  
Discussant: Charles L. Branch, Jr.

3:55–4:00 pm  
107 Radiological Predictors of Kyphosis After Thoracolumbar Burst Fractures Managed Using Thoracolumbarsacral Orthosis and Long-term Follow-up of Outcomes  
Michael M.H. Yang, Baldeep Dulko, Jacob Oh, Steven Casha

4:00–4:05 pm  
Discussant: John Chi

4:05–4:10 pm  
108 Outcomes of Surgery for Sacral Chordoma and Impact of Complications: A Report of 50 Consecutive Patients with Long-term Follow-up  

4:10–4:15 pm  
Discussant: Ilya Laufer

4:15–4:20 pm  
109 Quantitative Multi-Parametric Spinal Cord MRI Detects Subclinical Tissue Injury in Asymptomatic Cervical Spinal Cord Compression  
Allan R. Martin, Benjamin De Leener, Julien Cohen-Adad, David W. Cadotte, Jefferson R. Wilson, Lindsay Tetreault, Aria Nouri, Adrian Crawley, David J. Mikulis, Howard J. Ginsberg, Michael G. Fehlings

4:20–4:25 pm  
Discussant: Daniel C. Lu

KUNTZ SCHOLARS - TOP ABSTRACTS
CONCURRENT SESSION 2

3:15–4:25 pm  
Marquis Ballroom Salons 7/8  
Moderators: Shekar N. Kurpad, Juan S. Uribe

3:15–3:20 pm  
110 Congenital Cervical Spine Stenosis in a Global Cohort of Patients with Degenerative Cervical Myelopathy: A Report Based on a MRI Diagnostic Criterion  
Aria Nouri, Lindsay Tetreault, Allan R. Martin, Anick Nater, Satoshi Nori, Michael G. Fehlings

3:20–3:25 pm  
Discussant: Marjorie C. Wang
3:25–3:30 pm
111 Preoperative Skin Antisepsis with Chlorhexidine Gluconate versus Povidone-Iodine: A Prospective Analysis of 6959 Consecutive Spinal Surgery Patients
George M. Ghobrial, MD, Michael Y. Wang, Barth A. Green, Howard B. Levene, Glen R. Manzano, Steven Vanni, Robert M. Starke, George Jimsheleishvili, Kenneth M. Crandall, Marina Dididze, Allan D. Levi

Discussant: Eric A. Potts

3:30–3:35 pm
Discussant: Eric A. Potts

3:35–3:40 pm
112 Development of a Preoperative Metastatic Spinal Tumor Frailty Index (MSTFI) Using a Nationwide Database and Its Association with Inpatient Morbidity, Mortality, and Length of Stay

Discussant: Khoi D. Than

3:40–3:45 pm
Discussant: Khoi D. Than

3:45–3:50 pm
113 Quality of Life After Spinal Cord Injury—Results from a Canadian National Cross-sectional Survey
Christian Iorio-Morin, Vanessa Noonan, Barry White, Luc Noreau, Jean Leblond, Frédéric S. Dumont, Nicolas Dea

Discussant: R. John Hurlbert

3:50–3:55 pm
Discussant: R. John Hurlbert

3:55–4:00 pm
114 Optical Topographic Imaging for Intraoperative Three-dimensional Navigation in the Cervical Spine: Accuracy Validation and Initial Clinical Feasibility
Daipayan Guha, Raphael Jakubovic, Shaurya Gupta, Michael G. Fehlings, Albert Yee, Victor Xiao Dong Yang

Discussant: Langston T. Holly

4:00–4:05 pm
Discussant: Langston T. Holly

4:05–4:10 pm
115 Patient-reported Outcomes After Surgical Stabilization of Spinal Tumors: Symptom-based Validation of the Spinal Instability Neoplastic Score (SINS) and Surgery
Ibrahim Hussain, Ori Barzilai, Anne Reiner, Natalie DiStefano, Lily McLaughlin, Shahiba Ogilvie, Mark H. Bilsky, Ilya Laufer

Discussant: John E. O’Toole
4:15–4:20 pm
116 The Effect of Steroids on Complications, Readmission, and Reoperation After Posterior Lumbar Spinal Fusion: An Analysis of 8492 Patients Using the ACS-NSQIP Database
Michael Brendan Cloney, Roxanna Garcia, Zachary A. Smith, Nader S. Dahdaleh

Discussant: Kurt M. Eichholz

KUNTZ SCHOLARS - TOP ABSTRACTS
CONCURRENT SESSION 3

3:15–4:25 pm Cataluna A/B

Moderators: Sanjay S. Dhall, Michele M. Johnson

3:15–3:20 pm
117 The Functional, Histologic, and Electrophysiologic Outcomes After Rapid-stretch Nerve Injury
Michael Karsy, Wesley Warner, Stewart Yeoh, Petr Tvrdik, Jie Zhang, Mark Alexander Mahan

Discussant: Rajiv Midha

3:25–3:30 pm
118 Biomechanical Evaluation of Lumbar Decompression Adjacent to Instrumented Segments
Peter Grunert, Anna Newcomb, Brian Kelly, Roger Härtl

Discussant: Eric J. Woodard

3:35–3:40 pm
119 Laminoplasty Versus Laminectomy-Fusion for the Treatment of Cervical Myelopathy: Preliminary Results from the CSM-study Comparing Cervical Sagittal Alignment and Clinical Outcomes

Discussant: Rick Sasso

3:45–3:50 pm
120 Multidisciplinary Evaluation Leads to the Decreased Utilization of Lumbar Spine Fusion: An Observational Cohort Pilot Study
Vijay Yanamadala, Jean-Christophe A. Leveque, Quinlan Buchlak, Anna Wright, Yourie Kim, Farrokh Farrokhi, Robert Mecklenburg, Rajiv Sethi
3:50–3:55 pm
Discussant: Philip R. Weinstein

3:55–4:00 pm
121 Comparing the Efficacy of Adipose-derived Versus Bone Marrow-Derived Stem Cells in Combination with a Clinical-grade Bone Graft Substitute in a Rat Model of Spinal Fusion
Benjamin D. Elder, Christina Holmes, Wataru Ishida, John Locke, Timothy F. Witham

4:00–4:05 pm
Discussant: Michael P. Steinmetz

4:05–4:10 pm
122 Allograft Versus Autograft: A Comparison of Postoperative Morbidity in Spinal Fusions Using the ACS-NSQIP Registry
Meghan Murphy, Brandon A. McCutcheon, Panagiotis Kerezoudis, Patrick R. Maloney, Kendall Snyder, Lorenzo Rinaldo, Daniel Levi Shepherd, Ahmad Nassr, Mohammed Ali Alvi, Jennifer Grauberger, Mohamad Bydon

4:10–4:15 pm
Discussant: Joseph Cheng

4:15–4:20 pm
123 Predictors for Obtaining a Postoperative Improvement Over the Minimum Clinically Important Difference After Lumbar Decompression Surgery
Vincent J. Alentado, Louisa Onywadume, Patrick Michael Flanigan, Michael P. Steinmetz, Edward C. Benzel, Thomas Mroz

4:20–4:25 pm
Discussant: Erica Fay Bisson

BEER AND WINE HAPPY HOUR DEBATES

4:30–6:00 pm
Marquis Ballroom Salons 4/5

Moderators: John J. Knightly, Michael P. Steinmetz

Learning Objectives: Upon completion of this course, participants will be able to:
- Describe current issues related to spine training for residents and fellows.
- Analyze benefits versus pitfalls of performing surgery in concurrent operating rooms.
- Discuss the potential impact and challenges of embracing new technology in spine practice.
THURSDAY

MEETING AGENDA

4:30-4:45 pm
Grab a cocktail and join us for this new and exciting debate session with lively presentations and discussions!

4:45-4:50 pm
Introduction
John J. Knightly

4:50-4:58 pm
Future of Spine Training—Spine Fellowship
James S. Harrop

4:58-5:06 pm
Future of Spine Training—Spine Residency
Daniel K. Resnick

5:06-5:12 pm
Discussion and Verdict
Volker K. H. Sonntag

5:12-5:20 pm
Running 2 ORs—Twice as Efficient!
Iain H. Kalfas

5:20-5:28 pm
Running 2 ORs—Twice the Headache!
Gregory R. Trost

5:28-5:34 pm
Discussion and Verdict
Michael Y. Wang

5:34-5:42 pm
Embracing New Technology: Staying Youthful and Current
Alexander R. Vaccaro

5:42-5:50 pm
Embracing New Technology: You Can’t Teach an Old Dog New Tricks
Christopher I. Shaffrey

5:50-6:00 pm
Discussion and Verdict
Regis W. Haid
FRIDAY
MARCH 10, 2017

7:00 am–5:00 pm  Grand Ballroom Foyer
Registration

7:00–8:00 am  Marquis Ballroom Foyer
Complimentary Continental Breakfast

7:30–8:00 am  Marquis Ballroom Salons 4/5
Challenging Cases 2
Speakers: Faiz U. Ahmad, Raul A Vasquez

MINIMALLY INVASIVE/MOTION PRESERVATION BREAKOUT

8:00–9:30 am  Cataluna A/B

Moderators: Paul Park, Khoi Duc Than
Speakers: Aaron J. Clark, Kevin T. Foley, Michael Y. Wang

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.
- Compare indications and clinical outcomes for various minimally invasive and motion preservation techniques.

8:00–8:02 am
124 Cervical Total Disc Replacement Using Tissue-engineered Intervertebral Discs Combined with an Anterior Bio-resorbable Stabilization System in an Ex Vivo Canine Model
Ibrahim Hussain, Gernot Lang, Jorge Mojica Santiago, Rodrigo Navarro-Ramirez, Lawrence J Bonassar, Roger Hartl

8:02–8:04 am
125 Pilot Study Assessing Preservation of Disc Height in an Ovine Model with Polymethyl-methacrylate and Hyaluronic Acid Injection
Arvin Raj Wali, David Rafael Santiago-Dieppa, Reid Hoshide, Nick Manesis, Gloria Lin, William R. Taylor
8:04–8:06 am
126 Biomechanical Evaluation of the Viscoelastic Cervical Disc Prosthesis in One- and Two-level Constructs
Richard D. Guyer, Leonard I. Voronov, Robert Havey, Gerard Carandang, Saeed Khayatzadeh, Josh Rubin, Nick Padovani, Kenneth Blank, Stephanie Werner, Avinash Patwardhan

8:06–8:08 am
127 Can We Increase Segmental Mobility by Cervical Arthroplasty?
Hsuan-Kan Chang, Jau-Ching Wu, Chih-Chang Chang, Tsung-Hsi Tu

8:08–8:10 am
128 Fish-mouth Kyphosis of the Device After Cervical Disc Arthroplasty

8:10–8:12 am
130 Cervical Total Disc Replacement Versus Anterior Cervical Discectomy and Fusion: Reoperation Rates, Complications, and Hospital Resource Utilization in 72,688 Patients in the United States
Kyle Anthony Smith, Kavelin Rumalla, Paul M. Arnold

8:12–8:14 am
132 Cervical Arthroplasty Versus Anterior Cervical Fusion for Symptomatic Adjacent Segment Disease After Anterior Cervical Fusion Surgery: Review of Treatment in 41 Patients
Sang-Bok Lee, Kyoung-Suok Cho

8:14–8:16 am
133 Cervical Arthroplasty for Moderate to Severe Disc Degeneration: Clinical and Radiological Assessments After a Minimum Follow-up of 24 Months
Seung Hwan Yoon, Chang Hyun Oh

8:16–8:24 am
Questions and Discussion

8:24–8:26 am
134 Minimally Invasive Spine Surgery in the Pediatric Population: A Case Series
Richard P. Menger, Matthew Hefner, Anthony H. Sin

8:26–8:28 am
135 Economic Performance of Oblique Lateral Lumbar Interbody Fusion (OLLIF) with a Focus on Hospital Throughput Efficiency
Hamid R. Abbasi, Christopher Murphy
8:28–8:30 am
136 Lateral Lumbar Interbody Fusion with Lateral Modular Plate Fixation and Interspinous Process Fixation: Two-year Outcomes from a Prospective Multi-center Study
Clint Hill, Brandon Strenge, Chris M. Ferry, Brieta Bejin, Sarah Martineck, Kim Martin, Tom Glorioso, Ryan Peter Denhaese

8:30–8:32 am
137 Lumber Plexus Injury After MIS Lateral Transpsoas Interbody Fusion at L4/5 Level: A Review of 62 Consecutive Cases
Jacob Januszewski, Shashank Gandhi, Konrad Bach, Andrew C. Vivas, Chun Po Yen, Jason Michael Paluzzi, Juan S. Uribe

8:32–8:34 am
138 Comparative Study of Intraoperative True CT Radiological Outcomes After Minimally Invasive Extreme Lateral Interbody Fusion (ELIF) and Minimally Invasive Transforaminal Lumbar Interbody Fusion (TLIF)
Rodrigo Navarro-Ramirez, Gernot Lang, Insa Janssen, Ajit Jada, Connor Berlin, Aaron Hilis, Micaella Zubkov, Roger Hartl

8:34–8:36 am
139 Minimally Invasive Transforaminal Versus Direct Lumbar Interbody Fusion: Effect on Return to Work and Narcotic Usage
Terence Verla, Rory R. Mayer, Lona Winnegan, Ibrahim Omeis

8:36–8:38 am
140 Management of Lumbar Adjacent Segment Disease (ASD) with Lateral Lumbar Interbody Fusion
Karthik Madhavan, Zachary Stephen Hubbard, Lynn McGrath Jr., Lee Onn Chieng, Christoph P. Hofstetter, Seth K. Williams, Steven Vanni

8:38–8:40 am
141 Reduction of Postoperative Narcotic Consumption in Awake TLIF: Enhanced Recovery After Surgery
Karthik Madhavan, Hsuan-Kan Chang, Timur Urakov, Lee Onn Chieng, Anand Veeravagu, Michael Y. Wang

8:40–8:42 am
142 Does Minimally Invasive Transforaminal Lumbar Interbody Fusion Influence Sagittal Spinopelvic Parameters in Single-level Low-grade Isthmic Spondylolisthesis? Comparative Analysis with Conventional Technique
Dal-Sung Ryu, Sang-Soak Ahn, Kyung-Hyun Kim, Jeong-Yoon Park, Sung-Uk Kuh, Dong-Kyu Chin, Keun-Su Kim, Yong-Eun Cho

8:42–8:44 am
143 Does the Posterior Lumbar Interbody Fusion (PLIF) with Percutaneous Pedicle Screw Fixation (PPS) at Lumbosacral Spine Have Good Results Compared with its Use at Lumbar Spine?
Sang-Don Kim, Hyun-Jin Hong

8:44–8:48 am
Questions and Discussion
MEETING AGENDA

8:48–8:50 am
144 Open Versus Minimally Invasive TLIF: Review of Outcomes and Consideration for Patient Selection
Liesl Close, Patrick W. Hitchon, Jennifer Noeller, Naalia Hramakova

8:50–8:52 am
145 Oswestry Disability Index (ODI), Safety and Fusion Rates in Minimally Invasive Transforaminal Lumbar Interbody Fusion (MITLIF): Multi-center Prospective Longitudinal Cohort Study
Troy Dawley, Justin G. Thomas, Liisa Bergmann, Doris Tong, Teck Mun Soo

8:52–8:54 am
146 What is the Effect of Open Versus Percutaneous Screws on Complications Among Patients Undergoing Lateral Interbody Fusion for Adult Spinal Deformity?
Khôi Duc Than, Stacie Nguyen, Paul Park, Dean Chou, Frank La Marca, Juan S. Uribe, Todd D. Vogel, Pierce D. Nunley, Robert Eastlack, Neel Anand, Adam S. Kanter, Praveen V. Mummaneni, Gregory M. Mundis, Jr., International Spine Study Group

8:54–8:56 am
147 Early Experience with a Hybrid Approach to Correcting Adult Degenerative Deformity: Combined MIS-LIF with SPO and Open Instrumentation
Oliver Flouty, Andrew James Grossbach, Logan Helland, Stephanus Viljoen

8:56–8:58 am
148 How Does Case Type, Length of Stay, and Comorbidities Affect Medicare DRG Reimbursement for Minimally Invasive Surgery (MIS) for Deformity?

