**Friday, September 14, 2018**

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<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
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<tr>
<td>12:00 PM – 04:00 PM</td>
<td>Executive Committee Meeting</td>
<td>The Boardroom</td>
</tr>
<tr>
<td>12:30 PM – 11:00 PM</td>
<td>Exhibits/Setup</td>
<td>Salon 3</td>
</tr>
<tr>
<td>02:00 PM – 05:00 PM</td>
<td>Registration</td>
<td>Salon 3 Foyer</td>
</tr>
<tr>
<td>06:00 PM – 09:30 PM</td>
<td>Welcome Reception</td>
<td>Croquet Lawn</td>
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**Saturday, September 15, 2018**

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<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
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<tbody>
<tr>
<td>06:30 AM – 07:25 AM</td>
<td>Breakfast with Exhibitors</td>
<td>Salon 3</td>
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<tr>
<td>06:30 AM - 12:00 PM</td>
<td>Registration</td>
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<tr>
<td>07:25 AM – 08:30 AM</td>
<td>Scientific Session 1</td>
<td>Plaza Ballroom</td>
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<tr>
<td>08:00 AM – 10:00 AM</td>
<td>Spouses Breakfast</td>
<td>Nanea Lanai</td>
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<tr>
<td>08:30 AM – 09:06 AM</td>
<td>Scientific Session 2</td>
<td>Plaza Ballroom</td>
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<tr>
<td>09:06 AM - 09:50 AM</td>
<td>General Interest Topic/The Volcano</td>
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<tr>
<td>09:50 AM – 10:20 AM</td>
<td>Coffee Break with Exhibitors</td>
<td>Salon 3</td>
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<tr>
<td>10:20 AM - 10:45 AM</td>
<td>Tribute to Charles Wilson</td>
<td>Plaza Ballroom</td>
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<tr>
<td>10:45 AM – 12:00 PM</td>
<td>Scientific Session 3</td>
<td>Plaza Ballroom</td>
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<tr>
<td>Noon</td>
<td>Adjourn for day</td>
<td></td>
</tr>
<tr>
<td>01:00 PM – 05:00 PM</td>
<td>*Tennis</td>
<td>Tennis Courts</td>
</tr>
<tr>
<td>01:00 PM – 05:00 PM</td>
<td>*Golf</td>
<td>Meet at Front Entrance for Shuttle</td>
</tr>
<tr>
<td>01:30 PM – 05:00 PM</td>
<td>*Snorkeling/Boat ride</td>
<td>Meet near Self Parking Lot</td>
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<tr>
<td>06:00 PM – 09:30 PM</td>
<td>Local’s Night/Dinner</td>
<td>Coconut Grove</td>
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**Sunday, September 16, 2018**

<table>
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<tr>
<th>Time</th>
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<tr>
<td>06:30 AM – 08:00 AM</td>
<td>Business Meeting (Members Breakfast)</td>
<td>Promenade 12</td>
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<tr>
<td>06:30 AM – 08:00 AM</td>
<td>Breakfast w/Exhibitors (nonmembers)</td>
<td>Salon 3</td>
</tr>
<tr>
<td>06:30 AM - 12:00 PM</td>
<td>Registration</td>
<td>Salon 3 Foyer</td>
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<tr>
<td>08:00 AM – 08:50 AM</td>
<td>Scientific Session 4</td>
<td>Plaza Ballroom</td>
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<tr>
<td>08:50 AM – 09:45 AM</td>
<td>Scientific Session 5</td>
<td>Plaza Ballroom</td>
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<td>09:45 AM - 10:35 AM</td>
<td>Ablin Award Lecture/Michael Edwards</td>
<td>Plaza Ballroom</td>
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<td>08:00 AM – 10:00 AM</td>
<td>Spouses’ Breakfast</td>
<td>Nanea Lanai</td>
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<tr>
<td>10:35 AM – 11:00 AM</td>
<td>Coffee Break with Exhibitors</td>
<td>Salon 3</td>
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<tr>
<td>11:00 AM – 11:45 AM</td>
<td>Cloward Award Lecture/Ed Laws</td>
<td>Plaza Ballroom</td>
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<td>11:45 AM - 12:30 PM</td>
<td>Presidential Address</td>
<td>Plaza Ballroom</td>
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<td>12:30 PM</td>
<td>Adjourn for the Day</td>
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<tr>
<td>01:00 PM – 05:00 PM</td>
<td>*Golf</td>
<td>Meet at Front Entrance for Shuttle</td>
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<tr>
<td>01:00 PM – 05:00 PM</td>
<td>*Tennis</td>
<td>Tennis Courts</td>
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<tr>
<td>02:00 PM – 05:00 PM</td>
<td>*Cultural Petroglyphs &amp; Historical Hike</td>
<td>Meet at Beach Shack</td>
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<td>01:30 PM – 05:00 PM</td>
<td>*Helicopter Ride</td>
<td>Meet at self parking for transport to Heliport</td>
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<tr>
<td>05:45 PM – 10:00 PM</td>
<td>Keiki Club (children)</td>
<td>Maile</td>
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<tr>
<td>05:45 PM – 06:00 PM</td>
<td>New Member w/Executive Committee Reception</td>
<td>Ballroom Courtyard</td>
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<tr>
<td>06:00 PM – 10:30 PM</td>
<td>Reception/Black Tie Dinner/Dancing</td>
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**Monday, September 17, 2018**

<table>
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<tr>
<td>06:30 AM – 07:30 AM</td>
<td>Breakfast with Exhibitors</td>
<td>Salon 3 Room</td>
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<td>06:30 AM – 12:00 PM</td>
<td>Registration</td>
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<td>07:30 AM – 08:00 AM</td>
<td>Resident Presentations</td>
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<td>Spouses Breakfast</td>
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<td>08:00 AM - 09:50 AM</td>
<td>Mini Symposium-Spine</td>
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<td>09:50 AM – 10:15 AM</td>
<td>Coffee Break with Exhibitors</td>
<td>Salon 3 Room</td>
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<tr>
<td>10:15 AM – 12:00 PM</td>
<td>Mini Symposium-Tumor</td>
<td>Plaza Ballroom</td>
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<tr>
<td>12:00 PM</td>
<td>Meeting Adjourns</td>
<td>See you in Arizona!</td>
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2018 LEARNING OBJECTIVES

The purpose of this meeting is to provide an update in the basic and clinical Sciences underlying neurosurgical practice through lectures, discussions, interactive sessions with neurological surgeons, neurologists, neuroradiologists, and other allied health personnel.

Upon completion of this program, participants should be able to:

Objective 1: Discuss the surgical care of intracranial pathology.

Objective 2: Review the surgical care of spinal disorders.

Objective 3: Discuss the challenges facing neurosurgeons regarding residency training competency, fellowship training and competency, and maintenance of certification.

Objective 4: Demonstrate critical care approaches for neurosurgery patients.

Jointly Provided by AANS
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The Western Neurosurgical Society would like to thank
Michi Wohns Carlson
2018 Exhibitor Coordinator
2018 Officers & Committees

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   Mark Belza
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   Charles Nussbaum
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GOLD SUPPORT

MEDTRONIC

INTEGRA LIFESCIENCES
https://www.integralife.com/H:

SILVER SUPPORT
DePuy Synthes
http://www.depuyssynthes.com/
EXHIBITORS

The Western Neurosurgical Society would like to thank the following exhibitors for their support in 2018


BrainLab [https://www.brainlab.com/](https://www.brainlab.com/)


KLS Martin [http://klsmartinnnorthamerica.com](http://klsmartinnnorthamerica.com)


OssDsign [https://www.ossdsign.com/](https://www.ossdsign.com/)

Olympus America [https://www.olympusamerica.com](https://www.olympusamerica.com)

Penumbra, Inc. [https://www.penumbrainc.com/](https://www.penumbrainc.com/)

Samsung NeuroLogica [https://www.neurologica.com](https://www.neurologica.com)


Sutter USA [https://www.sutter-usa.com/](https://www.sutter-usa.com/)

Synaptive Medical [http://synaptivemedical.com](http://synaptivemedical.com)

Synergy Medical corporation [http://synergymedcorp.com/](http://synergymedcorp.com/)

TerumboBCT [www.harvesttech.com](http://www.harvesttech.com)
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<th>NAME</th>
<th>STATUS</th>
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<tr>
<td>Ausaf Bari</td>
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<td>Bergsneider</td>
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<td>Edward Laws</td>
<td>Cloward Award</td>
<td>WNS</td>
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<td>Blake Berman</td>
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<td>Siddiqi</td>
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<td>Richard Chu</td>
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<td>Terrence Burns</td>
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<td>Ken Hon</td>
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<td>Raymond Tien</td>
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<tr>
<td>David Westra</td>
<td>Member Candidate</td>
<td>Abou-Samra</td>
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JOINT PROVIDERSHIP ACCREDITATION STATEMENT:

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 the AANS and (name of nonaccredited provider). The AANS is accredited by the ACCME to provide continuing medical education for physicians."

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The AANS designates this live activity for a maximum of 12.25 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity."

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Speakers, paper presenters/authors and staff (and the significant others of those mentioned) who have disclosed a relationship* with commercial interests whose products may have a relevance to their presentation are listed below.

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<th>TYPE OF RELATIONSHIP</th>
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<tr>
<td>Thomas Chen, MD</td>
<td>Yes</td>
<td>Industry Grant Support, Stock or Shareholder (NeOnc Technologies)</td>
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<tr>
<td>Richard Chua, MD</td>
<td>Yes</td>
<td>Consultant Fee; Medtronsics and Biologics</td>
</tr>
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<td>Samer Ghostine, MD</td>
<td>Yes</td>
<td>Consultant Fee; Globus Other Fiduciaries; Spineart</td>
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<td>Mark Hamilton, MD</td>
<td>Yes</td>
<td>Honorarium (Medtronic)</td>
</tr>
<tr>
<td>Michael Lemole, MD</td>
<td>Yes</td>
<td>Consultant Fee (Sony-OlympusMed); Fiduciary (Scientific Advisory Board Member - Athletes for Care)</td>
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<td>Gordon Li*, MD planner</td>
<td>Yes</td>
<td>Educational Grant (NIH); Consultant Fee (Medtronic)</td>
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<td>Michael Lim, MD</td>
<td>Yes</td>
<td>Industry Grant; BMS, Merck, SQZ, Tocagen, DNAtrix, Consultant Fee; Stryker, Baxter</td>
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<td>Andrew Little, MD</td>
<td>Yes</td>
<td>Share/Stockholder (Kogent surgical, spiway)</td>
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<td>Martin Mortazavi, MD</td>
<td>Yes</td>
<td>Other Financial or Material Support (Fiagon, Depuy Synthes, Haag-Streit Surgical, American Surgical Company)</td>
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<td>Praveen Mummaneni, MD</td>
<td>Yes</td>
<td>University Grant (AO Spine, UCSF); Consultant Fee (Depuy Spine, Globus, Stryker); Share or Stockholder (Spineart/ISD); Honorarium (Spineart/ISD); Fiduciary (CNS treasurer); Other Financial (Depuy, Thieme Publishing, Springer Publishing); Employee (UCSF)</td>
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<td>Stephen Ritland, MD</td>
<td>Yes</td>
<td>Consultant Fee (Stryker, Medtronic); Honorarium (Medtronic, Stryker)</td>
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<td>Thomas Scully, MD</td>
<td>Yes</td>
<td>Consultant Fee (RTI, LifeSpine); Stock or Shareholder (Langford); Fiduciary (Langford Systems Board)</td>
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<td>Laura Snyder, MD</td>
<td>Yes</td>
<td>University Grant (Barrow Neurological Foundation); Industry Grant (Medtronic); Consultant Fee (Globus); Consultant Fee, Stock/Shareholder</td>
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<td>Khoi Than, MD</td>
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<td>Yes</td>
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<tr>
<td>Isaac Yang, MD</td>
<td>Yes</td>
<td>University Grant (Tina &amp; Fred Segal); Industry grant support (Stryker, Brainlab); Consultant Fee (Baxter, Brainlab)</td>
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Speakers, paper presenters/authors and staff (and the significant others of those mentioned) who have reported they do not have any relationships with commercial interests:

*educational content planner of this meeting

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<td>Brian Andrews, MD</td>
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<td>Ciara Harraher, MD *</td>
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The Fairmont Orchid Kohala Coast, Hawaii | 9
DR. GEORGE ABLIN
1923-1999

In 2000, the members of the Western Neurosurgical Society inaugurated a new lectureship designed to honor, in a tangible and enduring manner, one of the Society’s most outstanding members. In its long history, the Society has had no more devoted contributor than Dr. George Ablin. He brought to the group stunning ability and experience, especially in matters of local, national, and international organization, in which he had few peers. He contributed through service in many areas including a memorable term as President. He was a wise and thoughtful counselor whose advice concerning many professional and personal questions always included a careful analysis, given with words of encouragement.