8:58–9:00 am
149 Current MIS Techniques Fail to Optimize Spinopelvic Parameters in Patients with High Pelvic Incidence

9:00–9:02 am
150 Early and Late Reoperation Rates and Etiologies are Similar Between cMIS and HYB Techniques for ASD Correction
9:02–9:04 am
151 Effect of Intraoperative Epidural Methylprednisolone in Patients Undergoing MIS Single Level Microdiscectomy: A Prospective Randomized Control Study of 220 Patients
Tianyi Niu, Derek Stephen Lu, James Leiter, Daniel C. Lu

9:04–9:06 am
152 Microsurgical Foraminotomy Via Wiltse Paraspinal Approach for Foraminal or Extraforaminal Stenosis at L5-S1 Level: Risk Factor Analysis for Poor Outcome
Won Mo Gu, Sung Ik Cho, Chung Kee Chough

9:06–9:08 am
153 Percutaneous Pedicle Screw Fixation after Direct Spinal Canal Decompression in Magerl Type A3 Thoracolumbar Burst Fractures with Neurological Injury: An Alternative Option
Jung-Kil Lee, Bong Ju Moon, Ki-Young Choi

9:08–9:12 am
Questions and Discussion

DEBATE

9:12–9:30 am Cataluna A/B

9:12–9:14 am
Case Presentation: Single-level Lumbar Spondylolisthesis
Aaron J. Clark

9:14–9:22 am
Percutaneous Endoscopic TLIF
Michael Y. Wang

9:22–9:30 am
MIS TLIF
Kevin T. Foley

SPINAL TRAUMA/GENERAL SPINE 1 BREAKOUT

8:00–9:30 am Marquis Ballroom Salon 6

Moderators: Beejal Y. Amin, Scott A. Meyer
Speakers: Paul M. Arnold, Sanjay S. Dhall, Michele M. Johnson

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.
• Compare indications and clinical outcomes for various management approaches to spinal trauma.
8:00–8:02 am
155 MRI Analysis of the Combined AOSpine North America and International Studies: 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

8:02–8:04 am
156 Assessment of Gait Disturbance by Foot Pressure Measurement in Patients with Myelopathy
Tetsuryu Mitsuyama, Yoshikazu Okada, Takakazu Kawamata

8:04–8:06 am
157 A Clinical Practice Guideline for the Management of Patients with Degenerative Cervical Myelopathy: Recommendations for Patients with Mild, Moderate, and Severe Disease, and Nonmyelopathic Patients with Evidence of Cord Compression

8:06–8:08 am
158 National Trends in Demographics and Outcomes Following Cervical Fusion for Cervical Spondylotic Myelopathy
Caroline E. Vonck, Joseph E. Tanenbaum, Gabriel Alexander Smith, Edward C. Benzel, Thomas Mroz, Michael P. Steinmetz

8:08–8:10 am
159 Comparative Effectiveness Between Laminectomy with Fusion and Laminoplasty for the Treatment of Multilevel Cervical Spondylotic Myelopathy
Heath P. Gould, Colin Haines, Emily Hu, Jacob A. Miller, Roy Xiao, Thomas E. Mroz, Don Moore

8:10–8:12 am
160 In Continuous Type Ossification of Posterior Longitudinal Ligament, Which One is Treatment of Choice: Laminectomy or Laminoplasty?
Sun-Joon Yoo, Dal-Sung Ryu, Kyung-Hyun Kim, Jeong-Yoon Park, Sung-Uk Kuh, Dong-Kyu Chin, Keun-Su Kim, Yong-Eun Cho
8:12–8:14 am
162 Correlation Between Cervical Sagittal Alignment Changes and T1 Slope of the Patients with Cervical Spondylotic Myelopathy and Cervical Ossification of the Posterior Longitudinal Ligament After Laminoplasty
Kang Ji In, Farid Yudoyono, Dong Ah Shin, Byeong Woo Kim, Zhimin Pan, Keung Nyun Kim, Do Heun Yoon, Seong Yi, Yoon Ha

8:14–8:16 am
163 Mid-term Follow up of Subsidence Rate in Flanged Mesh Cage Reconstruction Without Plating in Anterior CSM/OPLL Surgery
Soo-Bin Im

8:16–8:24 am
Questions and Discussion

8:24–8:26 am
164 CrossFit Related Spinal Injuries: A Retrospective Study
Benjamin Hopkins, Michael Brendan Cloney, Kartik Kesavabhotla, Adeola L. Adeoye, Zachary A. Smith, Tyler R. Koski, Wellington Hsu, Nader S. Dahdahleh

8:26–8:28 am
165 Isolated Occipital Condyle Fractures are Unlikely to Result in Delayed Instability Regardless of Management Style
Nathan Davis, Nathan Quig, Casey Hribar, Deb A. Bhowmick

8:28–8:30 am
166 A Finite Element Analysis of the Occitipoatlantal Capsular Ligaments as the Primary Stabilizers of the Craniocervical Junction
Andrew T. Dailey, Rinchen Phuntsok, Douglas L. Brockmeyer, Benjamin Ellis

8:30–8:32 am
167 Management of Acute Isolated Atlas Fractures: A Retrospective Study of 65 Patients
Hyun Su Kim, Kartik Kesavabhotla, Michael Brendan Cloney, Adeola L. Adeoye, Nader S. Dahdahleh

8:32–8:34 am
168 Use of the Acutrak 4/5 Headless Compression Screw for Odontoid Fixation in Type II Odontoid Fractures: A Technical note and Case Series
Michael Kakareka, Xin Xin, Steven S. Yocom, Alan R. Turtz

8:34–8:36 am
169 Clinical Guideline in Managing Peri-operative Spinal Cord Injury: Results from a Survey of the AOSpine International Community
Anick Nater, Jean-Christophe Murray, Lindsay Tetreault, Aria Nouri, Allan R. Martin, Michael G. Fehlings
8:36–8:38 am
170 Indication of Anterior Decompression in Complex Irreducible Atlanto Axial Dislocation
Arun K. Srivastava

8:38–8:40 am
171 Long-term Clinical Outcomes Following Surgical Management of Cervical Spine Fractures in Elderly Patients
Nitin Agarwal, James Zhou, Gurpreet Surinder Gandhoke, Michael Koltz, Adam S. Kanter, David O. Okonkwo, D. Kojo Hamilton

8:40–8:42 am
172 Thoracolumbar Fractures in the Elderly: Complications After Non-operative and Operative Treatment
Taylor Elise Purvis, Rafael De la Garza-Ramos, C. Rory Goodwin, Daniel M. Sciubba

8:42–8:44 am
173 Posterior Thoracolumbar Corpectomy and Reconstruction with Two Small Cages
Jae-Young Park, Bong-Ju Moon, Jung-Kil Lee

8:44–8:48 am
174 Questions and Discussion

8:48–8:50 am
174 Surgical Practice in Traumatic Spinal Fracture Treatment with Regard to the TLICS and SLICS Systems: A Review of 58 Patients at the University of Wisconsin
Kimberly M. Hamilton, Darnell T. Josiah, Nathaniel P. Brooks

8:50–8:52 am
175 Prevention of Iatrogenic Cervical Cord Injury: Preoperative Screening
Stephen Shelby Burks, Jason Liounakos, David McCarthy, Howard B. Levene

8:52–8:54 am
176 Early Surgical Intervention for Acute Central Cord Syndrome is not Associated with Increased Mortality
Jakub Godzik, Jay Dalton, Rohit Mauria, Alan Cook, Kristina Chapple, Jay D. Turner

8:54–8:56 am
Marcus D. Mazur, Christopher M. Holland, Erica F Bisson, Meic H. Schmidt, Andrew T. Dailey

8:56–8:58 am
178 Pathologic Position of the Transverse Ligament Prevents Reduction in Fixed, Irreducible Os Odontoideum Operative Illustration and Radiographic Correlate in 41 Patients
Brian J. Dlouhy, Bruno Policeni, Arnold H. Menezes
8:58–9:00 am
179 Short Segment Posterior Fixation with Index Level Screws Versus Long Segment Posterior Fixation for Thoracolumbar Spine Fracture: Angle of Correction and Pain

9:00–9:02 am
180 The Relationship between Mortality and Acute Spinal Cord Injury
Chengmin Zhang, Fred H. Geisler, Karen K. Anderson, Qiang Zhou, Paul M. Arnold

9:02–9:04 am
181 Application of AOSpine Subaxial Cervical Spine Injury Classification in Simple and Complex Cases
Bizhan Aarabi, Cumhur Oner, Alexander R. Vaccaro, Gregory Schroeder, Noori Akhtar Danesh

9:04–9:06 am
182 A Clinical Practice Guideline for the Management of Patients with Acute Spinal Cord Injury: Recommendations on the Role of Baseline Magnetic Resonance Imaging in Clinical Decision Making and Outcome Prediction

9:06–9:08 am
183 A Clinical Practice Guideline for the Management of Patients with Acute Spinal Cord Injury: Recommendations on the Type and Timing of Rehabilitation

9:08–9:12 am
Questions and Discussion
DEBATE

9:12–9:14 am
Case Presentations: Acute Cervical SCI
Michele Marie Johnson

9:14–9:22 am
Patient Immediately to Surgery < 24 hours
Paul M. Arnold

9:22–9:30 am
Patient Immediately to ICU: Mean Arterial Pressure Elevation
Sanjay S. Dhall

SPINAL DEFORMITY BREAKOUT

8:00–9:30 am
Marquis Ballroom Salons 7/8

Moderators: Charles A. Sansur, Justin S. Smith
Speakers: John R. Dimar, Munish C. Gupta, D. Kojo Hamilton

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.
- Compare indications and clinical outcomes for various management approaches to spinal deformity.

8:00–8:02 am
184 Variations of Lumbopelvic Alignment in Standing, Seated, and Slumped Postures in a Cohort of Asymptomatic Adults: Implications for Lumbar Fusion Surgery

8:02–8:04 am
185 Spinal Deformity Surgery in Patients with Movement Disorders

8:04–8:06 am
186 Spine Deformity Surgery in the Elderly: Risk Factors and 30-day Outcomes
John K. Yue, David Sing, Sourabh Sharma, Pavan S. Upadhyayula, Lionel N. Metz
8:06–8:08 am
187 Early Ambulation Decreases Length of Hospital Stay, Peri-operative Complications and Improves Functional Outcomes in Elderly Patients Undergoing Surgery for Correction of Adult Degenerative Scoliosis Owoicho Adogwa, Aladine A. Elsamadicy, Jared Fialkoff, Joseph S. Cheng, Isaac O. Karikari, Carlos Antonio Bagley

8:08–8:10 am

8:10–8:12 am

8:12–8:14 am
190 Impact of Surgical Approach Translates on Complication Rates After Elective Spinal Fusion (>3 Levels) for Adult Spine Deformity Aladine A. Elsamadicy, Owoicho Adogwa, Shay Behrens, Angel Chen, Ankit Mehta, Raul A Vasquez, Joseph S. Cheng, Carlos Antonio Bagley, Isaac O. Karikari

8:14–8:16 am
191 Asymmetric Pedicle Subtraction Osteotomy for Adult Spinal Deformity with Coronal Imbalance: Complications, Radiographical, and Surgical Outcomes Andrew Kai-Hong Chan, Darryl Lau, Sigurd Berven, Shane Burch, Serena Hu, Praveen V. Mummaneni, Vedat Deviren, Christopher P. Ames

8:16–8:18 am
192 Adult Spinal Deformity Patients with Previous Fusions Have an Equal Chance of Reaching Substantial Clinical Benefit Thresholds in Health-related Quality of Life Measures but Do Not Reach the Same Absolute Level of Improvement Tamir T. Ailon, Justin S. Smith, Christopher I. Shaffrey, Alex Sorocceanu, Virginie Lafage, Frank Schwab, Douglas C. Burton, Robert Hart, Han Jo Kim, Jeffrey Lynn Gum, Richard A. Hostin, Jr., Michael P. Kelly, Steven D. Glassman, Justin K. Scheer, Shay Bess, Christopher P. Ames, International Spine Study Group
193 Under-Correction of Sagittal Deformities Based on Age-Adjusted Alignment Thresholds Leads to Worse HRQOL While Over-correction Provides No Additional Benefit
Justin K. Scheer, Renaud Lafage, Barthelemy Liabaud, Frank Schwab, Justin S. Smith, Gregory M. Mundis, Jr., Richard A. Hostin, Jr., Christopher I. Shaffrey, Douglas C. Burton, Han Jo Kim, Shay Bess, Munish C. Gupta, Virginie Lafage, Christopher P. Ames

Questions and Discussion

194 Use of a Validated Predictive Model for Patient Selection in Adult Spinal Deformity (ASD) Surgery Has the Potential to Enhance QALYs Gained at Two Years: Simulation in 234 ASD Patients

195 Predictive Modeling of Length of Hospital Stay (LOS) Following Adult Spinal Deformity (ASD) Correction: Analysis of 653 Patients with an Accuracy of 75 Percent Within Two Days
Justin Kemp Scheer, Tamir T. Ailon, Justin S. Smith, Robert Hart, Douglas C. Burton, Shay Bess, Brian J. Neuman, Peter G. Passias, Emily Miller, Christopher I. Shaffrey, Frank Schwab, Virginie Lafage, Eric Klineberg, Christopher P. Ames

196 The Impact of Different Intraoperative Fluid Administration Strategies on Postoperative Exubation Following Multi-level Thoracic and Lumbar Spine Surgery: A Propensity Score Matched Analysis

197 Direct Costs of Adult Scoliosis in the United States
Rory R. Mayer, Terence Verla, J-Wen Pan, Ben Allen Strickland, Andrew Jea, Sandi Lam

198 Biomechanical Study to Determine Change in Range-of-Motion of Human Thoracic Cadaveric Spine with Intact Rib Cage Following Sequential Ponte Osteotomies
Erin M. Mannen, Paul M. Arnold, John T. Anderson, E.(Lisa) A. Friis
8:34–8:36 am
199 Neurologic and Radiographic Outcomes of Anterior Column Realignment (ACR)
Rajiv Saigal, Gregory M. Mundis, Jr., Robert Eastlack, Stacie Nguyen, Behrooz A. Akbarnia

8:36–8:38 am
200 Neurological Comorbidities Predict Proximal Junctional Kyphosis: A Case-matched Cohort Analysis Performed at a Single Center
Hideyuki Arima, Steven D. Glassman, John R. Dimar, Leah Y. Carreon

8:38–8:40 am
201 Bimodal Incidence and Causes of Proximal Junctional Kyphosis (PJK) in Adult Spinal Deformity (ASD)

8:40–8:42 am
202 Towards a Better Understanding of Cervical Sagittal Alignment: Utilizing a Novel Angle to Describe the Relationship between T1 Vertebral Body Slope, Cervical Lordosis, and Cervical Sagittal Alignment

8:42–8:44 am
203 Gliding Anterior Cervical Cage Placement Combined with Posterior Fusion for Correction of Fixed Cervical Deformity with Myelopathy
Andrew James Grossbach, Oliver Flouty, Stephanus Viljoen

8:44–8:48 am
Questions and Discussion

8:48–8:50 am
204 Primary Drivers of Cervical Deformity: Prevalence and Effect of Surgical Treatment Strategies on Postoperative Alignment
Peter G. Passias, Cyrus M. Jalai, Virginie Lafage, Renaud Lafage, Themistocles Protopsaltis, Gregory W. Poorman, Subaraman Ramchandran, Samantha R. Horn, Munish C. Gupta, Robert Hart, Vedat Deviren, Alex Soroceau, Justin S. Smith, Frank Schwab, Christopher I. Shaffrey, Christopher P. Ames, International Spine Study Group (ISSG)
8:50–8:52 am
205 Reciprocal Changes in Unfused Spinal Regions After Treatment of Cervical Deformity Based on Deformity Driver and Surgical Strategies

8:52–8:54 am
206 Outcomes of Operative Treatment for Adult Cervical Deformity: A Prospective Multicenter Assessment with One-year Follow-up

8:54–8:56 am
207 Three-column Osteotomy for Correction of Cervical and Cervicothoracic Deformities: Alignment Changes and Early Complications in A Multicenter Prospective Series of 24 Patients

8:56–8:58 am
208 Impact of Multi-level Interbody Fusion in the Treatment of Severe Adult Scoliosis (Thoracolumbar Coronal Cobb Angle >50 Degrees)

8:58–9:00 am
209 Does Concave Versus Convex Approach Matter when Using Lateral Lumbar Interbody Fusion for Adult Scoliosis?
9:00–9:02 am
210 Patients with High Pelvic Tilt Achieve the Same Clinical Success as Those with Low Pelvic Tilt After Minimally Invasive Deformity Surgery

9:02–9:04 am
211 Advanced Lateral Approaches with Hyperlordotic Interbody Grafts can Correct Spinopelvic Mismatch While Avoiding the Blood Loss Associated with Pedicle Subtraction Osteotomy
Jean-Christophe A. Leveque, Vijay Yamamadala, Quinlan Buchlak, Rajiv Sethi

9:04–9:06 am
212 Scoliotic Deformity Correction in 107 Patients Undergoing Single-level Minimally Invasive Transforaminal Lumbar Interbody Fusion
Vikram Chakravarthy, Namath Syed Hussain, Mick J. Perez-Cruet

9:06–9:08 am
213 Treatment of the Fractional Curve with Circumferential Minimally Invasive (cMIS) Interbody Versus Oery Without Interbody Fusion: An Analysis of Surgical Outcomes
Dean Chou, Praveen V. Mummaneni, Pierce D. Nunley, Joseph M. Zavatsky, Robert Eastlack, David O. Okonkwo, Michael Y. Wang, Paul Park, Juan S. Uribe, Neel Anand, Vedat Deviren, Behrooz A. Akbarnia, Stacie Nguyen, Gregory M. Mundis, Jr., International Spine Study Group

9:08–9:12 am
Questions and Discussion

DEBATE

9:12–9:30 am
Marquis Ballroom Salons 7/8

9:12–9:14 am
Case Presentation: Coronal Deformity with Radiculopathy in the Elderly Patient
D. Kojo Hamilton

9:14–9:22 am
Focal Decompression
John R. Dimar

9:22–9:30 am
Correction and Fusion
Munish C. Gupta
Moderators: Ali Baaj, Victor Chang

Learning Objectives: Upon completion of this course, participants will be able to:

1. Analyze the findings of novel neurosurgical studies; critique the design and methodology of these studies.
2. List important areas for further knowledge development and research.
3. Identify the most important ongoing clinical trials.

8:00–8:02 am
231 Characterizing Factors Leading to Malpractice Litigation: An Opportunity for Spine Surgeons to Reduce Legal Liability
Nitin Agarwal, Raghav Gupta, Prateek Agarwal, Pravin Matthew, Richard Wolferz, Jr., Christopher Kim, Arpan V. Prabhu, Adam S. Kantor, David O. Okonkwo, D. Kojo Hamilton

8:02–8:04 am
215 New Lamina Spacer that can be Applied to Both of Open Door and Double Door Cervical Laminoplasty and Gives Consecutive Bone Union Between Spacer and Opened Lamina-clinical Outcomes and Bone Union of the Opened Lamina and Spacer
Futoshi Suetsuna

8:04–8:06 am
216 Voice and Swallowing Outcomes Following Re-operative ACDF Surgery with a Two Surgical Team Approach
Matthew Erwood, Beverly C. Walters, Timothy Connolly, Amber S. Gordon, William Carroll, Bonita Agee, Mark N. Hadley

8:06–8:08 am
217 Risk Factors For Durotomy in Elective Spine Surgery
Panagiotis Kerezoudis, Meghan Murphy, Mohammed Ali Alvi, Patrick R. Maloney, Lorenzo Rinaldo, Daniel Levi Shepherd, Daniel S. Ubl, Elizabeth B. Habermann, Mohamad Bydon

8:08–8:10 am
218 The Extent of Lumbar Decompression and its Effect on Postoperative Morbidity
Mohammed Ali Alvi, Patrick R. Maloney, Brandon A. McCutcheon, Meghan Murphy, Elizabeth B. Habermann, Cynthia Crowson, Daniel Levi Shepherd, Panagiotis Kerezoudis, Jennifer Grauberger, Mohamad Bydon

8:10–8:12 am
219 Safety of Use of Autologous Concentrated Bone Marrow Aspirate in Spinal Fusion Procedures
Lara Walsh Massie, Kelly Tundo, Lonni Schultz, Mokbel K. Chedid
8:12—8:14 am
220 Feasibility of C7 Lateral Mass Screws as a First-line Fixation Method: A Consecutive Series of 49 Patients Over Seven Years
Kevin T. Huang, Yethulsa Fingfing, Muhammad M. Abd-El-Barr, John Chi

8:14—8:16 am
221 Limiting the Cranial Extent of Fusion to the Atlas does not Result Delayed Cranio cervical Settling or Occipitocervical Instability After Surgical Decompression for Basilar Invagination
Brice Allen Kessler, Nathan Davis, Joshua E. Loewenstein, Deb A. Bhowmick

8:16—8:18 am
222 Perioperative Malnutrition and its Relationship to Hospital Course and Clinical Outcomes in Patients Undergoing Surgery for Cervical Myelopathy
Christopher M. Holland, Jian Guan, Vijay Ravindra, Erica Fay Bisson

8:18—8:20 am
223 Thoracolumbar Arthrodesis of Degenerative Spondylosis with Stereotactic Cortical Screws and Interbody Fusion
Michael Karsy, Kyrl Cole, Jian Guan, Andrea Archambault Brock, Chad Douglas Cole

8:20—8:24 am
Questions and Discussion

8:24—8:26 am
224 A Clinical and Radiological Study of Zero Profile Device for Anterior Cervical Discectomy and Fusion
Allen Ho, Sayantan Deb, Suzanne Audrey Tharin, Eric Tranvinh, Stephen Skirboll

8:26—8:28 am
225 Should Long Segment Cervical Fusions be Routinely Carried into the Thoracic Spine? A Multi-center Analysis
Eric Traumees, Devender Singh, Matthew Geck, John K. Stokes

8:28—8:30 am
226 Expandable Versus Static Inter-body Grafts Reduce Operative Time, Improve Lordosis, and Accelerate Return to Work After Fusion for Lumbar Stenosis and Spondylolisthesis
Matthew J. McGirt, Vincent Rossi, Domagoj Coric, Paul Keetae Kim, Kevin Scott Cahill, Deborah Pfortmiller

8:30—8:32 am
227 Titanium Versus Polyetheretherketone (PEEK) Interbody Fusion: Meta-analysis and Review of the Literature
Scott Seaman, Panagiotis Kerezoudis, Mohamad Bydon, James Torner, Patrick W. Hitchon
8:32–8:34 am
228 Risk Adjustment Modeling for Urinary Retention in the Michigan Spine Surgery Improvement Collaborative (MSSIC): Results from 8,442 Lumbar Patients
Victor Chang, Michael Bazydlo, Lonni Schultz, David Nerenz, Jason M. Schwalb, Stephen Bartol, Muwaffak Abdulhak

8:34–8:36 am
229 Does Saving the Spinous Process in Decompression Surgery Positively Affect Future Instability: A Single Institution Experience
Ziev Moses, Muhammad M. Abd-El-Barr, Justin Slavin, Viren Sahai Vasudeva, John Chi, Michael W. Groff

8:36–8:38 am
John M. Caridi, Samuel K. Cho, Branko Kopjar

8:38–8:40 am
214 Re-admission, Re-operation, and Patient Reported Outcomes After Lumbar Fusion Surgery for Spondylolisthesis in 480 Patients from the QOD Registry - Supported by the NREF Regis Haid Fund

8:40–8:42 am
233 Impact of Resident Participation on Outcomes After Posterior Lumbar Fusion: An Analysis of 5655 Patients from the American College of Surgeons National Surgical Quality Improvement Program Database
Jonathan Tad Yamaguchi, Robert B. Kim, Roxanna Garcia, Zachary A. Smith, Nader S. Dahdaleh

8:42–8:48 am
Questions and Discussion

8:48–8:50 am
234 The Timing of Surgery and Symptom Resolution in Patients Undergoing Transforaminal Lumbar Interbody Fusion for Lumbar Degenerative Disc Disease and Radiculopathy
Sharad Rajpal, Alan T. Villavicencio, Sigita Burneikiene, Ewell Lee Nelson
8:50–8:52 am
235 Can We Predict Long-term Disability and Discharge Destination After Elective Cervical Spine Surgery
Ahilan Sivaganesan, Silky Chotai, Matthew J. McGirt, Clint Devin

8:52–8:54 am
236 Risk Factors for Dysphagia After Anterior Cervical Surgery: Preliminary Results from a Prospective Multicenter Study of the AOSLA Group
Asdrubal Falavigna, Marco Antonio Koff, Diego Dozza, Juan Pablo Guyot, Ratko Yurac, Pablo Jalón, Jose Maria Jimenez, Barón Zárate, Nicolas Scheverin, Ericson Sfreddo

8:54–8:56 am
237 The Timing of Venous Thromboembolic Events After Spine Surgery: A Single Center Experience with 6870 Consecutive Patients
Michael Brendan Cloney, Ekamjeet Dhillon, Helena Roberts, Zachary A. Smith, George R. Cybulski, Tyler R. Koski, Nader S. Dahdaleh

8:56–8:58 am
238 Bone Morphogenetic Protein (BMP) and Surgical Site Infection Rates following Lumbar Spine Surgery: A Report from Washington State SCOAP-CERTAIN Collaborative
Vijay Yanamadala, Jean-Christophe A. Leveque, Sara Khor, Quinlan Buchlak, Amy Cizik, Rajiv Sethi

8:58–9:00 am
239 Pre-Clinical and Initial Clinical Experience of a Novel Rapid Intra-Operative Registration Technique of Optical Machine-vision to Pre-operative Imaging for Spinal Surgical Navigation
Raphael Jakubovic, Daipayan Guha, Michael Lu, Shaurya Gupta, David W. Cadotte, Chris Heyn, Peter Howard, Todd Graham Mainprize, Albert Yee, Victor Xiao Dong Yang

9:00–9:02 am
240 Dysphagia in Standalone Versus Conventional Anterior Cervical Discectomy
Christian Fisahn, Fernando Enrique Alonso, Marc Daniel Moisi, Rod J. Oskouian, Jr., R. Shane Tubbs, Jens Chapman

9:02–9:04 am
241 Use of Liberal Hemoglobin Triggers in Spine Surgery

9:04–9:06 am
242 The Effect of Time to Surgery for Degenerative Lumbar Stenosis in a Workers’ Compensation Setting
243 Lumbar Fusion for Symptomatic Mechanical Disc Collapse Without Stenosis Improves Pain, Disability, and Quality of Life: Rethinking the Debate on Degenerative Disc Disease (DDD)
Matthew J. McGirt, Clinton J. Devin, Deborah Pfortmiller, Silky Chotai, Mohamad Bydon, Steven D. Glassman, Anthony L. Asher

9:08–9:12 am
Questions and Discussion

244 Comparative Study on the Zero-profile Cage with Screws System and Stand-alone Rectangular PEEK Cage System-augmented Fusions After Single Level Anterior Cervical Discectomy
Jong Tae Kim, Doo Yong Choi, Myeng Hoon Shin, Ho Jin Lee

9:14–9:16 am
245 The Relationship Between the Deep Paraspinal Muscles of the Cervical Spine and Fusion Rate After Anterior Decompression and Fusion
Sung Bum Kim, Man-Kyu Choi

9:16–9:18 am
246 Vertebral Segmentation Osteotomy (type 2.5 osteotomy) for Degenerative Lumbar Sagittal Imbalance: Technical Notes and Surgical Results
Gwang Soo Lee, Dal-Sung Ryu, Kyung-Hyun Kim, Jeong-Yoon Park, Sung-Uk Kuh, Dong-Kyu Chin, Keun-Su Kim, Yong-Eun Cho

9:18–9:20 am
247 What is the Proper Management for Pyogenic Spondylodiscitis? Conservative? Surgery?
James Ki Shinn, Seung Hwan Yoon, Do Keun Kim, Ji Yong Kim

9:20–9:22 am
248 Clinical Outcomes of Correcting Cervical Deformity in Cerebral Palsy Patients
Yoon Ha, Chang-Kyu Lee, Dong Ah Shin, Seong Yi, Keung Nyun Kim, Hyun C. Shin, Do-Heum Yoon

9:22–9:30 am
Questions and Discussion
9:00 am–1:00 pm  Grand Ballroom
Exhibit Hall Open
Visit the Exhibits for the latest product and technology information

BEVERAGE BREAK AND WHAT'S NEW SESSION 3

9:30–10:15 am  Grand Ballroom

Moderators: Cory Hartman, Robert A. Hirschl, Raul A. Vasquez

9:33–9:43 am
Helping to Improve Sagittal Alignment Through Expandable Technology
David M. Ibrahimi
Sponsored by:

9:47–9:57 am
Clinical Experience of Mazor Robotics Guidance Systems and O-Arm Imaging in Degenerative and Deformity Cases
Jeffrey L. Gum
Sponsored by:

10:02–10:12 am
Investigational Neuro-Spinal Scaffold for Acute Spinal Cord Injury
Michael Fehlings
Sponsored by:
SCIENTIFIC SESSION 4

10:15–11:45 am  Marquis Ballroom Salons 4/5
Ahead of the Curve: Quality, Patient Reported Outcomes, and Registries

Moderators: Zoher Ghogawala, John K. Ratliff, Robert G. Whitmore

Learning Objectives: Upon completion of this course, participants will be able to:
- Discuss how outcomes collection and quality measures may have significant impact on spine practices.
- Describe the impact of value-based care on spine practice.
- Identify strategies for addressing current changes in value-based care.

10:15–10:20 am
PROs and Spine Surgery: What Are They and Why Are They Important?
John K. Ratliff

10:20–10:30 am
Analysis of the Lumbar Spondylolisthesis RCTs: Swedish and SLIP Studies
Zoher Ghogawala

10:30–10:45 am
NASS Registry
Daniel K. Resnick

10:45–11:00 am
QOD Registry
Anthony L. Asher

11:00–11:15 am
ACS NSQIP Registry
Jonathan Grauer

11:15–11:30 am
Payer Perspective/Using Data for Negotiations
Alan M. Scarrow

11:30–11:45 am
How to Navigate/Maintain your CAHPS Score
Sohail Mirza
DSPN BUSINESS MEETING

11:45 am–12:00 pm Marquis Ballroom Salons 4/5

Moderator: Daniel J. Hoh
Speakers: Praveen V. Mummaneni, Katie O. Orrico, Alan M. Scarrow, Marjorie C. Wang, Michael Y. Wang, Christopher E. Wolfla

11:45–11:48 am Washington Committee Report
Katie O. Orrico

11:48–11:50 am Secretary’s Report
Marjorie C. Wang

11:50–11:53 am Treasurer’s Report
Michael Y. Wang

11:53–11:56 am Future Sites Committee Report
Christopher E. Wolfla

11:56–11:58 am Nominating Committee Report
Praveen V. Mummaneni

11:58–12:00 pm CNS Update
Alan M. Scarrow

COMPLIMENTARY LUNCH IN THE EXHIBIT HALL

12:00–1:00 pm Grand Ballroom
No ticket required. Please enjoy lunch with the exhibitors.

NON-CME SPONSORED LUNCH SYMPOSIA

12:00-1:00 pm Marquis Ballroom Salons 7/8

iGA: A Comprehensive Approach to Planning for and Achieving Integrated Global Alignment
Donald Blaskiewicz, Regis W. Haid, Themistocles S. Protopsaltis, Christopher I. Shaffrey, Juan S. Uribe, Neill M. Wright

Cataluna A&B
Mobi-C®: Cervical Disc Arthroplasty Taken To Another Level
Pierce Nunley

Marquis Ballroom Salon 6
Techniques to Optimize Spinal Balance
Andrew Dailey
## SPECIAL COURSE 5

**Course Title:** Innovation in Spinal Tumor Management  
**Time:** 1:00–3:00 pm  
**Location:** Cataluna A/B  
**Fee:** $150

**Course Directors:** John Chi, Ilya Laufer, John H. Shin  
**Speakers:** Christopher P. Ames, Nicholas M. Boullis, Charles Fisher, Peter C. Gerszten, Yoon Ha, Allan D. Levi, John E. O’Toole, Daniel M. Sciubba, Claudio Esteves Tatsui

**Course Description:** This course will provide a comprehensive review of the care of patients with primary and metastatic spinal tumors. Experts in the field of spinal oncology will use a case-based format to overview topics related to evaluation, treatment and complication management.

**Learning Objectives:** Upon completion of this course, participants will be able to:
1. Discuss the evaluation and management of patients with metastatic epidural spinal cord compression.
2. Compare surgery versus radiosurgery for the treatment of spinal schwannoma.

### 1:00–1:02 pm

**Introduction**

### 1:02–1:26 pm

**Debate: Steroids for Symptomatic Metastatic Epidural Spinal Cord Compression**

1:02–1:12 pm  
**Steroids—YES**  
*Charles Fisher*

1:12–1:22 pm  
**Steroids—NO**  
*John E. O’Toole*

1:22–1:26 pm  
**Rebuttals/Discussion**

### 1:26–1:36 pm

**Neurologic Recovery in Metastatic Epidural Spinal Cord Compression**  
*Daniel M. Sciubba*

### 1:36–1:50 pm

**Spinal Tumor Ablation Therapy**  
*Claudio Esteves Tatsui*

### 1:50–2:15 pm

**Debate: Spinal Schwannoma**
1:50–2:00 pm
Surgery—YES
Allan D. Levi

2:00–2:10 pm
Radiosurgery—YES
Peter C. Gerszten

2:10–2:15 pm
Rebuttals/Discussion

2:15–2:25 pm
Robot Assisted Removal of Sacral Tumors
Yoon Ha

2:25–2:35 pm
QOL for Primary and Metastatic Tumor Surgery
Christopher P. Ames

2:35–2:45 pm
Neuromodulation for Cancer Pain
Nicholas M. Boulis

2:45–3:00 pm
Questions

SPECIAL COURSE 6
1:00–3:00 pm Marquis Ballroom Salon 6
AOSNA: Advances in Spinal Surgery $150

Course Directors: Michael G. Fehlings, Justin S. Smith
Speakers: Paul M. Arnold, Clinton Devin, Michael G. Fehlings, James S. Harrop, Brian K Kwon, Thomas E. Mroz, Jefferson R. Wilson

Course Description: This course will explore recent advances in the management of spinal trauma, degenerative cervical myelopathy, spinal deformity, and chronic pain. Faculty will overview current research in the area of spinal cord injury and spinal biologics. Novel technology in the field of robotics, navigation, and neuromodulation will be introduced. Strategies for optimizing spine practice in the era of value-based care will be reviewed.