There was no more active and engaged participant in all of the Society’s affairs.

George Ablin was raised in Chicago, received his BS and MD from the University of Michigan, interned at Charity Hospital, New Orleans, Louisiana, did his residency at the University of Wisconsin, later was Instructor at the University of Michigan, and also became a Clinical Professor at California State University, Bakersfield. Dr Ablin was Board Certified in Neurological Surgery, a Fellow of the American College of Surgeons, and a Diplomat of the National Board of Medical Examiners.

Dr Ablin began practice in neurosurgery in Bakersfield, California, in 1953, was President of the Kern County Medical Society in 1984, and was very active in the California Medical Association in various leadership positions. He was Treasurer of the California Medical Review Board and received Distinguished Service awards from the Congress of Neurological Surgeons and the American Association of Neurological Surgeons. He was named Honorary President of the World Neurological Society and in 1989 he was selected as the Kern County Physician of the Year. George was the devoted father of seven children, three of whom became physicians.

George combined an exceptionally perceptive understanding of others, including hundreds of fellow neurosurgeons, with warmth and gentleness and lively humor. He loved his colleagues and friends, and he loved this Society. With this permanent lectureship, the members of the Western Neurosurgical Society honor George Ablin and his cherished wife, Millie.
George Ablin Memorial Lecturer 2018

Michael Edwards, MD

The Ablin Lecture at each annual meeting affords the President the opportunity to present speakers on topics that he feels would interest meeting attendees. The lecture honors the memory of George Ablin and his contributions to neurosurgery in general and the Western in particular. This year’s lecturer is Mike Edwards whose long career as a practitioner and teacher of pediatric neurosurgery in northern California affords him a unique view of a subspecialty over time.

Dr. Edwards completed his Bachelor of Science degree from the University of Florida, Gainesville and his Medical Degree from Tulane University. He continued at Tulane for his internship and neurosurgical residency. He then moved west to San Francisco to complete a neuro-oncology fellowship under Charles B. Wilson in 1977. He remained at UCSF as faculty and was appointed the director of the pediatric division in 1987. From 1992-1995, Dr. Edwards served as the Vice-Chair of the department and he remained a Clinical Professor until 1999. He then practiced in Sacramento at Sutter Medical Center but returned to the Bay Area in 2004 as an Endowed Professor of Neurosurgery and Pediatric Neurosurgery at Stanford University Medical Center. In 2007, he became the Chief of Pediatric Neurosurgery at Lucile Packard Children’s Hospital at Stanford and served in this role until his recent retirement.

Michael has been very active in organized neurosurgery throughout his career, serving on many committees in the AANS and CNS and as the President of the California Association of Neurosurgeons in 2005. He has been a visiting professor across the United States and has given invited lectures across the globe. As an international leader in pediatric neurosurgery, he has served on multiple medical advisory boards relating to pediatric neurosurgical diseases and on editorial boards of many peer-reviewed journals.

His research has mainly focused on brain tumor biology and therapy with a special interest in childhood medulloblastoma. He has published over 200 peer-reviewed articles and edited several neurosurgical books. Dr. Edwards is by all accounts, a master surgeon but by far one of his greatest gifts, is training future neurosurgeons and inspiring the next generation of pediatric neurosurgeons. The many pediatric fellows he trained during his career have gone on to flourish in practice all over the world.

Michael and his wife, Linda, have a son and daughter who they enjoy bicycling and skiing with at their H: on Lake Tahoe. You may also find him driving his Ford Raptor or spending time with his grandchildren. We look forward to welcoming him to the Western Neurosurgical Society annual meeting as our Ablin Lecturer.

--C. Harraher, MD
WNS Communications Committee
PRIOR ABLIN LECTURES


2002 Tom Campbell, JD, PhD. Professor of Law, Stanford University. Former Congressman. “Is Freedom Possible in Medicine”

2003 Frederic H. Chaffee, PhD. Director, WM Keck Observatory, Hawaii. “The WM Keck Observatory at the Dawn of the New Millennium”

2004 Gerald Kooyman, PhD. Research Professor, Scripps Institute of Oceanography, San Diego. “Emperor Penguins: Life at the Limits”


2006 August Turak. Spiritual and Business Consultant. “Spirituality and the Neurosurgeon”


2008 Michael Bliss, PhD. Emeritus Professor, University of Toronto. “Working Too Hard and Achieving Too Much? The Cost of Being Harvey Cushing”

2009 Michael A. DeGeorgia, MD. Professor of Neurology. Case Western Reserve University, Cleveland, Ohio. “Struck Down: The Collision of Stroke and World History”

2010 Chris Wood, PhD. Vice President for Administration, Santa Fe Institute. “What Kind of Computer Is The Brain?”

2011 Volker Sonntag, MD. Vice Chairman, Division of Neurological Surgery Barrow Neurological Institute, Phoenix, Arizona. “Cervical Instrumentation: Past, Present & Future”

2012 Robert Schrier, MD. Professor of Medicine, University of Colorado. “Illnesses in the US Presidents in the 20th Century: Potential Impact on History”

2013 Samuel Eric Wilson, MD. Professor, Department of Surgery, University of California, Irvine. “Between Scylla and Charybdis: Can Academic Surgery Survive?”

2014 Jon H. Robertson, MD. Professor of Neurosurgery, University of Tennessee. “The challenge of the Future Neurosurgical Education”


2016 Larry R. Squire, Ph.D. The Legacy of Patient H.M. – Cognitive Neuroscience of Human Memory

2017 Lucy Kalanithi, MD, FACP “When Breath Becomes Air: A Conversation with Lucy Kalanithi”
Ralph B. Cloward
1908-2000

In 2002 the Western Neurosurgical Society established a Medal and Lecture to honor one of its most innovative and pioneering members, Ralph Bingham Cloward. With the gracious support of the Cloward family, this award honors Ralph and his devoted wife Florence, our former president and first lady, both treasured friends who have enriched the Western.

Ralph Cloward was born in Salt Lake City, Utah, in 1908. He completed his undergraduate studies at the Universities of Hawaii and Utah, and his medical education subsequently at the University of Utah and Rush Medical School in Chicago. He interned at St. Luke’s Hospital, Chicago, and then trained to become a neurosurgeon under Professor Percival Bailey at the University of Chicago. He began practicing neurology and neurosurgery in the Territory of Hawaii in 1938.

His academic accomplishments include Professor and Chair of Neurosurgery at the University of Chicago, 1954-55, and visiting professorships at the University of Oregon, University of Southern California, and Rush Medical School. He served long-term as Professor of Neurosurgery at the John A. Burns School of Medicine at the University of Hawaii. He authored numerous papers and book chapters.

Dr. Cloward’s inspired, pioneering quantum leaps encompassed many areas of neurosurgery, but his enduring interest was the spine, where he devised three major operations. He first performed the posterior lumbar interbody fusion in 1943, reporting the operation at a meeting of the Hawaiian Territorial Medical Association in 1945 and publishing it in the Journal of Neurosurgery in 1953. His unique approach for treating hyperhidrosis was reported in 1957. Independently he conceived an anterior approach to the cervical spine, devised instruments for its implementation, and published his classic paper in the Journal of Neurosurgery on anterior cervical discectomy and fusion in 1958. He designed over 100 surgical instruments, which continue to be used today by practicing neurosurgeons.

Throughout his career he educated the international community of neurosurgeons in the operations he devised. He performed them throughout the United States and in 41 cities within 27 countries of the world and in the process healed patients of their painful conditions. Hundreds of thousands of patients benefited both directly and indirectly from his creativity, technical genius, insight and enthusiasm as a teacher and medical evangelist.

In first recognizing all lesions of the spine to be in the province of neurosurgeons, Dr. Cloward engendered controversy and endured severe criticism from upsetting the environment of establishment neurosurgeons by his pioneering breakthroughs. He demonstrated that even in a complex technological world with large research efforts, budgets, and bureaucracies, the individual is key. Engraved on the Medal are words the Cloward legacy epitomizes, which honors recipients “For Epochal Innovation and Pioneering Application.”
2018 CLOWARD AWARD RECIPIENT

Edward R. Laws, Jr., MD, FACS
Professor of Neurosurgery, Harvard Medical School
Director, Pituitary/Neuroendocrine Center, Brigham & Women's Hospital

Virtuosity in Surgery and Neurosurgery

Dr. Edward Laws received his bachelor’s degree from Princeton University with honors in Economics and Sociology in the Special Program in American Civilization, and then attended the Johns Hopkins University School of Medicine in Baltimore, Maryland. He did his surgical internship and neurosurgical residency at Johns Hopkins. After completing his residency, he joined the faculty at the Johns Hopkins Medical School. In 1972, he moved to the Mayo Clinic in Rochester, Minnesota where he became Professor of Neurosurgery and developed major interests in Pituitary and Brain tumor treatment and research. In 1987 he became Professor and Chairman of the Department of Neurosurgery at the George Washington University in Washington, DC, and in 1992 joined the faculty of the University of Virginia as Professor of Neurosurgery and Professor of Medicine, developing a Multidisciplinary Pituitary Center there. Subsequently, he was Professor of Neurosurgery at Stanford University, and in 2008 established the Pituitary/Neuroendocrine Center at the Brigham and Women’s Hospital in Boston where he currently is Professor of Neurosurgery at Harvard Medical School. During his surgical career he has operated upon more than 8000 brain tumors, of which 6,000 have been Pituitary lesions.

Dr. Laws has served as President of the World Federation of Neurosurgical Societies, President of the Congress of Neurological Surgeons, Editor of Neurosurgery, President of the American Association of Neurological Surgeons, and President of the Pituitary Society. He has been the fifth neurosurgeon to become President of the American College of Surgeons, and was elected to membership in the National Academy of Medicine. He remains actively involved in Brain and Pituitary tumor research and surgery.