Learning Objectives: Upon completion of this course, participants will be able to:
- Discuss current concepts regarding management of spinal trauma, degenerative cervical myelopathy, spinal deformity, and chronic pain.
- Describe novel research in spinal cord injury and spinal biologics.
- Review recent advances in robotics, navigation, and neuromodulation.
1:00-1:06 pm
Introduction
Michael G. Fehlings

1:06-1:22 pm
Spinal Trauma: Controversies and the Cutting Edge
James S. Harrop

1:22-1:38 pm
Spinal Cord Injury: Repair and Regeneration
Brian K Kwon

1:38-1:54 pm
Spinal Biologics: Past, Present, Future
Thomas E. Mroz

1:54-2:10 pm
Degenerative Cervical Myelopathy
Jefferson R. Wilson

2:10-2:26 pm
Spinal Deformity in the Aging Spine: Leveraging Research to Improve Outcomes
Justin S. Smith

2:26-2:42 pm
Bending the Cost Curve—Establishing Value in Spine Surgery
Clinton Devin

2:42-3:00 pm
Robotics and Navigation
Paul M. Arnold
SPECIAL COURSE 7

1:00–3:00 pm  Marquis Ballroom
Salons 7/8
Innovation in Cervical Spine Surgery  $150

Course Directors: Jeremy L. Fogelson, Robert F. Heary, K. Daniel Riew


Course Description: This course will explore current concepts regarding various surgical approaches for cervical spine disorders. Using a case-based format, faculty will discuss indications, techniques, and outcomes. We will also overview novel technologies designed to enhance cervical spine surgery, and strategies for managing complications.

Learning Objectives: Upon completion of this course, participants will be able to:

- Assess the most current treatment options for cervical degenerative disease.
- Describe indications and expected outcomes for various surgical approaches.
- Describe novel cervical spine surgical techniques and technologies.

1:00–1:01 pm
Case Presentation: Soft Disc HNP in a Professional Athlete Playing Contact Sports

1:02–1:06 pm
ADCF
Jeremy L. Fogelson

1:07–1:11 pm
Posterior Foraminotomy
Zoher Ghogawala

1:12–1:16 pm
Arthroplasty
Domagoj Coric

1:17–1:21 pm
Anterior Transcorporal Discectomy
K. Daniel Riew

1:22–1:30 pm
Questions and Discussion
1:31–1:32 pm
Case Presentation: Neutral Cervical Spine with Multilevel Spinal Cord Compression–Minimal Neck Pain

1:32–1:36 pm
4-level ACDF
James S. Harrop

1:37–1:41 pm
Laminectomy and Fusion
Robert F. Heary

1:42–1:46 pm
Laminoplasty
Hiroshi Nakagawa

1:47–1:54 pm
Questions and Discussion

1:55–2:30 pm
Anterior Cervical Fusion Technology Update and Poster Cervical Spine Complications

1:55–1:59 pm
Stand-alone Cages Versus Plated Fusion
Se-Hoon Kim

2:00–2:04 pm
Is BMP Safe for ACDF?
Todd Albert

2:05–2:09 pm
Cervical Spine Sagittal Alignment After Anterior Versus Posterior Surgery
Yong Eun Cho

2:10–2:14 pm
C5 Root Palsy: Prevention
Thomas E. Mroz

2:15–2:19 pm
Refractory C5 Root Palsy: Nerve Transfer
Robert J. Spinner

2:20–3:00 pm
Questions and Discussion
**CADAVER LAB**

1:00–5:00 pm  
Marquis Ballroom  
Salons 1–3

Hands-on Cadaver Lab: Innovative Techniques in Minimally Invasive and Deformity Surgery (Non-CME)

**Course Directors:** Luis M. Tumialan, Rishi K. Wadhwa  
**Course Faculty:** Paul J. Houle, Sonia V. Eden, Larry T. Khoo, Sharad Raipal, Hugo Benalcazar, Bruce M. McCormack, Daniel Refai, Line Jacques, Allan D. Levi, Rajiv Midha, Eric L. Zager, Daniel M. Sciubba, Joseph O’Brien, Robert E. Isaacs, Ajit Krishnaney

**Course Description:** Participants will engage in hands-on learning of innovative new technologies in spine and peripheral nerve surgery. In this four-hour cadaver lab, participants will learn advanced techniques in minimally invasive, deformity spine surgery and peripheral nerve repair. Rotations will include various MIS and deformity approaches and instrumentation, as well as, peripheral nerve grafting. One-on-one instruction will be performed with experienced faculty using the latest state-of-the-art devices. Surgeons with limited prior experience will learn practical techniques to introduce into their clinical practice. Those with advanced experience will have the opportunity to share surgical technique refinement with expert faculty, and to survey a variety of new technologies.

Cadaver Lab is sponsored by

7:00–9:00 pm  
Marbella Room  
Young Neurosurgeons Dinner

**Speaker:** Volker K. H. Sonntag

All residents, fellows, and young neurosurgeons are invited to enjoy a delicious dinner with Meritorious Member Award Recipient, Volker K. H. Sonntag. RSVP required. Please RSVP by 6:00 pm, Thursday, March 9.

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**Educational Grant Provided By:**  
DePuy Synthes
PERIPHERAL NERVE, BASIC SCIENCE BREAKOUT

8:00–9:30 am Marquis Ballroom Salon 6

Moderators: Holly Gilmer, Daniel C. Lu, Shaun T. O’Leary, Eve C. Tsai
Speakers: Aruna Ganju, Bradley Jacobs, Ajit A. Krishnaney

Learning Objectives: Upon completion of this course, participants will be able to:
1. Analyze the findings of novel neurosurgical studies, critique the design and methodology of these studies.
2. List important areas for further knowledge development and research.
3. Compare indications and clinical outcomes for various management approaches to spine and peripheral nerve disorders.

8:00–8:02 am
250 The Correlation Between Definite Preoperative Differential Diagnosis and Pathologic Results of Nerve Biopsy
Linden Fornoff, Kyle Schmidt, Steven Tenny, Kenneth A. Follett

8:02–8:04 am
251 Neurologic Outcomes following Proximal Hamstring Avulsion and Repair
Thomas J. Wilson, Aaron Krych, Robert J. Spinner

8:04–8:06 am
252 Outcome Analysis of Common Peroneal Nerve Neuroplasty at the Lateral Fibular Head
John Souter, Kevin Swong, Vikram C. Prabhu

8:06–8:08 am
253 Osteopontin Enhances IGF-1 Signaling in Promoting Axon Regeneration After Nerve Injury in the Central Nervous System
Yi Lu, Hong Guo

8:08–8:10 am
254 Intra-operative Localization of Peripheral Nerves Using Ultrasound-guided Instrument Placement in Patients with Peripheral Nerve Pain Syndromes
P. Troy Henning, Thomas J. Wilson, Matthew Willsey, Jessi Koshy John, Miriana Popadich, Lynda Jun-San Yang
8:10–8:12 am
255 Development of a Sciatic Nerve Schwannoma Model for Surgical Simulation Using 3D Printing and Polymer Hydrogels
Jonathan Jay Stone, Shivali Mukerji, G. Edward Vates

8:12–8:14 am
256 Effectiveness of Distal Supercharge End-to-Side Nerve Repair for Neuroma In-continuity (NIC) Nerve Injury
Mustafa Nadi, Sudheesh Ramachandran, Yuval Shapira, Rajiv Midha, Joanne Forden, Abir Islam, Guifang Guo

8:14–8:16 am
257 Trends in Lower Extremity Nerve Injuries Using the National Inpatient Sample
Michael Jensen, Ryan Watkins, Michael Karsy, Jian Guan, Mark A. Mahan

8:16–8:18 am
258 Trends in Upper Extremity Nerve Injury Using the National Inpatient Sample Database
Ryan Watkins, Michael Jensen, Michael Karsy, Jian Guan, Mark Alexander Mahan

8:18–8:20 am
259 An Overlooked Cause of Neck Pain: Calcific Tendinitis of the Longus Colli
Hyun-Seung Rhyu, Jung-Kil Lee, Bong Ju Moon, Ki-Young Choi

8:20–8:24 am
Questions and Discussion

8:24–8:26 am
260 Ovarian Hormones Differentially Affect Pain Responsiveness in Plasma Membrane Calcium ATPase 2 (pmCA2) Heterozygous Mice
Veronika Khariv, Li Ni, Robert F. Heary, Stella Elkabes

8:26–8:28 am
262 A Novel Resorbable, Osteoconductive Tetracalcium Phosphate-phosphoserine Bone Adhesive for Spinal Fusion: Initial In Vivo Studies in a Rabbit Posterolateral Fusion Model
Howard Eisenbrock, Brian J. Hess, George W. Kay, Michael C. Brown, David J. Kosh, Andrey Marchenko, Jonathan R. Slotkin, Eric J. Woodard

8:28–8:30 am
263 Bioresorbable Electrical Stimulator for Improved Bone Regeneration
**MEETING AGENDA**

**8:30–8:32 am**
264 Design and Evaluation of Bioresorbable Spinal Cord Stimulator

**8:32–8:34 am**
265 Toll-like Receptor 9 Antagonism Inhibits Spinal Cord Astrocyte Proliferation and Migration
Lun Li, Li Ni, Eliseo Eugenin, Robert F. Heary, Stella Elkabes

**8:34–8:36 am**
266 Deficient Toll-like Receptor 4 Signaling Alters Chondroitin Sulfate Proteoglycan Expression Following Spinal Cord Injury in Mice
Viren Sahai Vasudeva, Jared Groff, Nandhu M. Sobhana, Mariano S. Viapiano

**8:36–8:38 am**
267 A Toll-like Receptor (TLR) 9 Antagonist Restores Astroglial Glutamate Transporter Expression in the Dorsal Horn (DH) Following Spinal Cord Injury (SCI): Implications for Below-level Neuropathic Pain
Alexandra Pallottie, Ayomi Ratnayake, Li Ni, Robert F. Heary, Stella Elkabes

**8:38–8:40 am**
268 Spinal Cord Injury Disrupts Resting-state Networks in the Human Brain
Ammar H. Hawasli, Jerrel Rutlin, Rory K.J. Murphy, Eric C. Leuthardt, Joshua S. Shimony, Wilson Zachary Ray

**8:40–8:42 am**
269 Increased Cortical Plasticity is a Driver of Recovery of Function in Spinal Cord Injury
David Gimbel, Cafferty William, Stephen Strittmatter

**8:42–8:48 am**
Questions and Discussion

**8:48–8:50 am**
270 Do Somatosensory Evoked Potential (SSEP) Changes Increase the Probability of a Postoperative Neurological Deficit Following Posterior Cervical Decompression Surgery?
Gurpreet Surinder Gandhoke, Jaspreet Kaur, Yash Kalpesh Pandya, Zachary J. Tempel, Donald Crammond, Jeffrey Balzer, Parthasarthy Thirumala, Adam S. Kanter

**8:50–8:52 am**
271 Chondroitinase ABC Pretreatment Enhances Functional Repair of the Chronically Injured Cervical Spinal Cord by Induced Pluripotent Stem Cell-derived Neural Stems Cells
Christopher Saagar Ahuja, Hidenorii Suzuki, Ryan Salewski, lijun li, Kajana Šatkunendrarajah, Narihito Nagoshi, Michael G. Fehlings
8:52–8:54 am
272 SmaRT Human Stem Cells to Optimize Regeneration of the Traumatically Injured Spinal Cord
Mohamad Khazaie, Christopher Saagar Ahuja, Michael G. Fehlings

8:54–8:56 am
274 Rehabilitation of Hand Function After Spinal Cord Injury Using a Novel Handgrip Device: A Prospective Cohort Study
Haydn Hoffman, Tiffany Sierro, Tianyi Niu, Melanie Sarino, Majid Sarrafzadeh, David L. McArthur, Reggie Edgerton, Daniel C. Lu

8:56–8:58 am
275 The Effects of Hypothermia on Functional Outcomes Following Simulated Iatrogenic Spinal Cord Injury
Ahmed Jorge, Parthasarathy D. Thirumala, Shreya Umredkar, Erika Fish, Rohan Krishnan

8:58–9:00 am
276 Interim Safety and Efficacy Findings from the SCIStar Study—A Phase 1/2a Trial of Human Embryonic Stem Cell-derived Oligodendrocyte Progenitor Cells (AST-OPC1) in Patients with Subacute Cervical Spinal Cord Injury
Richard G. Fessler, Donald Leslie, Gary K. Steinberg, Charles Y. Liu, Shekar N. Kurpad, Kevah Khajavi, Jane Lebkowski, Edward Wirth

9:00–9:02 am
277 INSPIRE Study Update on 10 Acute Complete Spinal Cord Injury Patients Implanted with a Biodegradable Polymer Scaffold
Domagoj Coric, Nicholas Theodore, Kee Duk Kim, Patrick Hsieth, Wilson Zachary Ray, K. Stuart Lee, Travis Michael Dumont, Kristen Neff, Lisa Crockett, Alex Aimetti, Thomas Ulich, Lorianne Masouka

9:02–9:04 am
278 Efficacy and Safety of Riluzole in Acute Spinal Cord Injury (SCI): Rationale and Design of AOSpine Phase III Multi-center Double-blinded Randomized Controlled Trial (RISCIS)
Michael G. Fehlings, Branko Kopjar, Robert G. Grossman

9:04–9:06 am
279 Magnetic Resonance Imaging (MRI) Does Not Distinguish between Contusion and Compound Cord Lesions Following Severe (AIS A) Traumatic Acute Thoracic Cord Injury: Intraoperative Microsurgical Observations from the INSPIRE Trial

9:06–9:12 am
Questions and Discussion
DEBATE

9:12–9:30 am Marquis Ballroom Salon 6

9:12–9:14 am
Case Presentation: Cervical Spondylosis with T2 Signal Change in the Cord
Bradley Jacobs

9:14–9:22 am
Surgery without Monitoring
Ajit A. Krishnaney

9:22–9:30 am
Surgery with Monitoring
Aruna Ganju

QUALITY, HEALTHCARE POLICY, AND GENERAL BREAKOUT

8:00–9:30 am Marquis Ballroom Salon 7

Moderators: Nathaniel P. Brooks, Sharad Rajpal
Speakers: Andrew T. Dailey, Daniel K. Resnick

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.
- Discuss implications of current and future healthcare policy changes on spine care.

8:00–8:02 am
280 Hospital-acquired Conditions in Spine Procedures
Layton Lamsam, Ian David Connolly, Anand Veeravagu, John K. Ratliff

8:02–8:04 am
281 Risk Adjustment Modeling for Surgical Site Infection in the Michigan Spine Surgery Improvement Collaborative (MSSIC): Results from 7,150 Lumbar Patients
Victor Chang, Michael Bazydlo, Lonni Schultz, David Nerenz, Jason M. Schwalb, Muwaffak Abdulhak, Stephen Bartol

8:04–8:06 am
282 Lumbar Spine Surgical Site Infection Prevention with a Systematized Peri-operative Protocol: A Propensity Matched Multidepartmental Multiyear Retrospective Cohort Study
Vijay Yanamadala, Thomas D. Cha, Louis G. Jenis, Joseph Schwab, Bryan D. Choi, Brian V. Nahed, Jean-Valery Coumans, Lawrence F. Borges, John H. Shin
283 Posterior Cervical Spine Surgical Site Infection Prevention with a Systematized Peri-operative Protocol: A Propensity Matched Multidepartmental Multiyear Retrospective Cohort Study
Vijay Yanamadala, Thomas D. Cha, Louis G. Jenis, Bryan D. Choi, Jean-Valery Coumans, Lawrence F. Borges, John H. Shin

284 Prophylactic Use of Intra-operative Vancomycin Powder and Post-operative Infection: An Analysis of Microbiological Patterns in 1,200 Consecutive Surgical Cases

285 Implementation of an Infection Prevention Bundle and Increased Physician Awareness Improve Surgical Outcomes and Reduce Costs Associated with Spine Surgery: A 10-year Experience
Prateek Agarwal, Nitin Agarwal, Ashley Querry, Zachary J. Tempel, Robert M. Friedlander, Peter C. Gerzsten, D. Kojo Hamilton, David O. Okonkwo, Adam S. Kanter

286 Coagulation Profile as a Risk Factor for 30-day Morbidity and Mortality Following Posterior Lumbar Fusion
Rachel S. Bronheim, Eric Karl Oermann, Samuel K. Cho, John M. Caridi

287 90-day Rehospitalization After Lumbar Spinal Fusion Surgery in New York State Between 2005 and 2014: A 10-year Meta-analysis of the Statewide Planning and Research Cooperative System (SPARCS)
Gernot Lang, Ali A. Baaj, Mauricio J. Avila, Jialin Mao, Wei-Chun Hsu, Roger Härtl, Art Sedrakyan

288 Predictors of Readmission, Reoperation, and Venous Thromboembolic Complications After Spine Surgery: A Single-institution Experience with 6,870 Consecutive Patients
Michael Brendan Cloney, Ekamjeet Dhillon, Helena Roberts, Zachary A. Smith, George R. Cybulski, Tyler R. Koski, Nader S. Dahdaleh
8:18–8:20 am
292 Using PROMIS Health Domains in Spine Surgery: An Evaluation of Responsiveness and Concurrent Validity

8:20–8:24 am
Questions and Discussion

8:24–8:26 am
290 A Modified Risk Assessment and Prediction Tool for Predicting Discharge Destination Following Lumbar Surgery: A Multicenter Analysis of 937 Patients from the Quality Outcomes Database
Jian Guan, John J. Knightly, Erica Fay Bisson

8:26–8:28 am
291 Patient Expectations and Preferences in the Spinal Surgery Clinic
Elizabeth Kuhn, Matthew Christopher Davis, Borna E. Tabibian, Patrick R. Pritchard

8:28–8:30 am
289 Preventing Promulgation of Inaccurate Complications
John J. Knightly, Scott A. Meyer, Andrew Koslov, Sherry Ninni

8:30–8:32 am
293 Effect of Insurance Status on Patient-reported Outcomes for Lumbar Stenosis Patients Treated Surgically
Galal El-Sayed, Samuel McClugage, III, Esther Dupepe, Matthew Christopher Davis, Mark N. Hadley, Beverly C. Walters

8:32–8:34 am
294 Barriers to the Use of Patient-reported Outcomes in Spine Care in Latin America: Rationale of the AOSLA Quality Assessment Registry
Asdrubal Falavigna, Alisson R. Teles, Zoher Ghogawala

8:34–8:36 am
295 The Effect of Prior Surgery on Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) Scores in Lumbar Spine Surgery Patients
Robert Winkelman, Jay M. Levin, Gabriel Alexander Smith, Michael P. Steinmetz, Thomas E. Mroz

8:36–8:38 am
296 The Association Between Patient Satisfaction and Clinical Outcomes in Lumbar Spine Surgery
Jay M. Levin, Robert Winkelman, Gabriel Alexander Smith, Thomas E. Mroz, Michael P. Steinmetz

8:38–8:40 am
297 The Impact of Depression on Patient Satisfaction in a Lumbar Spine Surgery Population
Jay M. Levin, Gabriel Alexander Smith, Robert Winkelman, Thomas E. Mroz, Michael P. Steinmetz
8:40–8:42 am
298 The Impact of Preoperative Depression Diagnosis on Outcomes Following Lumbar Arthrodesis
Chloe O’Connell, Anand Veeravagu, Tej Deepak Azad, Eli Johnson, Vaishali Mittal, Daniel Vail, John K. Ratliff

8:42–8:44 am
299 Psychological Burden of Musculoskeletal Diseases: Investigation on Spine, Hip and Knee In-hospital Patients
Bassel G. Diebo, Cyrus M. Jalai, Gregory W. Poorman, Qais Naziri, Samantha R. Horn, Thomas Errico, Ashish Patel, Virginie Lafage, Carl Paulino, Peter G. Passias

8:44–8:48 am
Questions and Discussion

8:48–8:50 am
300 Lumbar Spine Fusion: A RAND/UCLA Appropriateness Study

8:50–8:52 am
301 Low-cost Accelerometers in Spine Surgery: Preliminary Results from a Prospective Validation Study
Paymon Rezaii, Allen Ho, Arjun Vivek Pendharker, Eric S. Sussman, John K. Ratliff, Atman Desai

8:52–8:54 am
302 Comparison of Patient Outcomes and Cost of Overlapping Versus Non-overlapping Spine Surgery
Corinna Clio Zygourakis, Saman Sizdahkhani, Malla K. Keefe, Janelle Lee, Praveen V. Mummaneni, Christopher P. Ames

8:54–8:56 am
303 Geographic and Hospital Variation in Cost of Lumbar Laminectomy and Lumbar Fusion for Degenerative Conditions
Corinna Clio Zygourakis, Caterina Liu, Glenn Wakam, Chris Moriates, Christy Boscardin, Adams Dudley, Ralph Gonzales, John K. Ratliff, Praveen V. Mummaneni, Christopher P. Ames

8:56–8:58 am
304 Four-year Cost Analysis for the Spinal Laminectomy Versus Instrumented Pedicle Screw (SLIP) Trial
Vijay Ravindra, Robert G. Whitmore, Jill Curran, Subu N. Magge, Zohar Ghogawala
8:58–9:00 am
Christopher D. Witiw, Fabrice Smieliauskas, John E. O’Toole, Michael G. Fehlings, Richard G. Fessler

9:00–9:02 am
306 Drivers of 90-day Cost After Anterior Cervical Discectomy and Fusion for Degenerative Disease
Ahilan Sivaganesan, Silky Chotai, Matthew J. McGirt, Clinton J. Devin

9:02–9:04 am
307 Anterior Cervical Diskectomy and Fusion (ACDF) in the Ambulatory Care Setting: Defining its Value Across the Acute and Post-acute Care Episode
Matthew J. McGirt, Saniya S. Godil, Tim E. Adamson, E. Hunter Dyer, Silky Chotai, Anthony L. Asher, Domagoj Coric

9:04–9:06 am
308 Posterior Micro-endoscopic Discectomy Versus ACDF for Single-level Radiculopathy: Comparative Effectiveness and Cost-utility Analysis
Matthew J. McGirt, E. Hunter Dyer, Domagoj Coric, Silky Chotai, Anthony L. Asher, Tim E. Adamson

9:06–9:08 am
309 Navigating Risk in a Capitated or Bundled Payment Model for Spine Surgery: Introduction of the Carolina-Semmes Prediction Tool
Matthew J. McGirt, Scott L. Parker, Silky Chotai, Deborah Pfortmiller, Jeffrey M. Sorenson, Kevin T. Foley, Anthony L. Asher

9:08–9:12 am
Questions and Discussion

DEBATE

9:12–9:30 am
Marquis Ballroom Salon 7

9:12–9:21 am
Patient Satisfaction Scores are Meaningful
Andrew T. Dailey

9:21–9:30 am
Patient Satisfaction Scores are Meaningless
Daniel K. Resnick
SPINAL TUMOR, GENERAL SPINE 3 BREAKOUT

8:00–9:30 am Marquis Ballroom Salon 8

Moderators: Marcella A. Madera, Ehud Mendel
Speakers: Dean Chou, Ziya L. Gokaslan, John H. Shin

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.
- Compare indications and clinical outcomes for various management approaches to spinal tumors.

8:00–8:02 am
310 Genetic Influences of Lumbar Disk Herniation in Young Patients
Travis Fulton, C. Rory Goodwin, A. Karim Ahmed, Daniel M. Sciubba, Nicholas Theodore

8:02–8:04 am
311 Epidural Corticosteroids Infiltrations for Lumbar Stenosis: A Prospective Study
Majd G. El Hajj Moussa, Charbel Tawk, Georges Nohra, Souhail Chamandi, Fadi Hoyek, Jean-Claude Lahoud

8:04–8:06 am
312 The Clivoaxial Angle is Associated with Development of Adjacent Segment Pathology After Craniocervical Fusion
Shashank Gandhi, Salvatore Insinga, Timothy G. White, Ahmad Latefi, Harold L. Rekate

8:06–8:08 am
313 The Effect of Smoking Status on Instrumentation Success After rhBMP-2 Supplemented Lumbar Fusion Constructs
Mohamed Macki, Sbaa Syeda, Kenan Rajjoub, Panagiotis Kerezoudis, Ali Bydon, Jean-Paul Wolinsky, Timothy F. Witham, Daniel M. Sciubba, Mohamad Bydon, Ziya L. Gokaslan

8:08–8:10 am
314 Micro Versus Macrodiscectomy: Does Use of the Microscope Reduce Complication Rates?
Meghan Murphy, Jeffrey Hakim, Panagiotis Kerezoudis, Jennifer Grauberger, Mohammed Ali Alvi, Daniel S. Ubi, Elizabeth B. Habermann, Mohamad Bydon

8:10–8:12 am
315 Extraforaminal Disk Herniations: What is the Best Approach? A Systematic Review and Meta-analysis
Oluwaseun Akinduro, Panagiotis Kerezoudis, Jamachi Eluchie, Jang W. Yoon, Mohamad Bydon
8:12–8:14 am
316 Pseudarthrosis in Patients Undergoing Multilevel Posterior Cervical or Cervical-thoracic Fusions: Multi-center Analysis
Eric Truumees, Devender Singh, Matthew Geck, John K. Stokes

8:14–8:16 am
317 Transforaminal Lumbar Interbody Fusion (TLIF) with Crescent-shaped, Expandable Lordotic Cage Provides Improved Lumbar Lordosis Compared to Static Cages, and Equivalent Lordosis when Compared to Tradition Smith-Petersen/Ponte Type Osteotomies
Akil Patel, Joshua Alexa, Evan Lewis, Charles A. Sansur, David M. Ibrahimi

8:16–8:18 am
318 A Retrospective Observational Study on the Treatment Outcomes of 26 Patients with Spinal Cord Astrocytoma Including Two Cases of Malignant Transformation
Yong-Eun Cho, Seong Jun Ryu, Dal-Sung Ryu, Kyung-Hyun Kim, Jeong-Yoon Park, Sung-Uk Kuh, Dong-Kyu Chin, Keun-Su Kim, Se Hoon Kim

8:18–8:20 am
319 Application of Direct Reprogramming Technology to Treat Malignant Spinal Cord Glioma
Yoon Ha, Jin Soo Oh, Dong Ah Shin, Seong Yi, Keung Nyun Kim, Do Hoon Yoon

8:20–8:24 am
Questions and Discussion

8:24–8:26 am
320 Diagnostic Utility of Intraoperative Neurophysiologic Monitoring for Intramedullary Spinal Cord Tumors: Systematic Review and Meta-analysis
Tej Deepak Azad, Arjun Vivek Pendharkar, Viet Nguyen, James Pan, Ian David Connolly, Anand Veeravagu, Rita Popat, John K. Ratliff, Gerald A. Grant

8:26–8:28 am
321 Somatosensory Evoked Potentials (SSEP) Changes and Development of New Postoperative Neurological Deficits in 53 Patients Undergoing Surgery for Spinal Cord Tumors
Jaspreet Kaur, Garpreet Surinder Gandhoke, Kourosh Tavanaiepour, Zachary J. Tempel, Donald Crammond, Jeffrey Balzer, Parthasarthy Thirumala, Adam S. Kanter

8:28–8:30 am
322 Independent Osteo-tropic Metastogenic Clones in Polymetastatic Renal Cell Carcinoma
Nelson Moussazadeh, Samuel H. Berman, Ilya Laufer, Mark H. Bilsky, Jorge Reis-Filho, Cameron Brennan
8:30–8:32 am  
323 Micro-invasive Uninstrumented Spinal Tumor Decompression (MUST-D) for Spinal Metastases  
Arthur L. Jenkins, Stanislaw Sobotka, Kyle J. Riley, Asif Javed, Jordan Patrick Hall

8:32–8:34 am  
324 Management of Extranodal Lymphoma of the Spine: A Study of 30 Patients  
Shamsudini Hashi, C. Rory Goodwin, A. Karim Ahmed, Taylor Elise Purvis, Nancy A. Abu-Bonsrah, Benjamin D. Elder, Genevieve Crane, Daniel M. Sciubba

8:34–8:36 am  
325 Complications Associated with Prolonged Length of Stay After Surgery for Metastatic Spinal Tumors  

8:36–8:38 am  
326 Preoperative Risk Stratification in Spine Tumor Surgery—A Comparison of Three Assessment Scores  
Nikita Lakomkin, Blaine Stannard, Scott L. Zuckerman, Justin Virojanapa, Joaquin Camara-Quintana, Luis Kolb, Julio Montejo, Joseph S. Cheng

8:38–8:40 am  
327 Predicting Survival in Patients with Spinal Metastatic Disease: A New Survival Index  
Dominic Nistal, Daniel Wei, Stanislaw Sobotka, Michael Martini, Arthur L. Jenkins

8:40–8:42 am  
328 Application of Morphometrics as a Predictor for Survival in Patients with Prostate Cancer Metastasis to the Spine  
Hesham Mostafa Zakaria, Lara Walsh Massie, Azam Basheer, David Boyce-Fappiano, Erinna Elibe, Lomni Schultz, Farzan Siddiqui, Brent Griffith, Ian Yu Lee, Victor Chang

8:42–8:44 am  
329 Surgical Timing Affect Survival in Patients with Cervical Metastasis  
Jong Hyeok Park, Sun-Ho Lee, Eun-Sang Kim, Whan Eoh

8:44–8:48 am  
Questions and Discussion

8:48–8:50 am  
330 Racial Disparities in Receiving Surgery and Survival in Patients with Primary Osseous Spinal Neoplasms  
Sayantan Deb, Matthew Schoen, Arjun Vivek Pendlhkar, Sean Altekruse, John K. Ratliff, Atman Desai
8:50–8:52 am
331 Distal Hard Palate Resection Allows for Increased Odontoid Resection from an Endoscopic Transnasal Approach Without Significant Dysphagia or Airway Complications
Joshua E. Loewenstein, Edward Yap, Brian Thorpe, Deb A. Bhowmick

8:52–8:54 am
332 A Comparison of Operative Time with Conventional Fluoroscopy Versus Spinal Neuronavigation in Instrumented Spinal Tumor Surgery
James A. Miller, Andrew J. Fabiano

8:54–8:56 am
333 Myositis Following Spine Radiosurgery for Metastatic Disease: A Case Series
Dennis T. Lockney, Angela Jia, Eric Lis, Natalie Lockney, Chengbao Liu, Benjamin Hopkins, Daniel Higginson, Yoshiya Josh Yamada, Ilya Laufer, Mark H. Bilsky, Adam Schmitt

8:56–8:58 am
334 Stereotactic Radiosurgery Versus Surgical Resection for Spinal Hemangioblastoma: A Systematic Review
Kelly Bridges, Khoi Duc Than

8:58–9:00 am
335 CyberKnife Stereotactic Radiosurgery for the Treatment of Symptomatic Vertebral Hemangiomas: A Single Institution Experience
Michael Zhang, Yi-Ren Chen, Steven D. Chang, Anand Veeravagu

9:00–9:02 am
336 Low-dose Stereotactic Body Radiotherapy for Spinal Metastases has Reduced Vertebral Body Fracture Rates While Maintaining Local and Pain Control
Kevin D. Kelley, Shashank Gandhi, Emile Gogineni, Cristina Sison, Katherine Wagner, Beatrice Bloom, Louis Potters, Maged Ghaly, Ahmad Latefi

9:02–9:04 am
337 Does Kyphoplasty Prior to Spine SBRT for Osseous Tumors Affect Local Control? A Retrospective Series Review
Ori Barzilai, Natalie DiStefano, Eric Lis, Yoshiya Josh Yamada, Mark H. Bilsky, Ilya Laufer

9:04–9:06 am
338 Stereotactic Radiosurgery for Intradural Spine Tumors Using Cone Beam Computed Tomography (CBCT) Image Guidance
Alp Ozpinar, Andres Monserrate, Benjamin M. Zussman, Ajay Niranjan, John Flickinger, Peter C. Gerszten
339 Predictors of Complications and Readmission Following Spinal Stereotactic Radiosurgery
Daniel Lubelski, Joseph E. Tanenbaum, Taylor Elise Purvis, Thomas Bomberger, C. Rory Goodwin, Ilya Laufer, Daniel M. Sciubba

9:08–9:12 am
Questions and Discussion

9:12–9:30 am
Marquis Ballroom Salon 8

DEBATE

9:12–9:14 am
Case Presentation: Solitary Renal Cell Met
John H. Shin

9:14–9:22 am
En Bloc Resection
Ziya L. Gokaslan

9:22–9:30 am
Minimally Invasive Separation Surgery with Radiosurgery
Dean Chou

GENERAL SPINE 4 BREAKOUT

8:00–9:30 am
Marquis Ballroom Salons 4/5

Moderators: Hsuan-Kan Chang, Christoph Hofstetter

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 the most important ongoing clinical trials.