He and his wife Margaret have four daughters and six grandchildren.
PRIOR CLOWARD AWARD RECIPIENTS


2006 Martin Weiss, MD, Professor of Neurosurgery University of Southern California. “A Historical Walk through Pituitary Surgery”

2007 Charles Wilson, MD, Past Chairman, Department of Neurosurgery University of California, San Francisco. “The Future of Neuroscience”

2008 Peter Jannetta, MD, Past Professor and Chairman Department of Neurosurgery, University of Pittsburgh. “Vascular Compression in the Brainstem: Main Streaming Neurosurgery”

2009 L. Nelson Hopkins, MD, Professor and Chairman of Neurosurgery University at Buffalo, State University of New York. “Neurosurgeons and Stroke: From Prevention to Treatment”

2010 Sean Mullan, MD, Professor Emeritus of Neurosurgery University of Chicago. “Some Neurosurgical Fossils”

2011 John A. Jane, Sr., MD, PhD, Professor of Neurosurgery University of Virginia Health System. “Anterior vs Posterior Approaches to the Cervical Spine”

2012 John R. Adler, Jr., MD Professor of Neurosurgery. Stanford University. “Stepping-Out of the OR: A Surgeon’s Foray into Entrepreneurship”

2014 Andres M. Lozono, MD, Professor of Neurosurgery, University of Toronto. “Taming Dysfunctional Brain Circuits”

2015 Edward Oldfield, MD, Professor Neurosurgery, University of Virginia. “The origin of concepts in neurosurgery: One neurosurgeon’s perspective”

2016 Donald P. Becker, MD Brain Trauma and Beyond: A Career in Neurosurgery

INVITED SPECIAL LECTURERS

Ken Hon, PhD
Professor of Geology, University of Hawaii (Volcanologist)
Interim Vice Chancellor, Academic Affairs, University of Hawaii at Hilo

I am a volcanologist and teach at the University of Hawaii at Hilo. While I specialize in Volcanology, I also teach courses in the Physical Geology, Volcanoes and Earthquakes, Geology of the Hawaiian Islands, Mineralogy, Petrology, Volcanology, and Remote Sensing.

My research interests with volcanoes concentrate on basaltic volcanoes in Hawaii and large ash-flow caldera eruptions. I'm probably best known for my work on the mechanics of pahoehoe lava emplacement, but all lava flows have a special place in my heart. I love trying to gently coax a volcano’s story out of the rocks and minerals. But if that doesn’t work, grinding them to bits and torturing them in hot furnaces and under electron beams is kind of fun too! One way or the other, they eventually talk and say some pretty interesting things.

Doing all this stuff seems to interest other people and I’ve been interviewed on many TV programs talking about the Hawaiian Islands, Kilauea, and lava flows. One of the most fun interviews was when I talked the History Channel into including my entire volcanology class in a program called SUICIDE MISSIONS: VOLCANOLOGISTS. The students were totally stoked and were good on camera.

Prior to coming to UHH, I worked for 15 years at the US Geological Survey in the Volcano Hazards Program, including 3 years at the Hawaiian Volcano Observatory. During my tenure at HVO the town of Kalapana was overrun by lava and I was intimately involved with monitoring the progress of lava flows and evacuating residents. This experience had a profound effect on me and made me much more interested in making science more applicable to people.

During August 2012, I was a co-convenor of the AGU Chapman Conference titled Hawaiian Volcanoes from Source to Surface. This conference was held to commemorate the 100th Anniversary of the Hawaiian Volcano Observatory and brought together researchers from around the world to discuss the state of knowledge about Hawaiian volcanism. ~Ken Hon, PhD

Big Island/Volcano

Tribute to Charlie Wilson

Dr. Charles Wilson passed away on February 24, 2018. Born in Neosho Missouri in 1929 his mother was half Cherokee, his father a pharmacist. Small but muscular, he loved to play football. He attended Tulane University for undergraduate, then medical education. First a pathologist, he decided on a career in neurosurgery while being treated for TB. Under Dr. Dean Echols at Tulane he learned his craft, and began a life quest to cure malignant gliomas. First Division Chair at the University of Kentucky, then at 38 years of age Department Chair at UCSF, he developed the world renowned Brain Tumor Research Center and his clinical practice treating the most challenging problems we face. He was tirelessly devoted to fostering the underrepresented: women, people of color, Native Americans. He trained generations of neurosurgical educators and scientists. Upon retirement he worked at the Institute for the Future, and with Minister Bill Rankin developed the Global AIDS Interfaith Alliance, providing antiviral medication to the pregnant women of Malawi. Charlie’s influence was global.
2018 RESIDENT AWARD RECIPIENTS

Basic Science Award
Allen Ho, MD Stanford

Allen was born and raised in Irvine, California. He completed his undergraduate training at University of California, San Diego as part of the combined-degree Medical Scholars Program with a major in Economics. He then left California to attend Harvard Medical School where he earned his MD in 2014. His research interests include expanding indications for deep brain stimulation and neuromodulation, technology-driven minimally-invasive approaches to cranial and spinal neurosurgery, and quality improvement initiatives within clinical neurosurgery. In the Halpern Lab, Allen is studying the utilization of robot-assisted stereotaxy in neurosurgery, minimally invasive and responsive therapies for epilepsy, and exploring the role of neuromodulation in alcohol addiction, OCD, and obesity in both animal models and humans. He is currently completing an in-folded Complex Spine Fellowship at Stanford.

Clinical Science Award
Yevgeniy Freyvert, MD UCLA

Dr. Yevgeniy Freyvert is a fifth-year Neurosurgery resident at University of California, Los Angeles. He completed his undergraduate degree in Molecular and Cell Biology and Integrative Biology at the University of California, Berkeley and his medical degree at the State University of New York, Syracuse. His prior research has spanned multiple fields including surgical tool development, genetic engineering, neurophysiology, and traumatic brain injury. He is currently investigating novel methods to reactivate the spinal cord after traumatic spinal cord injury. In his spare time, Dr. Freyvert enjoys the outdoors, science fiction, and cooking.
Saturday September 15, 2018

06:30 AM - 07:25 AM Breakfast with Exhibitors (Salon 3)

07:25 AM - 07:30 AM Welcome – Martin Weinand, MD

07:30 AM - 08:30 AM Scientific Session 1 (Plaza Ballroom): Spine Neurosurgery (9 min talk, 3 min discussion)

Moderators: Ciara Harraher, MD and Marco Lee, MD

1. Andrew Dailey, MD: University of Utah “The Occipitoatlantal Capsular Ligaments Are The Primary Stabilizers Of The Occipitoatlantal Joint In The Cranio cervical Junction: A Finite Element Analysis” Member

2. Lee Tan, MD: UCSF “Topical Transexamic Acid in Spinal Surgery: a systemic review and meta-analysis” Member Candidate

3. Martin Mortazavi, MD: Thousand Oaks “The evolving role of Subarachnoid Trabeculae Dissection” Member Candidate

4. Praveen Mummaneni, MD: UCSF “Elderly patients have worse EQ-5D outcomes after spondylolisthesis surgery than young patients, yet they are satisfied with surgery.” Member

5. Estrada Bernard, MD: Anchorage Neurosurgical Institutes “Spinal cord stimulator implantation: paddle electrode based program using MIS techniques” Member Candidate

8:30 AM - 9:06 AM Scientific Session 2 (Plaza Ballroom): Vascular neurosurgery (9 min talk, 3 min discussion)

Moderators: Ciara Harraher, MD and Marco Lee, MD

1. Gary Steinberg, MD, PhD: Stanford “Surgical Treatment of Recurrent Previously Coiled and/or Stent-Coiled Intracerebral Aneurysms: A Single-Center Experience in a Series of 75 Patients” Member

2. Ian Ross, MD: Huntington Hospital “EDAS for adult ischemic cerebrovascular disease” Member

3. Isaac Yang, MD: UCLA The Meningioma Vascularity Index: A Semi automated Volumetric Analysis of Flow Voids to Predict Intraoperative Blood Loss in Non-Embolized Meningiomas Member

General Interest Topic: Big Island/Volcano (Plaza Ballroom)

09:06 AM – 09:50 AM Ken Hon PhD, Professor of Geology, University of Hawaii (Volcanologist!), Interim Vice Chancellor, Academic Affairs, University of Hawaii at Hilo.
09:50 AM - 10:20 AM  Break with Exhibitors (Salon 3)
10:20 AM - 10:45 AM  Brian Andrews, MD “Tribute to Charlie Wilson”
10:45 AM - Noon  Scientific Session 3 (Plaza Ballroom): Functional Neurosurgery (9 min talk, 3.5 min discussion)
   Moderator: Odette Harris, MD

   1. Mark Sedrak, MD: Kaiser Redwood City “Mathematics of Stereotactic Neurosurgery and implications of practice” Member Candidate
   2. Nader Pouratian, MD: UCLA “Phosphene thresholds in the blind inherit the strength-duration curve of neuronal excitation” Member Candidate
   3. Jason Hauptman, MD: University of Washington “Changes in Resting State Connectivity in Pediatric Temporal Lobe Epilepsy” Member Candidate
   4. Ausaf Bari, MD: UCLA “Mapping of the Human Amygdala and Hippocampus Reveals Roles in Sleep, Euphoria and Aggression” Member Candidate
   5. Andrew Ko, MD: University of Washington “STN DBS modulates cortical excitability measured using direct cortical motor-evoked potentials” Member Candidate
   6. Richard Perrin, MD: Sierra Neurosurgery “Spontaneous pneumocephalus associated with a ventriculoperitoneal shunt: case review and review of the literature” Member Candidate

Noon  Adjourn, afternoon activities

---- Local's Night ---- 06:00 PM – 09:30 PM Coconut Grove
Sunday September 16, 2018

06:30 AM - 08:00 AM  **Member Business Meeting (Promenade 12) & Guest Breakfast (Salon 3)**

08:00 AM - 08:50 AM  **Scientific Session (4) Plaza Ballroom: Brain Tumor** (9 min talk, 3 min discussion)

  **Moderators:** Marvin Bergsneider, MD and Gordon Li, MD

4.  **Thomas Chen,** **MD:** USC Intra-arterial NEO100 transiently opens up the BBB Member
5.  **Marvin Bergsneider,** **MD:** UCLA Efficacy of Gliadel Wafers for Treatment of Recurrent Malignant Meningiomas Member
6.  **Kenneth De Los Reyes,** **MD:** Loma Linda “Male secondary hypogonadism and endoscopic pituitary surgery” Member Candidate
7.  **Terry Burns,** **MD:** Mayo Clinic “Pro-tumorigenic impacts of prior brain radiation within the glioblastoma microenvironment” Member Candidate

08:50-09:45  **Scientific Session (5) Plaza Ballroom: General Interest** (8 min talk, 3 min discussion)

  **Moderators:** Marc Vanefsky, MD and Andrew Little, MD

1.  **Jeff Rush,** **MD:** Colorado Private Practice “The Future for Marijuana” Member
2.  **Mark Hamilton,** **MD:** University of Calgary “Development and Application of a Surgical Site Infection Prevention Bundle for Shunt-Related Cerebrospinal Fluid Insertions and Revisions in Adult Patients” Member
3.  **Samer Ghostine,** **MD:** UC Riverside “Challenges in building a neurosurgical program amidst Healthcare politics in the Inland Empire” Member Candidate
4.  **Scott Berta,** **MD:** UCSF “The Future of Neuroscience Medicine” Member Candidate
5.  **Anand Veeravagu,** **MD:** Stanford “Deformity Spine Surgery and Movement Disorders-risks and expectations” Member Candidate

09:45 – 10:35  **Ablin Lecture (Plaza Ballroom)**

09:45 - 09:50  Introduction by Gordon Li, MD
09:50 to 10:35  Michael Edwards, MD 40 years of Pediatric Neurosurgery: The impact of Moore’s Law

10:35-11:00  **Break with Exhibitors (Salon 3)**

11:00 – 11:45  **Cloward Award Lecture (Plaza Ballroom)**

11:00-11:05  Introduction by Tom Scully, MD
11:05-11:45  Ed Laws, MD, PhD, Virtuosity in Surgery and Neurosurgery

11:45 – 12:30  **Presidential Address**

11:45-11:50  Introduction by Mike Lemole, MD
11:50-12:30  Epilepsy Surgery: One Neurosurgeon’s Journey, Martin Weinand, MD

12:30  **Adjourn,** afternoon activities

05:45 PM – 06:00 PM New Member w/Executive Committee Reception Ballroom Courtyard
06:00 PM – 10:30 PM Reception/Black Tie Dinner/Dancing Ballroom Courtyard and Salons 1 & 2
Monday September 17, 2018