8:00–8:02 am
340 Adjacent-level Degeneration in the Lumbar Spine: Biomechanical Evaluation of a Novel Combination Cortical and Pedicle Screw Construct
James Leonard West, Wesley Hsu

8:02–8:04 am
341 Patient-reported Outcomes After Two-Level Anterior Cervical Discectomy and Fusion Versus Single-level Corpectomy for Cervical Myelopathy: An Analysis of a Quality Outcomes Database Cohort
Taylor Sommer, Jian Guan, Vijay Ravindra, Andrew T. Dailey, Robert S. Hood, Meic H. Schmidt, Erica Fay Bisson
8:04–8:06 am
342 Aesthetic Comparison Between Subcuticular Suture and Staple Closure of Anterior Cervical Spine (ACS) Incision Scars: A Prospective Controlled Single-blinded Clinical Trial
Sina Rajamand, Diana Kakos, Doris Tong, Teck Mun Soo

8:06–8:08 am
343 Systematic Review of Patient-specific Surgical Simulation: Next Step in Advancing Medical Education
Won Hyung (Andrew) Ryu, Navjit Dharampal, Ahmed Mostafa, Ehud Sharlin, Gail Kopp, Bradley Jacobs, R. John Hurlbert, Sonny Chan, Garnette R. Sutherland

8:08–8:10 am
344 The Influence of Manual Bending Spinal Rods on Construct Fatigue Life
Joseph E. Tanenbaum, Gabriel Alexander Smith, Stephen Kral, James Barber, Michael P. Steinmetz

8:10–8:12 am
345 Safety and Accuracy of Freehand Versus Navigated C2 Pedicle/Pars Screw Placement
Randall Hlubek, Michael Bohl, Clinton David Morgan, Tyler Scott Cole, Jay D. Turner, Udaya K. Kakarla

8:12–8:14 am
346 The Safety and Efficacy of Outpatient Anterior Cervical Discectomy and Fusion
Michael Weiss, Zoltan Bereczki, Stefan Prada, Jed Paul Weber, Michael P. Perry, Chip Wade, Reginald J. Davis

8:14–8:16 am
347 Spine Surgery A Mari Usque Ad Mare: Pre-operative Patient Metrics Across Canada
Godefroy Hardy St-Pierre, Michael M.H. Yang, R. John Hurlbert

8:16–8:18 am
348 Prognostic Utility of Pain Diagrams for Predicting Surgical Intervention Among Spine Referrals
Michael M.H. Yang, Khaled Almansoori, Godefroy Hardy St-Pierre, Stephan DuPlessis

8:18–8:20 am
349 Potential Mechanism of Injury During Cervical Spine Procedures as an Etiology for Post-operative C5 Palsy—An Anatomical Study
Fernando Enrique Alonso, Vlad Voin, David Hanscom, Jens Chapman, Rod J. Oskouian, Jr., R. Shane Tubbs

8:20–8:24 am
Questions and Discussion

8:24–8:26 am
350 Occipital-Cervical Fusion in Patients with Chiari Malformations and Connective Tissue Diseases: A Review of Practices and Guidelines
Mauricio J. Avila, Jeffrey P. Greenfield, Ali A. Baaj
8:26–8:28 am
351 Inadvertent Durotomies During Spine Surgery are not Subject to the “July Effect”
Angela Richardson, Joanna Elizabeth Gernsback, Allan D. Levi

8:28–8:30 am
352 Nested Transforaminal Lumbar Interbodies: Increasing the Dimensions of the Interbody Footprint to Match Transpsoas and Anterior Graft Size
Luis M. Tumialan, Angelina N. Garvin, Frederick F. Marciano

8:30–8:32 am
353 Is Three Months an Appropriate Time to Evaluate Clinical Outcomes After Anterior Cervical Discectomy and Fusion?
Marcus D. Mazur, Erica Fay Bisson

8:32–8:34 am
354 Thirty-day Outcomes of Thoracolumbar Spinal Fusion Surgery in Extreme Obesity
Jacob R. Joseph, Brandon Smith, Jennifer Neva, M. Oakley Strasser, Xilin Liu, Yamaan Saadeh, Paul Park

8:34–8:36 am
355 Trends in the Use of Patient-reported Outcome Instruments in Neurosurgical Adult Thoracolumbar Deformity and Degenerative Disease Literature
Hanna Algattas, Jonathan A. Cohen, Nitin Agarwal, D. Kojo Hamilton

8:36–8:38 am
356 Fusion Rate, Dysphagia, and Patient Satisfaction for 4-level Anterior Cervical Decompression and Fusion (ACDF)
Ratnesh Nandan Mehra, Richard F. Cook, Doris Tong, Teck Mun Soo

8:38–8:40 am
357 Prediction of Clinical Outcomes After Transforaminal Lumbar Interbody Fusions Based on Preoperative Opioid Use
Alan T. Villavicencio, Lee Nelson, Vinod Kantha, Sharad Rajpal, Sigita Burneikiene

8:40–8:42 am
358 Sitting Radiographs Use is a Novel Preoperative Planning Tool in Patients Undergoing Surgery for Degenerative Spinal Disease
Muhammad Burhan Janjua, Jared Tishelman, Gregory W. Poorman, Aaron James Buckland, Themistocles Protopsaltis

8:42–8:44 am
359 Preoperative Hyponatremia and Perioperative Complications in Cervical Spinal Fusion
Thomas Thallner Bomberger, Joseph E. Tanenbaum, Daniel Lubelski, Edward C. Benzel, Michael P. Steinmetz, Thomas E. Mroz

8:44–8:48 am
Questions and Discussion
8:48–8:50 am
360 FEA Model Demonstrates Fully Expanded TLIF Spacers Provide More Lordosis, Less Foraminal Compression, and More Endplate Stress than Static Spacers: The Relationship to Implant Positioning
Noelle F. Klocke, Wenhai Wang, Karthik Madhavan, Wilson Z. Ray, MD, Anthony J. Russo, Steven Vanni, Lee Onn Chieng, Anmar H. Hawasli, Christoph Paul Hofstetter, Brandon Bucklen

8:50–8:52 am
361 Assessment of Sagittal Balance Post TLIF—Are We Kyphosing the Lumbar Spine
Karthik Madhavan, Alan Gregory Shamrock, Lee Onn Chieng, Steven Vanni, Michael Y. Wang

8:52–8:54 am
362 Predictors of Adjacent Segment Disease in Anterior Lumbar Interbody Fusion and Transforaminal Lumbar Interbody Fusion

8:54–8:56 am
363 Biomechanical Characterization of an Anterior Cervical Plate Capable of Extreme Oblique Screw Angulation: Does Angulation Affect Construct Rigidity?
Chris M. Ferry, Anup Gandhi, Sam Farmer, Tom Glorioso, Jason Inzana, John E. Wanebo, Ripul Rajen Panchal

8:56–8:58 am
364 Robot-guided Pedicle Screw Fixation for Lumbar Spondylolisthesis—Long-term Clinical Outcomes and Revisions
Marc L. Schröder, Victor E. Staartjes

8:58–9:00 am
365 Preemptive Analgesia for Postoperative Pain Relief in Thoraco-lumbo-sacral Spine Operations: A Double-blind, Placebo-controlled, Randomized-controlled Trial
Linda S. Aglio, Muhammad M. Abd-El-Barr, Vwaire Orhurhu, Grace Kim, Jie Zhou, Laverne Gugino, Lisa Crossley, James Gosnell, John Chi, Michael W. Groff

9:00–9:02 am
366 Impact of Age on Change in Self-image Five Years After Complex Spinal Fusion (≥5 Levels)
Owoicho Adogwa, Aladine A. Elsamadicy, Amanda Sergesketter, Keith Bridwell, Isaac O. Karikari

9:02–9:04 am
367 Comparisons Between Extraforaminal Approach and Contralateral Approach to Lumbar Foraminal Disc Herniations
Joon Young Ahn, Se Young Pyo, Ho Soo Kim, Young Tae Jung
9:04–9:06 am
368 Comparative Analysis of Fusionless Surgery Versus Fusion Extension as the Treatment of L5-S1 Adjacent Segment Disease After a Lumbar Fusion Surgery That Stops at L5
Un Young Choi, Dal-Sung Ryu, Kyung-Hyun Kim, Jeong-Yoon Park, Sung-Uk Kuh, Dong-Kyu Chin, Keun-Su Kim, Yong-Eun Cho

9:06–9:08 am
369 Biomechanical Analysis of S2 Alar Iliac (S2AI) Screw Fixation
Sung Hyun Noh, Man-Kyu Choi, Dong Ah Shin, Kyung-Hyun Kim, Jeong-Yoon Park, Sung-Uk Kuh, Dong-Kyu Chin, Keun-Su Kim, Yong-Eun Cho

9:08–9:12 am
Questions and Discussion

9:12–9:14 am
370 Contralateral Approach for the Treatment of Lumbar Spinal Stenosis in Combination with Foraminal Disc Herniations
Se Young Pyo, Sang Hyeong Jun, Ho Soo Kim, Young Tae Jung

9:14–9:16 am
371 Comparison of Radiologic Outcomes of Three Different Methods in Single-level Anterior Cervical Discectomy and Fusion; Stand-alone Cage Versus PEEK-titanium Combined Anchored Cage Versus Anterior Cervical Plate Fixation
Jong Uk Hwang, Geun Sung Song, Dong Wuk Son

9:16–9:18 am
372 The Effect of Uncinate Process Resection on Subsidence Following Anterior Cervical Discectomy and Fusion
Geun Sung Song, Dong Wuk Son, Sang Weon Lee; Jun Seok Lee, Jong Wuk Hwang, Su Hun Lee, Sun Ki Sung

9:18–9:20 am
373 Randomized Controlled Study of Percutaneous Epidural Neuroplasty Using Racz Catheter and Epidural Steroid Injection in Cervical Disc Disease
Chang Hyun Oh, Gyu Yeul Ji, Dong Ah Shin

9:20–9:22 am
374 Clinical Course of Cervical Percutaneous Epidural Neuroplasty in Single-level Cervical Disc Disease with 12-month Follow-up
Chang Hyun Oh, Gyu Yeul Ji, Dong Ah Shin

9:22–9:24 am
375 Triple Injection Therapy Including Neuropathy, Musculopathy, and Enthesopathy Improved Non-specific Chronic Lower Back Pain After Post Surgery Syndrome
Chang Hyun Oh, Seung Hwan Yoon

9:24–9:30 am
Questions and Discussion
MEETING AGENDA

9:30-10:00 am  Marquis Ballroom Foyer
Beverage Break

CAHILL CONTROVERSIES

10:00 am–12:00 pm  Marquis Ballroom Salons 4/5

Moderators: Daniel J. Hoh, Adam S. Kanter
Speakers: Joseph S. Cheng, Richard G. Fessler, Michael W. Groff, Tyler R. Koski, Frank La Marca, Gerald E. Rodts, Charles A. Sansur, Luis M. Tumialan, Juan S. Uribe, Christopher E. Wolfe

Learning Objectives: Upon completion of this course, participants will be able to:

- Compare indications, treatment, and outcome with focal decompression versus sagittal realignment surgery.
- Analyze indications, treatment, and outcome with decompression only versus decompression and fusion for lumbar synovial cyst.
- Discuss benefits versus challenges of performing anterior cervical discectomy and fusion in an ambulatory setting.
- Describe conservative versus surgical treatment in the elderly with minimally symptomatic cervical stenosis.
- Analyze strategies for treating minimally symptomatic proximal junctional kyphosis.

10:00–10:04 am
Case Presentation: Lumbar Stenosis with PI–LL Mismatch

10:04–10:12 am
Decompression Only
Michael W. Groff

10:12–10:20 am
Sagittal Realignment
Frank La Marca

10:20–10:24 am
Discussion

10:24–10:28 am
Case Presentation: Lumbar Synovial Cyst

10:28–10:36 am
Decompression Only
Joseph S. Cheng

10:36–10:44 am
Decompression and Fusion
Charles A. Sansur

10:44–10:48 am
Discussion
10:48–10:52 am
Case Presentation: 2 Level ACDF

10:52–11:00 am
Treat in Ambulatory Surgery Center
Luis M. Tumialan

11:00–11:08 am
Treat in Inpatient Hospital
Gerald E. Rodts

11:08–11:12 am
Discussion

11:12–11:16 am
Case Presentation: Elderly Patient with Minimally Symptomatic Cervical Stenosis

11:16–11:24 am
Manage Conservatively
Christopher E. Wolfla

11:24–11:32 am
Treat Surgically
Richard G. Fessler

11:32–11:36 am
Discussion

11:36–11:40 am
Case Presentation: Patient with Proximal Junctional Kyphosis

11:40–11:48 am
Traditional Surgical Techniques to Prevent PJK
Tyler R. Koski

11:48–11:56 am
Minimally Invasive Techniques to Prevent PJK
Juan S. Uribe

11:56–12:00 pm
Discussion

12:00 pm
Meeting Adjourns
Thank you
The following companies have provided an educational grant in support of the Annual Meeting

DePuy Synthes
Medtronic
Stryker
Globus Medical
Brainlab
Zimmer Biomet

Thank you
The following companies have provided in-kind equipment

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Medtronic
Stryker
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INDICATIONS
The Rialto™ SI Fusion System is intended for sacroiliac joint fusion for conditions including sacroiliac joint disruptions and degenerative sacroiliitis.

RISKS
- Pain, discomfort, or abnormal sensations caused by the presence of the implant.
- Migration, loosening, or fracture of the implant.

Experience Virtual Reality for the Rialto™ SI Fusion System in the Leon room located across from the general session.
SPINE SUMMIT 2017

EXHIBIT HALL HOURS

Thursday, March 9
9:00 am–4:30 pm

Friday, March 10
9:00 am–1:00 pm
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Accreditation

This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of Congress of Neurological Surgeons and the Section on Disorders of the Spine and Peripheral Nerves. The Congress of Neurological Surgeons is accredited by the ACCME to provide continuing medical education for physicians.

AMA Credit Designation Statement

The CNS designates this live activity for a maximum of 23 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

CME Credit

A maximum of 15.75 AMA PRA Category 1 Credits™ may be earned for Scientific Sessions only.

Mid-Level Practitioners

Attendees will receive a certificate of completion for the general Scientific Program and for any optional events attended. Please contact your individual membership association and certification board to determine the requirements for accepting credits.

Additional CME Credits can be earned by attending the following:

Special Courses

Attendees will receive a maximum of 3.75 AMA PRA Category 1 Credits™ for an eligible half-day Wednesday Special Course. Attendees will receive a maximum of 2.5 AMA PRA Category 1 Credits™ for an eligible Friday afternoon Special Course. Physicians should claim only the credit commensurate with the extent of their participation in the activity.
Claiming Credit

CME and attendance credits can be claimed through the online credit system at www.cns.org. Log in using your last name and the email address with which you registered. You will need to enter the number of hours you are claiming for each session you attended. Physicians should only claim credit for the learning activities at the Spine Summit 2017 in which they actively participated. The tracking system lets you create and email a certificate immediately following the Spine Summit 2017 either while you are still in Las Vegas or from the convenience of your home or office.

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.

FDA Statement

Some drugs or medical devices demonstrated at the Spine Summit 2017 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 Spine Summit 2017 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 on 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.
**Speaker Ready Room**

The Speaker Ready Room is located in Andalucia. The hours are:

- **Wednesday, March 8**: 8:00 am–6:00 pm
- **Thursday, March 9**: 6:00 am–6:00 pm
- **Friday, March 10**: 6:00 am–5:00 pm
- **Saturday, March 11**: 6:30 am–12:00 pm

All speakers and abstract presenters should visit the Speaker Ready Room prior to their presentation. All Scientific Session faculty are required to check in at the Speaker Ready Room no less than two hours prior to the start of your session. For a morning session, please check in the prior afternoon.

**Exhibit Hall**

- **Grand Ballroom**
  - **Thursday, March 9**: 9:00 am–4:30 pm
  - **Friday, March 10**: 9:00 am–1:00 pm

**Registration**

- **Grand Ballroom Foyer**
  - **Wednesday, March 8**: 11:00 am–5:30 pm
  - **Thursday, March 9**: 6:30 am–6:00 pm
  - **Friday, March 10**: 7:00 am–5:00 pm
  - **Saturday, March 11**: 7:30 am–12:00 pm

**No Smoking Policy**

Smoking is not permitted at any official Section on Disorders of the Spine and Peripheral Nerves Spine Summit 2017 events. The JW Marriott Las Vegas Resort and Spa is a non-smoking hotel. Smoking is only permitted in designated areas of the casino.

**Media Guidelines**

The Section on Disorders of the Spine and Peripheral Nerves is pleased to welcome media representatives to the 33rd Annual Meeting. Please note the following press guidelines.

- Only individuals who are working for and representing a recognized news organization may register as press. Press with credentials are observers of, and not participants in, all presentation question-and-answer sessions. Questions from all press are limited to before and after presentations. Journalists who want to use slides, graphs, and other visuals to illustrate coverage must have the presenter’s permission. Press with credential may cover all presentations with the exception of debates and the Cahill Controversies, as debate topics do not necessarily reflect the opinions of the participant and cannot be publicized as such. We appreciate your interest in spine and peripheral nerve topics and hope that you have an enjoyable time at Spine Summit 2017.
Disclaimer

The material presented at the DSPN Spine Summit 2017 Annual Meeting has been made available by the Section on Disorders of the Spine and Peripheral Nerves and the CNS for educational purposes only. These materials are not intended to represent the only, nor necessarily the best method or procedure appropriate for the medical situations discussed, but rather are intended to present an approach, view, statement or opinion of the faculty, which may be helpful to others who face similar situations.

All drugs and medical devices used in the United States are administered in accordance with the Food and Drug Administration (FDA) regulations. These regulations vary depending on the risks associated with the drug or medical devices compared to products already on the market, and the scope of the clinical data available.

Some drugs and medical devices demonstrated or described within the print publications of the Section of Disorders of the Spine and Peripheral Nerves jointly sponsored by the CNS have FDA clearance for use for specific purposes or for use only in restricted research settings. The FDA has stated that it is the responsibility of the physician to determine the FDA status of each drug or device he or she wants to use in compliance with applicable laws.

Neither the content (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 Section on Disorders of the Spine and Peripheral Nerves jointly sponsored by the CNS, or by its committees, commissions or affiliates.

**Opening Reception**

Outdoor Pool

Wednesday, March 8  
6:30 – 8:00 pm

Network with old friends and new colleagues over a delicious array of food while you admire an incredible performance by masters of acrobatics and fire-breathing, Cirque du Soleil! Each medical attendee and spouse/guest registered for the meeting will receive one complimentary ticket. Please note this event is held outdoors. Resort casual attire is recommended.

**Young Neurosurgeons Dinner**

Marbella Room

Friday, March 10  
7:00 pm

All residents, fellows and young neurosurgeons are welcome. RSVP to meetings@cns.org or at the registration desk by 6:00 pm on Thursday, March 10, 2017.
The Congress of Neurological Surgeons controls the content and production of this CME activity and attempts to assure the presentation of balanced, objective information. In accordance with the Standards for Commercial Support established by the Accreditation Council for Continuing Medical Education, speakers are asked to disclose any relationship they have with commercial companies which may be related to the content of their lecture.

Speakers who have disclosed a relationship with commercial companies whose products may have a relevance to their presentation are listed below. Faculty who are also considered Planners are designated by P.

Any planner or faculty member not on the disclosure list has stated they have nothing to disclose. Disclosures are current as of February 8, 2017.

### Positional Interest Codes

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### Hamid R. Abbasi, MD, PhD, FACNS
Consulting Agreement - Amendia (6), Zygta (6); Grants - AMW LLC (6); Intellectual Fees - AMW LLC (2); Other - Eminent Spine (2), Inspired Spine (2)

### Muwaffak Abdulhak, MD
Consulting Agreement - Innovative Surgical Solution (2), Integra (2); Ownership - Depuy Spine (10)

### Faiz U. Ahmad, MD, MChP
Consulting Agreement - Depuy Synthes (2), Medtronic Inc (2), Stryker (2); Other - Operative Neurosurgery (DMS) (4)

### Nicholas U. Ahn, MD
Consulting Agreement - Ohio Bureau of Workers’ Compensation (2); Grants - Stryker (6), Ulrich (6)

### Alex Aimeiti, PhD
Salary - Invivo Therapeutics (5)

### Behrooz A. Akbarnia, MD
Consulting Agreement - Depuy Synpe (2), K2M (2), Noomed (2); Nuvasive (2); Ownership - Depuy Spine (2), Nuvasive (2)

### Todd Albert, MD
Other - United Healthcare (6); Ownership Interest - Biometrix (10), Crossestream Medical (10), Gentis (10), International Orthopedic Alliance (Bonovo) (10); Invivo Therapeutics (10); Invuity (10); Paradigm Spine, LLC (10); Pulse Equity (10); Spinicity (10); Vital (10); Royalty - Depuy Synthes, Inc (6); Faceit Link (6); Zimmer Biomet (6)

### Christopher P. Ames, MD
Consulting Agreement - Depuy (2), Medtronic (2), Stryker (2); Other - Fish & Richardson, P.C. (6); Royalty - Biomet Spine (6), Stryker (6)

### Beejai Y. Amin, MD
Consulting Agreement - Depuy (2); Honoraria - Globus (6)

### Neel Anand, MD
Consulting Agreement - Medtronic (2); Ownership Interest - Globus Medical (6); Royalty - Baxano Surgical (6); Globus Medical (6), Medtronics (6), Nuvasive (6)

### Paul A. Anderson, MD
Consulting Agreement - Titan Surgical (6); Ownership Interest - Si Biome (6); Easing Orthopedics (6); Spartaec (6), Titan Surgical (6); Royalty - RTI (6), Stryker (6)

### Hideyuki Arima, MD, PhD
Salary - Norton Healthcare (5)

### Paul M. Arnold, MD
Consulting Agreement - FzioMed (2), InVivo (2), Medtronic (2), Stryker Spine (2), Intellectual Fees - Evoke Medical (8); Other - AO Spine North America (2); Ownership interest - Z-Plasty (6)

### Eli M. Baron, MD
Royalty - Elsevier (6), McGraw Hill (6)

### Stephen Bartol, MD, MBA, FACS
Ownership Interest - Syntell (7)

### Brieta Bejcin
Salary - Zimmer Biomet (5)

### Edward C. Benzel, MD
Consulting Agreement - Axium (2); Ownership Interest - Depuy (6), Orthomems (6), Turning Point (6)

### Sigurd Berven, MD
Consulting Agreement - Globus (2), Medtronic (2), Stryker (2); Ownership interest - Providence Medical (8), Simpitrax (6)

### Shay Bess, MD
Grants - Biomet (6), Depuy Spine (6), K2 Medical (6), Medtronic (6); Nuvasive (6); Other - AO Spine North America (6); Intellectual Fees - Innovasis (6), Nuvasive (6); Royalty - K2 Medical (6), Pioneer (6)

### Deb A. Bhowmick, MD
Consulting Agreement - Medtronic Inc. (2)

### Mark H. Bilsky, MD
Consulting Agreement - BrainLab (2), Depuy Synthes (2), Globus (2)

### Erica Fay Bisson, MD, MPH
Consulting Agreement - nView (2)

### Nicholas M. Boulos, MD
Consulting Agreement - Agilis (2), MRI Intervention Inc. (2); Ownership interest - Oxford Biomedica (2), Queens (2), Regenex (2), Voyager Therapeutics (2); Ownership interest - Switch Bio (8)

### Charles L. Branch, Jr., MD
Consulting Agreement - Medtronic (2); Royalty - Medtronic (6)

### Keith Bridwell, MD
Royalty - Wolters Kluwer (6)

### Darrel S. Brodke, MD
Ownership interest - Amedica (2); Royalty - Amedica (2); Depuy Synthes (2), Medtronic (2)

### Michael C. Brown, BS
Ownership interest - Launchpad Medical (8)
DISCLOSURES

Brandon Bucklen, PhD
Salary - Globus Medical Inc (5)

Shane Burch
Consulting Agreement - Medtronic (2); Grants - Integra Life Science (6), Lilly Inc. (6), NIH (6); Honoraria - Medtronic (6)

Douglas C. Burton, MD
Consulting Agreement - DePuy Synthes Spine (6); Royalty - DePuy Synthes Spine (6)

Kevin Scott Cahill, MD, PhD
Consulting Agreement - Ethicon Biosurgery (6), Globus Medical (6), SpineWave (6); Royalty - Globus Medical (6), SpineWave (6)

Leah Y. Carreon, MD, MSc
Grants - AO Spine (6), Norton Healthcare (6), OREF (6); Honoraria - CTF (6), Global Evidence Advisory Board, Medtronic (6), Medtronic (6), NIH (6); Salary - Norton Healthcare (6)

Victor Chang, MD*
Consulting Agreement - Globus (2), Depuy Synthes (2); Other - Medtronic (6)

Mokkel K. Chedid, MD, FACS
Grants - Isto Technologies (2)

John Chi, MD, MPH*
Consulting Agreement - Depuy Synthes (6); Other - K2M (7)

Dean Chou, MD*
Consulting Agreement - Globus (2), Medtronic (2), Orthofix (2); Royalty - Globus (6)

Sean D. Christie, MD, FACS(C)
Consulting Agreement - Medtronic Canada (2); Grants - Rick Hansen Institute (6)

Michael W. Collins, PhD, MA
Consulting Agreement - IMPACT Applications Inc. (6)

Domagoj Coric, MD*
Consulting Agreement - Globus Medical (2), Medtronic (2), Depuy Synthes (2); Other - Invivo (6); Ownership Interest - Spinal Kinetics (2), Spine Wave (2); Royalty - RTI (6), Spine Wave (2)

Lisa Crockett
Salary - Invivo (5)

Andrew T. Dailey, MD
Consulting Agreement - K2M (2), Medtronic (2), Orthofix (2); Honoraria - AO North America (6); Royalty - Biomet (2)

Alan H. Daniels, MD
Consulting Agreement - Osseus (2), Stryker Spine (2)

Reginald J. Davis, MD, FACS
Consulting Agreement - LDR (2), Vertifex (2)

Ryan Peter Denhaese, MD
Consulting Agreement - Biomet Spine, LLC (6)

Vedat Deviren, MD
Consulting Agreement - NuVasive (2), Nuvasive (6)

Sanjay S. Dhill, MD*
Honoraria - Depuy Synapse (6), Globus Spine (6)

John R. Dimar, MD
Consulting Agreement - Medtronic (2); Other - JBJS Highlights, Spine, Spine Deformity, JAAOS and Global Spine (4), Nuvasive (6); Salary - Norton Healthcare (5)

Robert Eastlack, MD
Consulting Agreement - Aesculap (2), Depuy Synthes Synthes Spine (2); Diffusion (2), Eli Lilly (2), Nuvasive (2), Pioneer (2); Grants - Baxano (6); Ownership Interest - Alphatec (6), Top Doctors (7); Royalty - Globus (2), NuTech (2)

Howard Eisenbrook, DO
Consulting Agreement - Launchpad Medical (2)

Thomas Errico
Grants - Fridolin Trust (6), OMEGA (6), Paradigm Spine (6); Royalty - Fastenfix (6), K2M (6)

Sam Farber
Salary - Biomet Spine, LLC (5)

Chris M. Ferry, BS, MS
Salary - Zimmer Biomet Spine (5)

Richard G. Fessler, MD, PhD
Consulting Agreement - Bvenue (2), Depuy Synthes Synthes Spine (2); Ownership Interest - IQ Innovations (8); Royalty - DePuy Synthes Spine (6), Medtronic (6), Stryker (6)

Charles Fisher, MD
Consulting Agreement - Medtronic (2), Nuvasive (2); Grants - OREF (6); Other - AO (6); Royalty - Medtronic (6)

Jeremy L. Fogelson, MD
Consulting Agreement - Depuy Synthes (2)

Kevin T. Foley, MD, FACS
Ownership Interest - Disciplinics (7), NuVasive (6), SpineWave (6); Tuvaluion (7); Royalty - Medtronic (2)

E.(Lisa) A. Frisil, PhD
Royalty - Applied Test Systems, Inc. (6)

Anup Gandhi, PhD
Salary - Biomet Spine, LLC (5)

Matthew Geek, MD
Other - SpineHope (6); Ownership Interest - Diffusion (6); Royalty - Genesys (6); Salary - Seton Brain and Spine Institute (5)

Steven D. Glassman
Consulting Agreement - Medtronic (6); Other - Medtronic (6), Nuvasive (10), Nuvasive (7); Royalty - Medtronic (2); Salary - Norton Health Care (5)

Tom Glorioso, MD
Consulting Agreement - Zimmer Biomet Spine (2)

Zya L. Gokaslan, MD
Grants - AO Foundation (6); Honoraria - AO Foundation (6); Ownership Interest - Spinal Kinetics (8)

C. Rory Goodwin, MD, PhD
Grants - UNCF Merck Postdoctoral Fellow and has received awards from the Burroughs Welcome Fund and The Johns Hopkins Neurosurgery Pain Research Institute (6)

Jonathan Grauer, MD
Consulting Agreement - Bioventus (2), Medtronic (2), Novella Clinical (2), Stryker (2)

Michael W. Groff, M.D.
Consulting Agreement - Depuy (2), EBi Spine Biomet (2)

Jeffrey M. Lynn Gum
Consulting Agreement - Acuity (2), Alphatec (2), Carelink (2), Getson Lehmman Group (2), LifeSpine (6), Medtronic (6), MilMed (6), Pacira Pharmaceuticals (2), PKInmed (2), Stryker (2); Honoraria - Alphatec (6), LifeSpine (6), Medtronic (6), MilMed (6), Pacira Pharmaceuticals (6); Other - Acuity (6); American Journal of Orthopedics (4), AO Spine (6), Medtronic (6), Norton Healthcare (5), OREF (6)

Munish C. Gupta
Consulting Agreement - Depuy Synthes Spine (2); Ownership Interest - Orthofix (6); Other - SRIS (6); Ownership Interest - J&J (6), Pfizer (6), Proctor and Gamble (6); Royalty - Depuy Spine (6)

Richard D. Guyer, MD
Consulting Agreement - K2M Inc. (2), Spinal Motion (2); Spinal Motion (2); Ownership Interest - St. Teresa Medical, Inc. (6)

Regis W. Haid, MD
Consulting Agreement - Globus Medical (2), Pedmented Health Care (2); Other - Nuvasive (6); Ownership Interest - Spine Universe (4); Royalty - Medtronic Sotamor Danek (6)