06:30-07:30  Breakfast with the Exhibitors (Salon 3)

07:30-08:00  Resident Award Presentations (Plaza Ballroom) (10 min talk, 5 min discussion)

Moderators: Melanie Hayden, MD and Michael Lim, MD

- Basic Science Award  Allen Ho, MD Stanford Initial Optimization of Nucleus Accumbens DBS with Coordinated Reset Stimulation for Binge Drinking
- Clinical Science Award  Yevgeniy Freyvert, MD UCLA Transcutaneous electrical stimulation and a serotonin agonist re-enable volitional hand control in tetraplegic patients

08:00-09:50  Mini Spine Symposium (Plaza Ballroom)  Minimally Invasive, Minimal Morbidity Spine Surgery

Moderator: Laura Snyder, MD (15 minute talks 5 minute questions)

08:00-08:20  Stephen Ritland, MD "Neuroanatomic considerations in MIS" member
08:20-08:40  Richard Chua, MD "MIS Techniques for Intradural Tumor Resection" member
08:40-09:00  John Hurlbert, MD “Nuisances in lumbar discectomy” Guest
09:00-09:20  Laura Snyder, MD "Improving the MIS TLIF and including Robotic Techniques" member
09:20-09:40  Khoi Than, MD "MIS and Hybrid Scoliosis techniques” member candidate
09:40-09:50  Discussion/Questions

09:50-10:15  Break with Exhibitors (Salon 3)

10:15-12:00  Mini Tumor symposium (Plaza Ballroom)

Moderator Gordon Li, MD (15 minute talks 5 minute questions)

10:15-10:35  Melanie Hayden, MD “Indication for radiosurgery and brain metastases” Member
10:35-10:55  Andrew Little, MD “Hot topics in pituitary surgery: preventing delayed hyponatremia, new pathology guidelines, and gland outcomes” Member
10:55-11:15  Michael Lim, MD "Current and Failed Glioblastoma trials" Invited Speaker
11:15-11:35  Juan Fernandez-Miranda, MD “Extended Approaches for Anterior Skull Base Surgery” Member Candidate
11:35-11:55  Kia Shahaie, MD “Keyhole/endoscopic minimally invasive cranial surgery” Guest
11:55-12:00  Discussion/Questions

12:00  Meeting Adjourn – See you in Arizona
ABSTRACTS – SATURDAY

Scientific Session I (1-5)

1. The Occipitoatlantal Capsular Ligaments Are The Primary Stabilizers Of The Occipitoatlantal Joint In The Craniocervical Junction: A Finite Element Analysis

Rinchen Phuntsok, Andrew T. Dailey, Benjamin J. Ellis, Douglas L. Brockmeyer (Salt Lake City, UT)

INTRODUCTION: There is contradictory evidence regarding the contribution of the different stabilizing ligaments of the occipitoatlantal (OA) joint. Cadaveric studies are limited by the nature of the injury scenarios that can be tested to identify stabilizing ligaments of the craniocervical junction (CCJ). Finite element (FE) analysis can overcome these limitations.

METHODS: Five normal FE models with subject-specific bony anatomy and nearly identical ligamentous properties were created. We then simulated the effect of isolated and combined injury scenarios of the Occipital atlantar capsular ligaments (OACLs), transverse ligament (TL), tectorial membrane (TM), and alar ligaments (ALs). Each model was tested in flexion-extension, axial rotation, and lateral bending. Isolated ligamentous injury scenarios consisted of either decreasing the stiffness of the OACLs or completely removing the TL, TM, or ALs. Combination scenarios were also evaluated.

RESULTS: An isolated OACL injury resulted in the largest percent increase in all ranges of motion (ROM) at the OA joint compared with the other isolated injuries. Flexion, extension, lateral bending, and axial rotation significantly increased by 12.9±8.4%, 12.2±11.5%, 84.6±8.3% and 78.9±11.4%, respectively (p≤0.05 for all). These increased ROMs at C0-C1 caused significant ROM increases at C0-C2 for all ROMs, except extension (p≤0.05 for all). Among combination injuries, OACL+TM+TL injury resulted in the most significant increases in ROM for both the OA joint (by 16.5±12.0%, 15.0±8.0%, 90.3±10.0%, and 149.5±35.0%, respectively, p≤0.05 for all) and the CCJ during all loading scenarios. OACL+AL injury caused the most significant percent increase (96.0±13.0%) for OA joint axial rotation.

CONCLUSIONS: These results demonstrate that the OACLs are the key stabilizing structures of the OA joint. Furthermore, reduction of OACL stiffness caused a significant increase in CCJ ROM in all planes. Isolated injuries of TL, TM or AL are unlikely to result in appreciable instability at the OA joint.

2. TITLE: Topical Tranexamic Acid in Spinal Surgery: a Systematic Review and Meta-Analysis

John F. Burke, MD, PhD, Department of Neurological Surgery, UCSF
Lee Tan, MD, UCSF-presenting

INTRODUCTION: Tranexamic acid (TXA) is a commonly used antifibrinolytic agent for perioperative blood conservation in several surgical specialties. Although historically administered intravenously, such systemic administration may be accompanied by severe side effects. Thus, the topical usage of TXA has been established in several fields but remains poorly evaluated in spine surgery.

METHODS: We systematically searched the literature for manuscripts and unpublished clinical trials reported by April 2018 exploring topical TXA usage in spine surgery. A random-effects analysis was performed comparing postoperative blood loss and hospitalization lengths of stay between patients receiving a control vs topical TXA for intraoperative blood management.
RESULTS: We identified 5 articles and 1 unpublished clinical trial that were placebo-controlled and comprised 218 patients receiving topical TXA in spine surgery. Patients receiving topical TXA demonstrated significantly lower postoperative blood loss as compared to the placebo group (standardized mean difference [SMD] 2.05, 95% confidence interval [CI] 0.84-3.26, $p < 0.001$) and had a lower hospitalization duration (MD 0.99, 95% CI 0.49-1.49, $p < 0.001$).

CONCLUSION: Topical TXA favorably reduced postoperative blood loss and hospitalization duration in patients undergoing spinal surgery. However, further randomized controlled trials will be needed to definitively establish the optimal therapeutic doses needed for hemorrhage management, and the pharmacodynamics of TXA in spinal surgery.

Supplementary Figure Below:

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<th>Study</th>
<th>Weights</th>
<th>SMD [95% CI]</th>
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<td>Krohn, 2003</td>
<td>13.90%</td>
<td>2.28 [1.36, 3.20]</td>
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<td>Saberi Unilateral, 2010</td>
<td>14.34%</td>
<td>2.38 [1.66, 3.11]</td>
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<td>Saberi Bilateral, 2010</td>
<td>13.06%</td>
<td>5.64 [4.40, 6.88]</td>
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<td>Ren First, 2017</td>
<td>14.85%</td>
<td>1.07 [0.65, 1.49]</td>
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<tr>
<td>Ren Second, 2017</td>
<td>14.84%</td>
<td>1.19 [0.76, 1.61]</td>
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<tr>
<td>Xu, 2017</td>
<td>14.69%</td>
<td>1.92 [1.39, 2.45]</td>
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<tr>
<td>Wood, 2017</td>
<td>14.31%</td>
<td>0.26 [-0.48, 1.00]</td>
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<tr>
<td>RE Model</td>
<td>100.00%</td>
<td>2.05 [0.84, 3.26]</td>
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Furthermore, there was a significantly high heterogeneity present between the studies (Cochran Q = 70.8182, $p < 0.001$, $I^2 = 96.32\%$).

3. Evolution of Retractorless Brain Surgery: The Evolving role of Subarachnoid Trabeculae Dissection

Martin M. Mortazavi, MD. California Institute of Neuroscience National Skull Base Center Thousand Oaks, CA

INTRODUCTION & BACKGROUND: The brain is being held in the subarachnoid space by subarachnoid trabeculae (SAT), which are columns of collagen located between arachnoid and pia mater. Arachnoid membranes with the intervening SAT form the walls and septa of subarachnoid cisterns which are natural pathways for microsurgical dissection. The knowledge of the boundaries and the contents of the subarachnoid trabeculae (SAT) is therefore critical to successful performance of atraumatic and retractorless microsurgical approach.

METHOD: A comprehensive review of published English speaking literature was performed. The inclusion and exclusion of studies was completed by the authors. All controversies and disagreements were settled by discussion. Subarachnoid space, subarachnoid trabeculae,
The Fairmont Orchid Kohala Coast, Hawaii

subarachnoid trabecular membrane, subarachnoid cisterns, microsurgical anatomy, and retractorless surgery were used as search terms.

RESULTS: SAT form cell-to-cell interconnections and junctions between the pia and arachnoid matters. These interconnections provide mechanical support to neurovascular structures. Morphologically, they differ broadly among various parts of the brain, especially within the subarachnoid cisterns compared to the subarachnoid space adjacent to the pia mater. An important aspect of modern safe neurosurgery is the evolution of retractor-less micro-neurosurgery. Due to presence of complex network of the SAT in the vicinity of blood vessels, careful dissection of the SAT allows the neurosurgeon to mobilize the cranial nerves, arteries, and veins within the subarachnoid cisterns. It also allows safe mobilization of brain without the need for retraction. Therefore, access to areas that previously considered to need retraction, would be eased by cautious sharp dissection of the SAT. (See Videos)

CONCLUSION: SAT are delicate collagen-reinforced fibers stretching between arachnoid and pia matters, as well as in between the arachnoid layers of the arachnoid cisterns. In modern safe retractorless neurosurgery, cautious dissection of SAT fibers is vital. Role of SAT in various conditions of brain and spinal cord is to be determined and require biomechanical studies.

References:


4. Elderly patients have worse EQ-5D outcomes after spondylolisthesis surgery than young patients, yet they are satisfied with surgery


Praveen V. Mummaneni, MD, Joan O’Reilly Professor in Spinal Surgery & Vice Chair of Neurological Surgery, Director of Minimally Invasive and Cervical Spine Surgery, Director, Minimally Invasive and Complex Spine Fellowship Program, Co-director, Spinal Surgery and UCSF Spine Center, University of California, San Francisco

INTRODUCTION:
A recent randomized control trial assessing outcomes following surgery for lumbar spinal stenosis and spondylolisthesis excluded patients who were older than 80 years. This study assesses outcomes for patients age>80 years following surgery for degenerative lumbar spondylolisthesis.

METHODS:
This was a retrospective analysis of a prospective registry. 808 patients underwent surgery for grade 1 degenerative lumbar spondylolisthesis at twelve high-enrolling sites. Elderly patients
were identified as age>80 years. Baseline and surgical variables were collected. Numeric rating scale (NRS) back pain, NRS leg pain, Oswestry Disability Index (ODI), EuroQol-5D (EQ-5D), and the North American Spine Society (NASS) Satisfaction Questionnaire were collected at baseline, 3 months, and 12 months.

RESULTS:
Thirty six (4.5%) patients were elderly (range 80-95 years). Elderly patients had lower mean BMI (28.1±4.9 vs. 31.7±6.4, p=0.01), had a higher proportion of osteoporosis (16.7 vs. 6.5%, p=0.04) and were less independently ambulatory at baseline (75.0 vs. 88.0%, p=0.04). Elderly patients received fewer fusion procedures (41.7 vs. 75.8%, p<0.001). There was no difference in satisfaction at 12 months (elderly 83.3 vs. 83.7% NASS 1/2; p=0.85) as well as in 3-month readmission (elderly 8.3 vs. 3.2%, p=0.24) and 12-month reoperation rates (elderly 8.3 vs. 4.9%, p=0.60). At baseline, the elderly cohort had less NRS back pain (5.6±3.1 vs. 6.9±2.6, p=0.02) and higher EQ-5D (0.62±0.19 vs. 0.54±0.24, p=0.04). At 12 months, both the elderly and the control cohort improved significantly with respect to mean baseline values for NRS back and leg pain, ODI, and EQ-5D (p<0.01 for all comparisons). In multivariate analysis, elderly status predicted inferior 12-month EQ5D (OR 0.89, 95% CI 0.82-0.96, p=0.002) and NRS leg pain (OR 3.2, 95% CI 1.2-8.9, p=0.02) but was not predictive of NRS back pain and ODI (all p>0.05).