James S. Harrop, MD, FACS*
Consulting Agreement - Depuy Spine (2); Other - Asterias (2), Bionventus (2), Ethicon (6), Teijin (2)
Robert Hart, MD  Consulting Agreement - Depuy Synthes (2), Globus (2), Medtronic (2); Grants - ISSGF (6), Medtronic (6); Honoraria - Depuy Synthes (6); Other - CSRIS (6), ISSIG (6), ISSLS (6), Spine Connect (6); Royalty - Depuy Synthes (6), Seaspine (6)  Roger Härte, MD  Consulting Agreement - BrainLab (2), Depuy Synthes (2), Lanx (2); Grants - Baxter (6)  Brian J. Hess, BS, MBA  Ownership Interest - Launchpad Medical (1)  Christoph Paul Hofstetter, MD, PhD  Consulting Agreement - Depuy Synthes (2), Synthesis (2), Wolf (2)  Langston T. Holly, MD*  Consulting Agreement - Medtronic (2); Grants - NIH (6); Royalty - Medtronic (6)  Richard A. Hostin, MD  Consulting Agreement - DePuy Spine (6); Grants - DePuy Spine (6), DOJO (6), K2M (6), Nuvasive (6), Seeger (6)  Patrick C. Hsieh, MD, MSc  Consulting Agreement - Depuy Synthes (2), Medtronic (2)  Wellington Hsu, MD  Consulting Agreement - ACONA (2), Bacterrin (2), Bioventus (2), Ceramic (2), Globus (2), Gyrafix (2), LifeLeaf (2), Medtronic (2), Pioneer (2), Relevant (2), Sl Bone (2), SpineSmith2 (2), Styrak (2), Synthes (2)  Serena Hu  Consulting Agreement - Medtronic (6); Honoraria - Medtronic (6); Other - Synthes (6); Royalty - Nuvasive (6)  David M. Ibrahimi, MD  Honoraria - Globus (6)  International Spine Study Group  Grants - DePuy Synthes (6); Other - Biomet (6), DePuy Spine (6), Innovaxis (6), Medtronic Sofamor Danek (6), Stryker (6)  Jason Inzana  Salary - Zimmer Biomet Spine (5)  Robert E. Isaacs, MD  Royalty - Nuvasive (6)  Bradley Jacobs, MD, FRCSC  Honoraria - DePuy Synthes (6)  Michele Marie Johnson, MD*  Consulting Agreement - Meditech (2), Mimedex (2), Nuvasive (2)  Iain H. Kalfas, MD  Royalty - Mako Surgical (6)  George W. Kay, DMD, MMSc  Ownership Interest - Launchpad Medical (8)  Khaleid Kebabish, MD  Consulting Agreement - DePuy Spine (2), K2M (2)  Maika K. Keefe, BS  Consulting Agreement - Deputy (2), Stryker (2), Zeiss (2)  Michael P. Kelly, MD  Grants - AO/Spine (4), Barnes-Jewish Hospital Foundation (6), CSRIS (6), OREF (6)  Han Jo Kim, MD  Consulting Agreement - K2M (6), Zimmer Biomet (6); Grants - CSRIS (6), ISSIG (6); Other - ASJ (6), ISN Journal (6)  Kee Kim, MD  Consulting Agreement - Stryker (6), Zimmer Biomet (2); Other - Invivo Therapeutics (6), Molecular Matrix (3); Royalty - Globus (2), LDR (6), Spinal USA (6)  Terrence T. Kim, MD  Consulting Agreement - Depuy/Johnson and Johnson (6), Medtronic (6)  Eric Klionemberg, MD  Consulting Agreement - DePuy Synthes Spine (6), Stryker (6); Grants - AO Spine (6), Honoraria - AO (6), K2M (6)  Noelle F. Klocke, MS  Salary - Globus Medical, Inc. (5)  Branko Kopjar, MD  Consulting Agreement - Cenepedics (2), Smith and Nephew (2)  Frederick Korley, MD, PhD  Grants - Immunuary (6); Honoraria - Abbott Laboratories (6)  David J. Kosh  Ownership Interest - Launchpad Medical (6)  Tyler R. Koski, MD  Consulting Agreement - MB Innovations / SpineWave (2), Medtronic (2), Nuvasive (2); Other - Nuvasive (2); Ownership Interest - Nuvasive (6)  Frank La Marca, MD  Consulting Agreement - Biomet (2), Globus Medical (2); Royalty - Biomet (2), Globus Medical (2)  Virginie Lefage, PhD  Consulting Agreement - NuVasive (6); Honoraria - DePuy Spine (6), Medtrica (6); Ownership Interest - Nemaris Inc (7)  Ahmad Latifi, DO  Consulting Agreement - K2M (6), Medtronic (6), Stryker (6)  Ilya Laufer, MD*  Consulting Agreement - DePuy Synthes (2), Globus (2), Medtronic (2), SpineWave (2)  Richard T. Layer, PhD  Salary - InVivo Therapeutics (5)  Jane Lubkowski, PhD  Salary - Asterias Biotherapeutics (5)  Charles T. Ledonio, MD  Consulting Agreement - Greatbatch (2)  Ian Yu Lee, MD  Consulting Agreement - Monteris (2); Honoraria - Varian (6)  Jean-Charles LeHuec  Consulting Agreement - CareVate Medical Ltd. (6); Other - Medtronic Sofamor Danek (6)  Lawrence Lenke  Other - Avactech (6), DePuy Spine (6); Royalty - Medtronic (6), Quality Medical Publishing (6)  Eric C. Leuthardt, MD  Consulting Agreement - Intellectual Ventures (2), Monteris (2); Intellectual Fees - Allied Minds (6); Ownership Interest - General Sensing (8), Neuronolitics (8), Osteoanage (8)  Allan D. Levi, MD, PhD  Grants - Department of Defense (6); Honoraria - Medtronic (6)  Gloria Lin, PhD  Salary - Spinovations (5)  Breton G. Line, BSME  Other - ISSIG (6)  Eric Lis  Consulting Agreement - Kyphon (6), Medtronic (2)  Daniel C. Lu, MD*  Other - Neurorecovery Technologies (2)  Nick Manesis, PhD  Salary - Spinovations (5)
DISCLOSURES

Andrey Marchenko, BS
Ownership Interest - Lauschpad Medical (8)

Frederick F. Marciano, MD
Royalty - Synthes (2)

Kim Martin
Salary - Zimmer Biomet (5)

Sarah Martineck
Consulting Agreement - Zimmer Biomet (2)

Lorianne K. Masouka, MD
Salary - InVivo Therapeutics (5), InVivo Therapeutics (7)

Eric M. Massicotte, MD
Honorary - Synthes (2), Medtronic (2)

Matthew J. McGirt MD*
Consulting Agreement - Stryker Spine (6)

Bernhard Meyer, MD
Consulting Agreement - BrainLAB (2), Medtronic (6); Grants - Ulrich Medical (6), Honorary - Neoxtim (6), Relievant (6); Royalty - SpineArt (6)

Jean-Pierre Mobasser, MD
Consulting Agreement - Medtronic (2); Royalty - Innomed (2), Medtronic (2)

Thomas E. Mroz, MD
Consulting Agreement - Ceramtec (2), Globus Medical (2), Stryker Spine (2); Ownership Interest - PearlRiver, Inc (6)

Praveen V. Mummaneni, MD*
Consulting Agreement - Depuy Spine (2); Honorary - AO Spine (6), Globus (6); Other - SpineTy/ISD (6); Royalty - Depuy Spine (6), Quality Medical Publishers (6), Springer Publishing (6), Thieme Publishers (6)

Gregory M. Mundis, Jr., MD
Consulting Agreement - K2M (2), Medtronic (2); Maxispin (2), Nuvasive (2); Grants - Nuvasive (6); Royalty - K2M (2), Nuvasive (2)

Christopher Murphy
Salary - AMW LLC (8)

Hiroshi Nakagawa, MD
Consulting Agreement - Stryker Corp (2)

Kristin M. Neff, BS, MS
Salary - InVivo Therapeutics (5)

Ewell Lee Nelson, MD
Consulting Agreement - Medtronic Navigation (2)

Brian J. Neuman, MD
Grants - DePuy Synthes (8)

Pierce D. Nunley, MD
Consulting Agreement - K2M (2), LDR (2); Ownership Interest - Amedica (6), Paradigm Spine (6), Spineology (6); Royalty - K2M (6), LDR (2), Osprey BioMedical (6)

Joseph R. O’Brien, MD, MPH
Consulting Agreement - Globus (6), NuVasive (6), Relievant (6), Stryker (6); Royalty - Globus (6), NuVasive (6)

Michael F. O’Brien, MD
Consulting Agreement - DePuy Spine (6); Grants - DePuy Spine (6); Royalty - DePuy Spine (6), Medtronic (6), Osteotech (6)

John E. O’Toole, MD, MSc*
Consulting Agreement - Globus Medical (2), RTI, Inc (2); Ownership Interest - Theracell, Inc. (6)

David O. Okonkwo, MD, PhD*
Consulting Agreement - Biomet (2)

Nick Padovani
Salary - K2M Inc. (5)

Ripul Rajan Panchal, DO
Consulting Agreement - Mizuho Orthopedic Systems, Inc (2), Zimmer Biomet Spine (2)

Paul Park, MD*
Consulting Agreement - Biomet (2), Globus (2), Medtronic (2); Honorary - Vertex Pharmaceutical (6); Royalty - Globus (6)

Peter G. Passias, MD
Consulting Agreement - Medtronic (2); Zimmer-Biomet (2)

Frank M. Phillips, MD
Consulting Agreement - NuVasive (2), SI-Bone (2), Spinal Kinetics (2); Ownership Interest - Theracell (3), Vital 5 (3); Royalty - DePuy (2), NuVasive (2); Stkrk (2)

Eric A. Potts, MD*
Consulting Agreement - Medtronic (6); Royalty - Medtronic (6)

Themistocles Protopsaltis, MD
Consulting Agreement - Medtronic (2); Grants - Zimmer Biomet (6)

Shadar Rajpal, MD*
Consulting Agreement - Medtronic (2)

Alexandre Rassouli, MD
Honorary - NuVasive, Inc. (6)

Wilson Zachary Ray*
Consulting Agreement - Depuy Synthes (2), In Vivo (2), Ulrich (2); Grants - Defense Advanced Research Project Agency (6), Department of Defense (6), Missouri Spinal Cord Injury Foundation (6), NIH/NINDS (6); Honorary - Depuy Synthes Spine (8); Other - InVivo Therapeutics (6); Ownership Interest - In Vivo (6), LDRH (6)

Daniel Reifai, MD*
Consulting Agreement - Depuy Spine (2), Globus (2), Medtronic (2); Stryker (2), Zimmer Biomet (2); Royalty - Aesculap (6), Medtronic (6), Stryker (6), Zimmer Biomet (6)

Daniel K. Resnick, MD, MS
Other - Developer of NASS registry (6)

Laurence D. Rhines, MD
Honorary - Globus (2), Stryker (2); Other - AOSpine International (7)

K. Daniel Riew, MD
Consulting Agreement - Biomet (6); Other - Amedica (6), Biomet, Medtronic Sofamor Danek (2), Bienville (6), Expanding Orthopedics (6), Neogen Spine (6), Osprey (6), Paradigm Spine (6), Pi3D (6), Spinal Kinetics (6), Spine Journal (4), SpinoLab (6), Vertiflex (6); Royalty - Biomet (6), Medtronic (6), Zeiss (6); Salary - AOspine (6)

Lee H. Riley, MD
Other - CSRS (7), Lifenet Health (7)

Gerald E. Rodts, MD
Ownership Interest - SpineUniverse.com (8); Royalty - Globus Medical (6), Medtronic Inc. (6)

Josh Rubin
Salary - K2M Inc. (5)

Anthony J. Russo, MD
Other - Global Medical, Inc. (6)

Won Hyung (Andrew) Ryu, BSc, MSc, MTM, MD
Other - Received travel grant to attend resident education courses from Depuy Synthes Spine (6)

Uzma Samadani, MD*
Consulting Agreement - Abbott (6); Grants - Abbott (6); Ownership Interest - Oculogica Inc (3)

Charles A. Sansur, MD, MHS*
Consulting Agreement - Globus (2), Medtronic (2), Stryker (2); Honorary - DePuy (5), K2M (6)

Rick Sasso, MD
Royalty - Medtronic (6)

Meic H. Schmidt, MD
Consulting Agreement - Ulrich Medical USA (2)

Marc L. Schrider, MD, PhD
Consulting Agreement - Mazor Robotics, Ltd. (2)
Frank Schwab, MD, PhD
Consulting Agreement - K2M (6), Medicea (6), Medtronic Spine (6); Grants - AO Spine (6), Depuy Synthes (6), Medtronic Spine (6); Honoraria - Biomet (6), K2M (6), Medtronic Spine (6), Nermans (6), Nuvasive (6), Intellectual Fees - K2M (6), Medtronic Spine (6), Nermans (6); Ownership Interest - Nermans (8); Royalty - K2M (6), Medtronic (6)

Jason M. Schwab, MD, FACS
Grants - Boston Scientific (6)

Daniel M. Sculba, MD\textsuperscript{a}
Consulting Agreement - Depuy Synthes (6), Globus (6); Medtronic (6), Orthofix (6), Stryker (2)

Christopher I. Shaffrey, MD, FACS
Consulting Agreement - Biomet (6), Medtronic (6), Nuvasive (6), Honoraria - Stryker (6); Intellectual Fees - Biomet (6), Medtronic (6), Nuvasive (6); Other - AO/ASIFNE North America (6), Depuy Spine (6), NACTN (6), NIH (6), NREF (6), Nuvasive (2), Nuvasive (6); Royalty - Biomet (6), Medtronic (6), Nuvasive (6)

Farzan Siddiqui
Grants - Philips Medical (6), Varian Medical Systems (6), AO Spine, American College of Veterinary Radiology (6), MD Anderson SBRT Symposium (6), St. John Providence Hospital (6), Wayne State University (6)

Richard L. Skolasky, MD
Other - Depuy Synthes (6)

Jonathan R. Slotkin, MD
Consulting Agreement - Medtronic (2), Stryker Spine (2); Ownership Interest - Launchpad Medical (8)

Justin S. Smith, MD, PhD\textsuperscript{b}
Consulting Agreement - Cerapedics (2), Nuvasive (2), Zimmer Biomet (2); Grants - AO/Spine (6), Depuy Synthes (6), NREF (6); Honoraria - K2M (2); Nuvasive (2), Zimmer Biomet (2); Royalty - Zimmer Biomet (2)

Volker K. H. Sonntag, MD
Royalty - Medtronic (6)

Michael P. Steinmetz, MD
Consulting Agreement - Intellino (6), Other - Depuy Synthes (6), Royalty - Biomet Spine (6)

John K. Stokes, MD
Other - Diffusion (6), Summit Medventures (6); Royalty - Genesys Orthopedics (6)

Brandon Strenge
Consulting Agreement - Zimmer Biomet (2)

William R. Taylor, MD
Consulting Agreement - Spinnovations (2)

Suzanne Audrey Tharin, MD, PhD
Other - Stryker (2)

Nicholas Theodore, MD
Royalty - Depuy Synthes Spine (2), Globus Medical (2), Stryker Spine (6)

Eric Truemeees, MD
Other - AAOS (4), Doctoral Research Group (6), NAES (4), Pfizer (5), Stryker Spine (6), Royalty - Stryker Spine (6)

Luis Manuel Tumialan, MD\textsuperscript{c}
Consulting Agreement - Depuy-Synthes (2), Medtronic (2), Spine Wave (2)

Thomas Ulich
Salary - InVivo Therapeutics (5), InVivo Therapies (7)

Juan S. Uribe, MD\textsuperscript{d}
Consulting Agreement - Nuvasive (2); Royalty - Nuvasive (2)

Alexander R. Vaccaro, MD
Consulting Agreement - Depuy (2), Expert Testimony (2), Gerson Lehman Group (2), Globus (2), Guidepoint Global (2), Innovative Surgical Design (2), Medcorpor (2), Medtronics (2), Nuvasive (2), Orthobullets (2), Stoult Medical (2), Stryker Spine (2); Other - AO Spine (6), Association of Collaborative Spine Research (6), Clinical Spine Surgery (4), Flagship Surgical (6), Innovative Surgical Design (6), Prime Surgeons (6), Progressive Spinal Technologies (6), Spine Journal (4), Spine Therapy Network, Inc (6); Ownership Interest - Advanced Spinal Intellectual Properties (6), Avaz Surgical (6), Bonovo Orthopedics (6), Computational Biodynamics (6), Cytomics (6), Dimension Orthotics, LLC (6), Electrocore (6), Flagship Surgical (6), FlowPharma (6), Gamma Spine (6), Globus (6), InVivo (6), Innovative Surgical Design (6), Location Based Intelligence (6), Paradigm Spine (6), Prime Surgeons (6), Progressive Spinal Technologies (6), Replication Medica (6), Rothman Institute and Related Properties (6), Spine Medica (6), SpineMed (6), Vertiflex (6); Royalty - Aesculap (6), Elsevier (6), Globus (6), Jaypee (6), Medtronics (6), Stryker Spine (6), Taylor Francis/Hodder and Stoughton (6), Theme (6)

Steven Vanni, DO
Consulting Agreement - Globus Medical, Inc. (2), Nuvasive (2), Spine Wave (2)

Alan T. Villavicencio, MD
Physician Owned Distributorship - Leading Edge Spinal Implants (8)

Michael S. Virk, MD, PhD
Grants - AO Spine Fellowship (6)

Rishi Kumar Wadhwa, MD\textsuperscript{e}
Consulting Agreement - Globus (2)

John E. Wanebo, MD
Consulting Agreement - Zimmer Biomet Spine (2)

Michael Y. Wang, MD, FACS
Consulting Agreement - Aesculap Spine (2), Depuy Spine (2), Jolmax (2), K2M (2); Intellectual Fees - Depuy Spine (2)

Wenhai Wang, PhD
Salary - Globus Medical Inc. (5)

Edward Wirth, MD, PhD
Salary - Asterias Biotherapeutics, Inc. (5)

Timothy F. Willham, BS, MD
Grants - Gordon and Marilyn Macklin Foundation (6); Other - Eli Lily and Company (6)

Eric J. Woodard, MD
Consulting Agreement - Intuvity Corp. (2), K2M (2), Launchpad Medical (6); Ownership Interest - Electrocore (6); Royalty - Stryker Spine (2), Salary - Vollum Corp. (3)

Yoshiya Josh Yamada, MD, FRCP
Consulting Agreement - Varian Medical Systems (2)

Victor Xiao Dong Yang, MD, PhD, MBDc, BSc
Grants - This work was funded by Surgeon-in-chief’s research support (6)

Steven S. Yocom, DO
Consulting Agreement - Precision Spine (2)

Joseph M. Zavatsky, MD
Consulting Agreement - Amenda (2), Biomet (2), Depuy (2); Royalty - Biomet (6)

Corina Clio Zygourakis, MD
Other - Nuvasive (10), Globus (10)
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