CONCLUSIONS:
In adjusted analysis, age>80 years was associated with inferior EQ-5D and leg pain at 12 months following lumbar spondylolisthesis surgery. However, elderly patients remained similarly satisfied with surgery. Regardless of age, both elderly and young patients achieved significant improvements in all PRO domains at 3- and 12-month time points.

Figure 1. Baseline, 3-month, and 12-month patient reported outcomes following surgery for grade 1 lumbar spondylolisthesis. (A) Average NRS back pain scores at baseline, 3 months, and 12 months following surgery by cohort. (B) Average NRS leg pain scores at baseline, 3 months, and 12 months following surgery by cohort. (C) Average ODI at baseline, 3 months, and 12 months following surgery by cohort. (D) Average EQ-5D at baseline, 3 months, and 12 months following surgery by cohort. The error bars represent one standard deviation. Though there were differences in NRS back pain at baseline and EQ-5D at baseline and 3 months, both cohorts improved significantly from baseline at 3 and 12 months (p<0.001, all comparisons). There were no differences at 12 months for NRS back pain, NRS leg pain, ODI, and EQ-5D between the cohorts. ** represents a statistically significant difference p<.05 between the elderly and young cohorts.
5. “Spinal cord stimulator implantation: paddle electrode based program using MIS techniques”  
Estrada Bernard, MD, Anchorage Neurosurgical Associates, Inc.

INTRODUCTION:
Spinal cord stimulator therapy is an effective method of chronic pain neuromodulation. Recent advancements in the modality have improved the efficacy by reducing unpleasant side effects. With the societal toll generated by the nationwide opiate crisis, spinal cord stimulator could play an increasing role in addressing the problem of chronic pain. Spinal cord stimulators can be implanted with percutaneous or paddle electrodes. Paddle electrodes, which are placed surgically, have the advantage of less post implantation lead migration and better spinal cord coverage for stimulation. Minimally invasive surgery (MIS) techniques provide a safe method of implanting these electrodes in an outpatient setting.

METHOD:
The project is a retrospective review of one hundred thirty cases of spinal cord stimulator implantations using paddle electrodes by a single neurosurgeon in a general neurosurgical practice using minimally invasive surgery techniques.

RESULTS:
All of the paddle electrodes were placed in an outpatient setting for an outpatient preimplantation trial. All of the preimplantation trials provided greater than 50% pain relief and progressed to permanent implantation. There were no postoperative epidural hematomas. Two electrodes required explantation due to an infection and one due to postoperative neurologic deficits attributable to a cord contusion related to spinal stenosis.

CONCLUSION:
A paddle electrode –based spinal cord stimulator therapy program can be a valuable component of a general neurosurgical practice. Paddle electrodes are advantageous over percutaneous electrodes. Using MIS techniques, these devices can be safely placed in an outpatient setting for preimplantation trial and can remain in place for permanent implantation. Patient selection parameters, developed protocol and lessons learned for safe implementation will be reviewed.

Scientific Session II (1-3)

1. Surgical Treatment of Recurrent Previously Coiled and/or Stent-Coiled Intracerebral Aneurysms: A Single-Center Experience in a Series of 75 Patients
   
   Gary K. Steinberg, MD, PhD, Stanford University

BACKGROUND:
Endovascular treated cerebral aneurysms have a greater recurrence rate compared to microsurgical clip ligation. Although repeat endovascular treatment is an option, microsurgical clip ligation might be the treatment of choice for some previously endovascular treated
recurrent aneurysms. We report our experience with 76 previously coiled or stent-coiled aneurysms.

METHODS:
Patients were retrospectively identified from our institution’s database. Demographic data, aneurysm size, location, perioperative coil extraction, occlusion rate and complication rate were recorded. Patients were divided into a previously coiled-only group and a previously stent-assisted coiled group.

RESULTS:
Seventy-five patients with seventy-six aneurysms were included. There were 69 patients in the coil-only group, seven patients in the stent-assisted coil group. Sixty-five (87%) patients presented initially with subarachnoid hemorrhage. Angiographic follow-up was available for 55 and 7 patients in each group. Complete or near-complete occlusion with acceptable small residual neck after clipping was obtained in 95% of patients in the coil-only group as opposed to 57% in the stent-assisted coiling group. Two patients in the coil-only group (2.9%) died postoperatively from a major stroke. Further, one patient died from re-hemorrhage 6 days after wrapping of a fragile basilar apex aneurysm. Minor complications (1 minor stroke that resolved, 1 wound infection, 1 hemorrhage not requiring evacuation and 1 cranial nerve palsy) occurred in 8.7%. In the stent-assisted coiling group the mortality was 0%. One major stroke (14.2%), 1 (14.2%) minor stroke that resolved and 1 (14.2%) cranial nerve palsy occurred in this group. Intraoperative coil extraction and previous stent-assisted coiling were significant predictors of complication rate in multivariate analysis (p=0.025 and p=0.0036 respectively). Previous stent-assisted coiling was a significant predictor of incomplete occlusion (p=0.036).

CONCLUSIONS:
Microsurgical clipping of previously endovascular treated recurrent aneurysms is an effective treatment with high obliterations rates. However, previously stent-assisted coiling and intraoperative coil extraction are predictors of worse outcome and incomplete occlusion.

2. **EDAS (encephalo-duro-arterio-synangiosis) for adult ischemic cerebrovascular disease**
   
   Ian B. Ross, MD  
   Huntington Memorial Hospital, Pasadena, CA

INTRODUCTION
Cerebral revascularization remains controversial. Failure of the EC-IC Bypass Study, in 1985, led to a moratorium on said procedures, especially for ischemia. Competitive flow with flow reversal and stagnation in certain vessels was felt to cause of thrombosis and increased risk of stroke in many cases. Indirect procedures, which promote the gradual development of collateral flow from non-transected vascular pedicles, have been successful in moyamoya disease, especially in children. They have not been well studied in adults.

METHODS
Between March, 2015 and November, 2017 we performed 11 encephalo-duro-arterio-synangiosis (EDAS) procedures on ten patients (age range 35 to 70 years, 70% female) with cerebral ischemia due to intracranial steno-occlusive disease. Two had a picture of moyamoya disease, two occlusive disease from tyrosine kinase inhibitor use, and the rest were felt to be atherosclerotic, with or without diabetes. Follow-up angiography was performed at roughly 6 months post procedure (range 5 months to 1.5 years). One patient was lost to follow-up, one post-procedure angiogram was pending at submission date for this abstract.
RESULTS
Of the 9 grafts studied, 5 showed robust flow, three minimal flow and one no flow. There were no peri-procedural complications, neurological or otherwise. All patients with follow-up remained clinically stable. The three patients who did not revascularize robustly had non-progressive, and less severe upstream disease. The “no flow” patient had had to restart a tyrosine kinase inhibitor for CML, but her cerebrovascular disease had not progressed on follow-up angiography.

CONCLUSION:
EDAS is safe. It may be a useful adjunct in carefully selected adult patients with ischemic cerebrovascular disease. Diabetes with intracranial disease is not a contraindication and these patients show good revascularization with the EDAS procedure. Patients who have intracranial disease secondary to tyrosine kinase inhibitor use may not be good candidates for EDAS.

3. The Meningioma Vascularity Index: a volumetric analysis of flow voids to predict intraoperative blood loss in nonembolized meningiomas
Isaac Yang: University of California, Los Angeles, CA. iyang@mednet.ucla.edu.

OBJECTIVE:
Meningiomas that appear hypervascular on neuroimaging could be amenable to preoperative embolization. However, methods for measuring hypervascularity have not been described, nor has the benefit of preoperative embolization been adjudicated. The objective of this study was to show a relationship between flow void volume (measured on MRI) and intraoperative estimated blood loss (EBL) in nonembolized meningiomas.

METHODS:
The authors performed volumetric analyses of 51 intracranial meningiomas (21 preoperatively embolized) resected at their institution. Through the use of image segmentation software and a voxel-based segmentation method, flow void volumes were measured on T2-weighted MR images. This metric was named the Meningioma Vascularity Index (MVI). The primary outcomes were intraoperative EBL and perioperative blood transfusion.

RESULTS:
In the nonembolized group, the MVI correlated with intraoperative EBL when controlling for tumor volume ($r = 0.55$, $p = 0.002$). The MVI also correlated with perioperative blood transfusion (point-biserial correlation $[r_{pb}] = 0.57$, $p = 0.001$). A greater MVI was associated with an increased risk of blood transfusion (odds ratio [OR] 5.79, 95% confidence interval [CI] 1.15–29.15) and subtotal resection (OR 7.64, 95% CI 1.74–33.58). In the embolized group, those relationships were not found. There were no significant differences in MVI, intraoperative EBL, or blood transfusion across groups.

CONCLUSIONS:
This study clearly shows a relationship between MVI and intraoperative EBL in nonembolized meningiomas when controlling for tumor volume. The MVI is a potential biomarker for tumors that would benefit from embolization.
ABBREVIATIONS  EBL = estimated blood loss; MMA = middle meningeal artery; MVI = Meningioma Vascular Index; n-BCA = n-butyl cyanoacrylate; PVA = polyvinyl alcohol; rpb = point-biserial correlation; vWF = von Willebrand factor.

SCIENTIFIC SESSION III (1-6)

1. Mathematics of stereotactic neurosurgery and implications on practice

   Mark Sedrak, MD, Kaiser Permanente, Redwood City, CA

   INTRODUCTION:
   Stereotactic procedures utilize mathematics of linear algebra as Cartesian coordinate systems in Euclidian space. Close understanding of these has wide ramifications in the clinical practice of neurosurgery. Unfortunately, this math is not compiled in a format that is well known to neurosurgeons.

   METHODS:
   Several mathematical hypotheses were tested in trial and error and developed on custom software to prove accuracy effectiveness. In the first design, clinical angles (coronal and sagittal) in frame based stereotaxis were used and converted to spherical coordinate systems. Then Talairach and CRW coordinates were developed and converted from one to the other using matrix transforms. Imaging data was then utilized and converted into stereotactic data and novel mathematics was used to find the “nearest” pixel to a desired location. These data were tested against standard stereotactic software for efficacy. Next, the use of biplanar XRay in surgery was analyzed using the assumption of point source and detection plane in CRW space. Lastly, reverse calculations in both planes followed by vector intersection calculation were programmed and reviewed in 3D scatterplot.

   RESULTS:
   Excellent correlation between mathematical models and stereotactic data was found. 3D scatterplot appeared very useful for identifying outlier’s in large pools of data. Matrix transforms can be utilized to convert frame based coordinates to anatomical coordinates. Modeling of imaging based data could also be readily converted into usable data that can be calculated. Ray tracing and projection models showed accurate overlap and vector intersection successfully produced accurate intraoperative localization of microelectrode and DBS primary leads.

   CONCLUSIONS:
   Fundamental mathematics of frame based stereotaxis is of high value to the functional neurosurgeon. No single publication describes the mathematics, making the subject all the more difficult to comprehend. Understanding of these fundamental can be very useful especially to the practice of frame based and frameless stereotaxis.

2. Phosphen e thresholds in the blind inherit the strength-duration curve of neuronal excitation

   Nader Pouratian, MD PhD, UCLA Neurosurgery
INTRODUCTION:
Studying the mechanism of eliciting subjective visual sensations called “phosphenes” is one way to understand the neural correlates of visual perception. Non-invasive measurements of cortical excitability during transcranial magnetic stimulation (TMS) of human primary visual cortex indicated the involvement of V1 excitation in producing phosphenes. However, electrophysiological mechanism of phosphene perception is poorly characterized by these non-invasive methods. We propose that phosphene thresholds obtained by invasive cortical stimulation of V1 provides a more reliable representation of V1 excitation and may inherit the basic characteristics of neuronal excitation specifically the strength-duration curve.

METHOD:
Two parallel cortical strip leads (each with 4 contacts) was implanted over the right medial occipital lobe of a blind volunteer to assess the feasibility of a visual cortical prosthesis. Phosphene thresholds in the form of stimulation current was measured for a range of stimulation pulse-widths and frequencies in multiple time points after implantation. Current thresholds were plotted against the stimulation Pulse-widths and frequencies.

RESULTS:
Current-pulse width and current-frequency curves shared the two basic characteristics of the strength-duration curve of neuronal excitation: i) a rheobase current (the minimal amplitude of infinite pulse width) was present in both curves and ii) for the lowest amount of pulse-width or frequency, a minimum charge is required to elicit a phosphene and the extra charge increases linearly as pulse-width or frequency increase.

CONCLUSION:
The similar attributes of phosphene threshold curves and strength-duration curve of neuronal excitation suggests that V1 may be directly involved in phosphene perception. Therefore our current knowledge of neuronal excitation can be employed to generate visual perception especially in the case of visual cortical prostheses.

3. Changes in resting state connectivity in pediatric temporal lobe epilepsy

Jason Hauptman, MD University of Washington/Seattle Children’s Hospital

OBJECT:
Functional connectivity magnetic resonance imaging (fcMRI) is a form of fMRI that allows for analysis of BOLD signal changes within a task-free, resting paradigm. This technique has been shown to have efficacy in evaluating network connectivity changes with epilepsy. Presurgical data from patients with unilateral temporal lobe epilepsy were evaluated using the fcMRI technique to define connectivity changes within and between the diseased and healthy temporal lobes using a within subjects design.

METHODS:
Using presurgical fcMRI data from pediatric patients with unilateral temporal lobe epilepsy, seed-based analyses were performed within the diseased and healthy temporal lobes. Connectivity within and between temporal lobe seeds were measured and compared.

RESULTS:
In the cohort studied, local ipsilateral temporal lobe connectivity was significantly increased on the diseased side compared to the healthy temporal lobe. Connectivity of the diseased side to the healthy side, on the other hand, was significantly reduced when compared to connectivity of the healthy side to the diseased temporal lobe. A statistically significant regression was observed when comparing the changes in local ipsilateral temporal lobe connectivity to the
changes in inter-temporal lobe connectivity. A statistically significant difference was also noted in ipsilateral connectivity changes between MTS and non-MTS patients.

CONCLUSION:
Using fCMRI, significant changes in ipsilateral temporal lobe and inter-temporal lobe connectivity can be appreciated in unilateral temporal lobe epilepsy. Furthermore, fCMRI may have a role in the presurgical evaluation of patients with intractable temporal lobe epilepsy.

4. Mapping of the Human Amygdala and Hippocampus Reveals Roles in Sleep, Euphoria and Aggression

Ausaf Bari M.D., Ph.D., UCLA Department of Neurosurgery, Los Angeles, CA

INTRODUCTION
The amygdala is known for its role in emotional processing, anxiety and reward. Evidence supporting these functions is derived mainly from non-human primate data, and detailed human mapping of the amygdala and hippocampus in subjects without structural brain abnormalities is lacking. Also, few studies have combined awake stimulation mapping of the amygdala with structural connectivity analysis.

METHODS
We performed stimulation mapping of the amygdala and adjacent hippocampus in a 40-year-old male after placement of bilateral amygdala deep brain stimulation (DBS) electrodes for post-traumatic stress disorder (PTSD). One month following surgery the subject underwent stimulation mapping in the epilepsy monitoring unit (parameters: 160 Hz, 90 μs pulse width and voltage: 0V to 5V). Behavioral, EEG and physiologic data were recorded. In addition, we performed probabilistic tractography using data from 197 healthy subjects in a structural connectivity analysis from the amygdala to various targets. Target structures consisted of the brainstem, dorsolateral prefrontal cortex (DLPFC), hippocampus, insula, nucleus accumbens (NAc), orbitofrontal cortex (OFC), and rostral anterior cingulate cortex (rACC). Voxel-wise amygdala statistical connectivity maps were calculated. These, along with the subject’s MRI and post-operative CT scans were registered to MNI space and overlaid on a histological brain atlas.

RESULTS
We found that stimulation of the right hippocampal contact induced profound voltage-dependent sleepiness which was correlated with diffuse slowing on EEG. Stimulation of more dorsal basolateral amygdala contacts resulted in euphoria at low voltages and was associated with amygdala voxels with higher OFC connectivity. Stimulation of these contacts at higher voltages resulted in aggressive behavior.

CONCLUSION
To our knowledge, this is the first description of direct hippocampal stimulation resulting in profound drowsiness in a subject without structural abnormalities. This finding highlights a potentially critical role of the hippocampus in orchestrating the initiation of sleep through its known fornical hypothalamic connections.
5. **STN DBS modulates cortical excitability measured using direct cortical motor-evoked potentials**

Andrew L. Ko, MD University of Washington, Seattle, WA

**OBJECTIVE:**
STN DBS is a safe and efficacious treatment for Parkinson’s disease. There is evidence that STN DBS affects distributed cortico-subcortical interactions, and that its effect may be due to changes in sensitivity to extrinsic afferents within these cortico-subcortical networks. In this study, we investigate the impact of STN DBS on EMG response thresholds during direct cortical motor-evoked potentials.

**METHODS:**
A temporary subdural electrode was implanted over hand sensorimotor cortex during placement of intracranial electrodes for STN DBS in 8 patients. SSEPs and intraoperative CT were used to localize the electrode used for MEPs, and EMG responses were recorded in the contralateral upper extremity. MEP thresholds were determined and response curves were obtained in DBS-ON and DBS-OFF conditions. DBS was applied using a bipolar configuration at 0-1+, 1-2+ and 2-3+, at 3.0V amplitude, 60 usec PW and a rate of 180 Hz. A generalized linear model was fit to MEP responses under each condition. Electrode localization was performed using LeadDBS and normalized to the MNI152 atlas.

**RESULTS:**
Significant decreases in the stimulation amplitude needed to generate EMG responses were seen in all 8 patients, at 13/24 DBS stimulation sites (p<0.05). Average decrease in MEP threshold during DBS was 1.27mA (SD=0.96), and was seen selectively at stimulation sites within the dorsolateral STN or dorsal to STN.

**CONCLUSIONS:**
STN DBS appears to lower stimulation amplitudes needed to evoke an EMG response using direct cortical stimulation. This may reflect changes in cortical excitability during stimulation in the dorsolateral STN.

**REFERENCES:**

6. **Spontaneous pneumocephalus associated with a ventriculoperitoneal shunt: case review and review of the literature**

Richard Perrin, MD Sierra Neurosurgery Group, Reno NV

Spontaneous pneumocephalus is rarely encountered in clinical practice. A case of spontaneous idiopathic pneumocephalus associated with the presence of a ventriculoperitoneal shunt is presented. The etiology of the pneumocephalus was never elucidated, but it is possible that changes in barometric pressure were contributing factors. The patient was managed conservatively. A review of the literature, including the pathophysiology, and treatment of pneumocephalus as well as potential risks of air transport of patients with pneumocephalus will be discussed.
1. **Intra-arterial NEO100 transiently opens up the Blood Brain Barrier**

   **Thomas C Chen,** University of Southern California, LA, California

   NEO100 is a GMP grade highly purified version of perillyl alcohol (POH), a monoterpene with cell cycle inhibitor properties. It is currently administered intranasally in Phase I/IIa trial in the United States for patients with recurrent GBM under IND from the FDA. Recently, we have found that NEO100 may be administered in a vitro setting, resulting in transient opening of the blood brain barrier. We have confirmed this finding in-vivo using an intracardiac injection of NEO100; intracardiac injection is used as an intra-arterial model for small rodents. Evans Blue injected intravenously after intracardiac NEO100 leads to staining throughout the whole brain. This effect is seen for up to 6 hours after injection; after that time, no Evans Blue stain is seen in the brain. We then injected a small molecule (dopamine), which normally does not cross the blood brain barrier. We were able to detect dopamine in the brain via HPLC after intracardiac injection of NEO100, followed by intravenous dopamine. Having demonstrated that non BBB permeable small molecules can cross into the brain with intra-arterial NEO100, we then tested fluorescent antibodies. Again, intracardiac injection of NEO100 followed by intravenous fluorescent antibodies allowed the antibodies to be detected in the normal brain. An in-vivo intracranial model of GL26 tumor was created. The checkpoint inhibitor antibody (anti-PD1) was used. Four groups (6 animals per group) were treated: Group 1-saline alone Group 2-NEO100 alone Group 3-anti-PD1 alone Group 4-NEO100 followed by anti-PD1. Kaplan Meier survival curves were constructed. All animals in Group 1 and Group 2 passed away within one week. Group 3 had one survivor, Group 4-all six animals survived and are still doing well. We will be translating this study into a clinical trial using interventional neuroradiology to deliver NEO100, followed by intravenous administration of anti-PD1.

2. **Efficacy of Gliadel Wafers for Treatment of Recurrent Malignant Meningiomas**

   **Marvin Bergsneider, MD UCLA,** Phioanh L Nghiemphu, MD, Linda Liau, MD PhD

   **BACKGROUND**

   The prognosis for patients presenting with recurrent grade II/III meningiomas failing radiotherapy is poor, associated with ~60% progression at 8 months and 17% PFS at one year. Few alternatives exist, as prior trials with chemotherapy, hormonal agents, and small molecule inhibitors have largely been ineffective.

   **OBJECTIVES**

   Here, we investigate the use of Gliadel BCNU wafers implanted during image-complete gross total resection of recurrent grade II/III meningiomas.

   **METHODS**

   Four patients ages 27-64 yo at first resection, diagnosed with recurrent grade II/III meningiomas, having failed 1-4 cycles of stereotactic radiosurgery/radiotherapy and chemotherapy, KPS>60%, were treated with Gliadel wafer implantation at 2nd, 4th, 4th and 7th resections during 3rd, 4th, 4th and 9th meningioma recurrences. Two patients were concurrently treated with
Temodar+Avastin. PFS for Gliadel-treated patients were retrospectively compared to our institutional control patients with newly diagnosed (n=10) or recurrent (n=21) grade II/III meningiomas. Patients in all groups were followed with serial imaging and neurologic examinations, and assessed for toxicity, complications, and PFS.

RESULTS
PFS in the experimental patients prior to Gliadel implantation was 2-22 months (ave 8.5 months) versus PFS after Gliadel implantation of 21-72 months (ave 41.5 months). PFS in control patients with newly diagnosed grade II/III meningiomas was 2-125 months (ave 48.7 months, p=0.0145); PFS in control patients with recurrent grade II/III tumors was 1-84 months (ave 15.5 months, p=0.0076). A patient who received Gliadel at 9th recurrence remains progression-free for >47 months, the longest period of tumor control during her last 6 recurrences. There were no significant toxicities or complications attributable directly to the use of Gliadel wafers in these patients that were unrelated to their underlying co-morbidities.

CONCLUSIONS:
Gliadel wafers may be safe and effective in controlling local recurrence in selected patients with grade II/III recurrent meningiomas that have failed radiation therapy. Further randomized, controlled studies of Gliadel wafers for refractory meningiomas may be warranted.

3. Male secondary hypogonadism and endoscopic pituitary surgery

Kenneth De Los Reyes, MD; Loma Linda University Health

The effects of endoscopic pituitary surgery and the hypothalamic-pituitary-gonadal axis in men are not as well understood as the other hormonal axes. We seek to understand the risk factors of developing new secondary hypogonadism as well as the predictors of male gonadal restoration in those with pre-operative secondary hypogonadism. We will study 100 consecutive males who underwent endoscopic endonasal pituitary tumor resection between August 2014 and May 2018. Basic demographic information as well as clinical, radiographic, and endocrine data will be collected and analyzed. We hypothesize that developing new secondary hypogonadism after endoscopic pituitary surgery is low (< 5%) and risk factors will include diabetes, obesity, opioid use and other chronic illnesses, as well as low GH post-operatively. Predictors of male gonadal restoration that will be reviewed include age, pre-operative co-morbidities and endocrine function and post-operative prolactin and GH levels.

4. Pro-tumorigenic impacts of prior brain radiation within the glioblastoma microenvironment

Terry C Burns, MD; Mayo Clinic, Rochester, MN

BACKGROUND
Standard management for glioblastoma includes brain radiation. Recurrence, however, is inevitable. Radiation impacts both tumor cells and the tumor microenvironment. The impact of the previously radiated microenvironment on recurrent glioblastoma is not well understood.
METHODS
Human glioblastoma cells were implanted into the striatum 24h following brain radiation doses of 0, 10, or 20 Gy. Microdialysis was performed in the contralateral striatum at 1 month, and radiation-induced alterations in the peri-tumoral microenvironment evaluated via untargeted metabolomics. Mice in all groups were euthanized at 2 months. Tumor size, cell density in the corpus callosum, and cell proliferation were assessed by histology. To more broadly assess the impact of a radiated microenvironment implanted cells, murine ESC-derived neural stem cells were implanted 48h following 0, 5, 10, 15, or 25Gy brain radiation.

RESULTS
At 2 months, mice previously radiated with 20Gy demonstrated larger GBM xenografts with increased proliferation and infiltration, relative to 0Gy or 10Gy pre-radiated animals. Doses of 0, 10Gy, and 20Gy each yielded significantly different metabolomic profiles, including more neurodegenerative-like changes evident with higher amounts of radiation. Implanted neural stem cells exhibited markedly infiltrative behavior in brains previously radiated with 15 or 25Gy, but remained at the injection site following 0, 5, or 10 Gy radiation. Studies of fractionated radiation, delayed implantation, and single cell RNAseq are ongoing to further characterize and elucidate mechanisms. A potential pro-tumorgenic role for senescent cells in the tumor microenvironment is also under investigation.

CONCLUSIONS
Multiple experimental paradigms suggest that the radiated brain facilitates more infiltrative or aggressive behavior of implanted neural stem cells or glioblastoma xenografts. Metabolomic changes in the extracellular milieu correlate with altered behavior of implanted cells. Ongoing work will assess if targeting senescent alterations in the tumor microenvironment could attenuate the aggressiveness of recurrent glioblastoma.

SCIENTIFIC SESSION V (1-5)

1. The Future for Majauana
   Jeffery L Rush, MD, FACS, Breckenridge, CO

Although the federal government still classifies marijuana as a Schedule 1 highly addictive drug with no medical benefit, as January 2018, it is now legal for medical use in 30 states, DC, Puerto Rico, and Guam, while 8 states plus DC have approved it for recreational use. This presentation will review the biochemistry of marijuana (tetrahydrocannabinoid THC and cannabidiol CBD) along with the endocannabinoid neurotransmitter system and its CB1 and CB2 receptors. It will discuss how different areas of the brain and body are affected by marijuana and what symptoms they may individually produce. While many of the medical uses remain anecdotal, the potential for new treatments in epilepsy, tremors, muscle spasms, and pain for multiple sclerosis, nausea from chemotherapy, post-traumatic stress disorder, anxiety and depression, as an appetite stimulant, in some autoimmune diseases, and in pain relief as an adjunct to replace or potentiate opiates, will be emphasized. The health risks associated with marijuana must also be recognized which include impairment of thinking and problem solving, decreased memory, reduced balance and coordination, hallucinations, addictions, and exposure to carcinogens. Nevertheless, it is clear that more research should be conducted on marijuana which appears to have the potential to benefit a significant portion of our ailing population.
2. Development and Application of a Surgical Site Infection Prevention Bundle for Shunt-Related Cerebrospinal Fluid Insertions and Revisions in Adult Patients

Mark G Hamilton, MDCM, FRCSC, University of Calgary, Foothills Hospital, Calgary, Alberta, Canada

INTRODUCTION
Shunt-related surgical site infections (SRSSI) result in significant morbidity including shunt malfunction, cognitive impairment, and require antibiotic therapy and surgical replacement. Rates of SRSSIs of 4.85% and 3.24% in children and adults, respectively, have been reported in the Canadian Nosocomial Infection Surveillance Program (CNISP) in 2013. We developed a CSF shunt SSI Prevention Bundle (SSIPB) for adult patients with a 9-point checklist as a quality improvement initiative and evaluated it post-implementation.

METHODS
A prospective surveillance system for SRSSI was designed based upon the CNISP protocol. Inclusion criteria included insertion or revision of any CSF shunts and exclusion criteria included patients with transcutaneous or external shunting devices or non-shunting devices, patients whose CSF was culture-positive at the time of shunt placement and if the surgery occurred > 12 months before the infection was identified. A standard shunt SSI definition was used. A SSIPB with a 9-point checklist addressing pre-, peri- and post-operative care was developed by Neurosurgery and Infection Prevention and Control (IPC) and then evaluated using an uncontrolled before-after design. No antibiotic-impregnated catheters were used. Differences were assessed using a x² or Fisher exact test as appropriate.

OUTCOMES:
The implementation of the bundle occurred over a 24-month period to ensure a full culture change. Comparing the before-after periods of 2012 - Q32015 vs. Q42015 - total rates of SRSSI of 17/431 (3.94%) vs. 1/160 (0.63%) were noted (p=0.055, two tailed). Insertion rate SRSSIs for 2012-Q32015 vs. Q42015-2016 were 12/205 (5.9%) vs. 0/66 (p=0.04, two-tailed).

CONCLUSIONS and LESSONS LEARNED: We observed a 6.3-fold reduction overall and a statistical significant decrease of SRSSIs for primary shunt insertions post-implementation of a shunt SSIPB without the use of antibiotic-impregnated catheters. Achieving compliance with the Operating Room checklist was challenging; however, it has achieved significant improvements in an operative setting where SSIs are associated with high morbidity.

3. Challenges in building a neurosurgical program amidst Healthcare politics in the Inland Empire

Samer Ghostine, MD: University of California, Riverside

The Inland empire, which encompasses Riverside and San Bernardino county, covers more than 27,000 square miles (70,000 Square Km). It has a population of 4.5 million people and is expected to grow to 7.2 million people over the next 30 years. The Inland Empire has grown in popularity over the years as housing prices, cost of living and maintaining a good quality of life have become more of a challenge in the Los Angeles and Orange county areas. Neurosurgical services are expected to increase nationwide, and in particular in the Inland Empire.

In this talk, the author aims at introducing the progression of his work in the Inland Empire, his vision and mission, and his understanding of the challenges Neurosurgeons face in the Inland empire. A discussion of different insurance plans, (HMO vs IEHP/medical/Kaiser) hospital politics
Neurosurgical services are crucial to the building of many programs most hospitals are interested in boasting like a stroke center, spine center, cancer/Neuro-oncology center, movement disorder center, pain program... Unfortunately, the support to Neurosurgeons in the Inland Empire is minimal to the exception of the Kaiser program, and politics at the level of hospital administration continue to hinder the growth of Neurosurgical programs.

In conclusion, this talk will aim at introducing the author’s views of the Inland Empire challenges neurosurgeons encounter to build neurosurgical programs, and educate future residents for the area.

4. **The Future of Neuroscience Medicine**

   **Scott C. Berta, MD FAANS**, Asst. Clinical Professor at UCSF Dept of Neurological Surgery

**OBJECTIVE**

Medicine is now advancing at an exponential rate. This is especially true in the fields of neurosurgery and neuroscience. The reason for the study is to review and summarize some of the latest technological advancements in neuroscience medicine. This includes but is not limited to technology breakthroughs in machine learning (ML), virtual reality (VR), big data in medicine, personalized medicine and gene sequencing.

**METHODS**

A literature search is performed using PubMed, Neurosurgery On-line, and other related sources on the topics including artificial intelligence, virtual reality, big data in medicine, personalized medicine, gene sequencing and how they relate to the field of neuroscience and neurosurgery.

**RESULTS**

Various studies and journal articles were identified and used in this study and resulted in findings that includes better performance of neurosurgeons using machine learning assistance, the ability to harness big data medicine in neurological areas such as Quality Outcomes Databases, the utilization of virtual reality training is such neurosurgical procedures including placement of ventriculostomies and pedicle screws, as well as the use of neuroproteomics and biomarkers to enhance diagnosis and treatment in neurosurgery.

**CONCLUSION**

Advancement in neurosurgery is largely based on adoption of new technology. This technology is advancing at an exponential rate in neurosurgery. In order to adopt these new technologies and incorporate them into practice relies on the neurosurgeons' ability to continue their own learning and understanding of these technologies as well as the reliance on well respected pioneers in the neurological field to continue promoting them. The results of these actions lead to a synergistic effect on the advancement of neurosurgery and neuroscience medicine.

5. **Deformity Spine Surgery and Movement Disorders—risks and expectations**

   **Anand Veeravagu, MD; Stanford**

**INTRODUCTION**

Movement disorders (MD) are a set of neurological diseases commonly characterized by impaired or uncontrolled motion. With MD patients generally being older in age, spinal
deformities may also develop; however, the efficacy of surgery in such cases is unclear. The objective of this study is to investigate the perioperative complication rates, morbidity, and short term outcomes of patients with MD after spinal deformity surgery.

METHODS
MarketScan data from 2007 to 2015 was queried to identify adult patients with MD who underwent spinal deformity surgery. Perioperative complication rates, 90-day postoperative outcomes, and total costs were compared between patients with MD and controls. Along with multiple logistic regression analysis, a 1:4 experimental to control propensity score match was conducted to assess the effect of MD on outcomes.

RESULTS
A total of 316 patients with MD (1.7%) were identified from the 18970 undergoing surgery for spinal deformity. Forty-four percent of MD patients were over the age of 65, compared to 31% in the control group (p < 0.0001). MD patients also had higher rates of osteoporosis (6.7% vs 3.0% p = 0.002) and use of rhBMP-2 (17.1% vs 11.0% p = 0.0006). The complication rate for MD patients was 44.6% and for the control group 35.6% (p = 0.009). The two most common perioperative complications were acute post-hemorrhagic anemia and deficiency anemia, both of which were significantly more in the MD cohort (26.9% vs 20.8% and 15.5% vs 8.5% respectively, p < 0.05). At 90-days, patients with a movement disorder were more likely to be readmitted and have a higher total cost (17.4% vs 13.2% and $94,672 vs $85,190 respectively, p < 0.05). There was a slightly higher observed reoperation rate for MD patients at 90-days, but this was not statistically significant. After propensity score matching, all baseline characteristics were consistent among the two groups. In this analysis, the complication rate remained statistically higher in the MD group (44.6% vs 37.6%, p < 0.05). 90-day readmissions and costs also remained significantly higher in the MD cohort. No significant difference in hospital stay was observed.

CONCLUSIONS
Patients with MD who undergo spinal deformity surgery may be at risk of higher rate of perioperative complications, 90-day readmissions, and may be more expensive to treat compared to patients without these disorders.

MONDAY RESIDENT AWARD ABSTRACTS

1. Initial optimization of Nucleus Accumbens Deep Brain Stimulation with Coordinated Reset for Binge Drinking

   Allen L Ho, Hemmings Wu, Bina Kakusa, Monique L Smith, Mary Salib, William J Giardino, Peter A Tass, Robert C Malenka, Casey H Halpern.
   Department of Neurosurgery, Stanford University School of Medicine, Stanford, CA.

   INTRODUCTION
   Alcoholism affects nearly 20 million Americans, and excessive binge drinking is responsible for over 100,000 deaths in the US each year. Deep brain stimulation (DBS) of the nucleus accumbens (NAc) has been proposed as a potential therapeutic but optimization of stimulatory parameters utilizing well-validated preclinical models is an important next step. We aimed to limit stimulation-on time in the NAc utilizing coordinated reset DBS (CR-DBS), a novel, spatiotemporal paradigm that induces a long-lasting reduction of pathological synchronization with a fraction of overall current delivery. Therefore, we examined the ability of conventional DBS and CR-DBS to block binge drinking in mice.

   METHODS
   Multipolar electrodes were implanted in the NAc of male C57BL/6J mice. Binge drinking was induced via a modified two-bottle choice version of the standard “Drinking-in-the-Dark” ethanol consumption protocol. Ethanol consumption was tracked in stimulation off and DBS
(130Hz, 60us, 150uA) conditions, as well as in an initial cohort receiving CR-DBS conditions (cycle repetition rate 130Hz). DBS was administered continuously for the 4 hour binge cycle, while CRS was only administered during the first hour.

RESULTS
Relative to sham control trials, DBS resulted in a 66% reduction in binge drinking (N=10; P=0.0002). CR-DBS was delivered for only 7.5% of the stimulation ‘on’ time of continuous DBS, and resulted in an 86% reduction in ethanol consumption that trended towards significance (N=4; P=0.09). Water consumption was unperturbed in both cohorts. Conclusion Conventional DBS is effective in reducing binge ethanol consumption in mice. Additionally, with further refinement of stimulation parameters and timing, CR-DBS may be able to achieve comparable binge drinking reduction with only a fraction of current delivery. This preclinical validation supports further study, and reveals, for the first time, the promise of CR-DBS for psychiatric conditions.

2. Transcutaneous electrical stimulation and a serotonin agonist re-enable volitional hand control in tetraplegic patients

Yevgeniy Freyvert, MD; UCLA Neurosurgery

INTRODUCTION
Spinal cord injury (SCI) affects significant societal and personal impact which scales with ascending level of injury. Upper extremity functional recovery is the top priority in the tetraplegic SCI population. We combine two neuromodulation strategies: transcutaneous electrical stimulation and buspirone pharmacological modulation, to facilitate upper limb motor recovery in chronic cervical SCI tetraplegic subjects.

METHODS
A double-blind protocol was used to determine the effects of cervical electrical stimulation alone or in combination with buspirone on upper limb function in subjects with chronic motor complete (AIS B) cervical injury (n=6). Voluntary upper limb function was evaluated through measures of controlled hand contraction, handgrip force, dexterity measures, and validated clinical assessment batteries. Spasticity was evaluated by the Modified Ashworth Scale. Subjects underwent pre-intervention assessment followed by three treatment phases with stimulation and buspirone or placebo. Delayed post-treatment testing was used to assess durable functional improvement.

RESULTS
All subjects demonstrated significant improvement in upper extremity function. Mean hand strength increased greater than 300% after transcutaneous electrical stimulation plus buspirone. A corresponding improvement was observed in upper extremity functional metrics. Spasticity was significantly and persistently reduced over the course of therapy. Functional improvements generally persisted after the study interventions were discontinued.

FIGURE
Aggregate force means during baseline (Pre), stimulation (+ Stim), and post-stimulation (Post) conditions. Horizontal lines indicate significant differences: P < 0.05 (dotted), P < 0.01 (dash-dot), or P < 0.001 (solid line).
CONCLUSIONS

We demonstrate that these novel interventions can neuromodulate cervical spinal circuitry to improve volitional hand function and reduce spasticity in tetraplegic subjects. The potential impact of these findings on individuals with upper limb paralysis could be dramatic functionally, psychologically, and economically. This investigation lays the groundwork for a therapeutic regimen incorporating non-invasive spinal cord stimulation combined with buspirone to facilitate durable neuromotor recovery in chronic SCI patients.
ORGANIZATIONAL COMMITTEE
Frank M. Anderson* 
Edwin B. Boldrey* 
Howard A. Brown* 
Herbert G. Crockett* 
John Raaf* 
Rupert B. Raney* 
David L. Reeves* 
C. Hunter Sheldon* 

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Aidan Raney* Rupert B. Raney* 
David L. Reeves* C. Hunter Sheldon* 
W. Eugene Stern Frank Turnbull* 
Karl O. Von Hagen* Arthur A. Ward, Jr.* 
Delbert Werden* Ward W. Woods* 
*deceased

DECEASED SOCIETY MEMBERS
(Expired while a member, non-Officers or founder)
Kenneth H. Abbott, Eben Alexander, Jr., James R. Atkinson, Thomas S. Bennett, Irvin H. Betts Jr., 
David Brown, John D. Camp, Norman L. Chater, Cyril B. Courville, John B. Doyle, Charles W. 
Elkins, Hal Pittman, John C. Oakley, Carl W. Rand, Aidan Raney, Nat, D. Reid, Ted Roberts, Adolf 
Welch, William Wright, Eric Yuhl, Edward Zapanta, Michael Robbins, Peter Allen, Deane B. "Skip" 
Jacques, William Hyman, Lester B. Lawrence, Grant Levin, Frank W. Lusignan, John S. Marsh, 
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Peter A. Lake, James Lanshe, Attila Felsosy, Robert D. Fiskin, Anthony Gallo, Leslie Geiger, John 
W. Hanbery, Hale A. Haven, William A Newsom, Shokei Yamada, Robert Florin, Homer 
McClintock

PAST SECRETARY-TREASURERS
Herbert, Crockett* 1955, 1956, 1957 
Ernest W. Mack* 1958, 1959, 1960 
PAST HISTORIANS

- Henry M. Cuneo* 1962-1966
- Ernest W. Mack* 1967-1971
- Donald B. Freshwater* 1972-1976
- George Ablin* 1977-1982
- Gale C. Clark* 1983-1984
- Robert Rand* 1985-1990
- Frank P. Smith* 1991-1995
- John P. Slater 1999-2002
- John T. Bonner 2002-2008
- Randall Smith 2009-2013
- Moustapha Abou-Samra 2014-2016
*deceased

PAST MEETINGS OF THE SOCIETY

1. Biltmore Hotel, Santa Barbara, CA  Nov 25-26, 1955
2. Timberline Lodge, OR  Dec 9-11, 1956
3. Holiday Hotel, Reno, NV  Sept 29-Oct 1, 1957
4. Del Monte Lodge, Pebble Beach, CA  Oct 19-22, 1958
5. La Valencia Hotel, La Jolla, CA  Sept 27-30, 1959
6. Del Monte Lodge, Pebble Beach, CA  Oct 23-26, 1960
10. Fairmont Hotel, San Francisco, CA  Oct 18-21, 1964
11. Olympic Hotel, Seattle, WA  Oct 3-6, 1965
12. Hotel Utah, Salt Lake City, UT  Nov 6-9, 1966
15. Del Monte Lodge, Pebble Beach, CA  Oct 15-18, 1969
19. Airport Marina Hotel, Albuquerque, NM  Sept 16-19, 1973
20. Santa Barbara Biltmore Hotel, CA  Oct 27-30, 1974
22. Harrah’s Hotel, Reno, NV  Sept 26-29, 1976
23. La Costa Resort Hotel, Carlsbad, CA  Sept 18-21, 1977
24. The Lodge, Pebble Beach, CA  Oct 8-11, 1978
25. Camelback, Inn, Scottsdale, AZ  Sept 23-26, 1979
27. The Empress Hotel, Victoria, BC Sept 20-23, 1981
29. Hotel del Coronado, Coronado, CA Oct 2-5, 1983
30. The Broadmoor, Colorado Springs, CO Sept 9-12, 1984
32. Maui Intercontinental, Wailea, Maui, HI Sept 28-Oct 1, 1986
33. Banff Springs Hotel, Banff, AB Sept 6-9, 1987
34. The Ritz-Carlton, Laguna Niguel, CA Sept 11-14, 1988
35. The Lodge, Sun Valley, ID Sept 10-13, 1989
36. Mauna Lani Bay Hotel, Kawaihae, HI Sept 9-12, 1990
40. Le Meridien Hotel, San Diego, CA Sept 18-21, 1994
41. Salishan Lodge, Gleneden Beach, OR Sept. 9-12, 1995
42. Manele Bay, Island of Lanai, HI Sept 14-17, 1996
43. Ojai Valley Inn, Ojai, CA Sept 20-23, 1997
44. Silverado Resort, Napa, CA Sept 12-15, 1998
45. Coeur d’Alene Resort, Coeur d’Alene, ID Sept 18-21, 1999
46. Mauna Lani Bay Hotel, Hawaii, HI Sept 9-11, 2000
47. Ocean Pointe Resort, Victoria BC (Cancelled) Sept 15-18, 2001
49. Hapuna Beach Prince Hotel, Kamuela, HI Sept 20-24, 2003
50. Rancho Bernardo Inn, San Diego, CA Sept 11-14, 2004
51. Squaw Creek Resort, Lake Tahoe, CA Sept. 17-20, 2005
52. Semiahmoo Resort & Spa, Blaine, WA Sept. 16-19, 2006
53. Mauna Lani Bay Hotel, Kawaihe, HI Sept. 8-11, 2007
54. Hotel Captain Cook, Anchorage, AK Aug. 16-19, 2008
55. Sun River Resort, Bend, OR Sept. 11-14, 2009
56. Eldorado Hotel, Santa Fe, NM In Memory of L. Philip Carter Oct. 8-11, 2010
57. The Grand Hyatt Kauai Resort & Spa, Island of Kauai, HI Sept. 10-13, 2011
58. Broadmoor Hotel, Colorado Springs, CO Sept. 7-10, 2012
60. The Lodge, Sun Valley, ID Aug. 16-19, 2014
61. Grand Hyatt Kauai Hotel, Kauai, HI Sept. 10-13, 2015
62. Park Hyatt Aviara, Carlsbad, CA Sept. 9-12, 2016
63. Fairmont Banff Springs Hotel, Banff, Alberta, Canada Sept. 8-11, 2017

FUTURE MEETINGS
Hyatt Regency at Gainey Ranch, Scottsdale, AZ November 8-11, 2019
Fairmont Grand Del Mar, San Diego, CA August 28-31, 2020
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<th>Past Vice-Presidents</th>
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<td>Robert Florin*</td>
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<td>Frank P. Smith*</td>
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<td>Ralph F. Kamm</td>
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<td>Steven L. Giannotta</td>
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<td>Donald J. Prolo</td>
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<td>Grant E. Gauger</td>
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<td>Randall W. Smith</td>
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<td>John P. Slater</td>
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<td>Moustapha Abou-Samra</td>
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<td>Kim Burchiel</td>
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<td>Gerald Silverberg</td>
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<td>Lawrence Shuer</td>
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<td>L. Philip Carter*</td>
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<td>David W. Newell</td>
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<td>Austin R.T. Colohan</td>
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<td>John T. Bonner</td>
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<td>Jeffery L. Rush</td>
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<td>Richard Wohns</td>
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<td>Gary Steinberg</td>
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<td>Linda Liau</td>
<td>2016</td>
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<td>Charles Nussbaum</td>
<td>2017</td>
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*deceased
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