Where Science Meets Innovation

A Joint Meeting of NANS & NIC

June 25–29, 2016

Baltimore, MD

Sheraton Inner Harbor

Jointly provided by the Congress of Neurological Surgeons, North American Neuromodulation Society, and Neural Interfaces Conference.

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Brief Summary: Prior to using these devices, please review the Instructions for Use for a complete listing of indications, contraindications, warnings, precautions, potential adverse events and directions for use.

SCS Indications for Use: Spinal cord stimulation as an aid in the management of chronic, intractable pain of the trunk and limbs. **Contraindications:** Patients who are unable to operate the system or who have failed to receive effective pain relief during trial stimulation. **Warnings/Precautions:** Diathermy therapy, implanted cardiac systems, magnetic resonance imaging (MRI), explosive or flammable gases, theft detectors and metal screening devices, lead movement, operation of machinery and equipment, postural changes, pediatric use, pregnancy, and case damage. Patients who are poor surgical risks, with multiple illnesses, or with active general infections should not be implanted. **Adverse Effects:** Painful stimulation, loss of pain relief, surgical risks (e.g., paralysis). The User's Guide must be reviewed for detailed disclosure.

DRG Indications for Use: The Axium™ Neurostimulator System is indicated for spinal column stimulation via epidural and intra-spinal lead access to the dorsal root ganglion as an aid in the management of moderate to severe chronic intractable* pain of the lower limbs in adult patients with Complex Regional Pain Syndrome (CRPS) types I and II.**

**Study subjects from the ACCURATE clinical study had failed to achieve adequate pain relief from at least two prior pharmacologic treatments from at least two different drug classes and continued their pharmacologic therapy during the clinical study.*

***Please note that in 1994, a consensus group of pain medicine experts gathered by the International Association for the Study of Pain (IASP) reviewed diagnostic criteria and agreed to rename reflex sympathetic dystrophy (RSD) and causalgia, as complex regional pain syndrome (CRPS) types I and II, respectively.*

SJM-WIP-0216-0001a | Item approved for U.S. use only.

Meeting Overview

The North American Neuromodulation Society (NANS), in collaboration with the Neural Interfaces Conference (NIC) Steering Committee, is pleased to announce a joint scientific conference June 25–29, 2016, at the Sheraton Inner Harbor in Baltimore, MD.

The conference will bring together a diverse group of scientists, engineers, and clinicians representing the basic and applied science aspects of neural interfaces and neuromodulation. The goal of the conference is to foster collaboration between these groups and provide an in-depth overview on the research and development of implantable medical devices and techniques along with their eventual integration into clinical practice, as well as provide the practical uses of neuromodulation and decision making in your practice.

The joint conference will provide a forum for the presentation and discussion of state-of-the-art developments in areas that include neural stimulation, neural plasticity, functional electrical stimulation, deep brain stimulation, auditory prosthesis, cortical prosthesis, peripheral nerve interfaces, biomaterials, microelectrode array technology, brain computer/machine interfaces, and other emerging areas. We also anticipate participation by representatives from federal government agencies as well as industry, creating excellent opportunities for sharing new ideas and networking.

Learning Objectives

Upon completion of this educational activity, participants should be able to

- explain the fundamentals and mechanisms of neuromodulation
- discuss the principles and management of chronic pain, especially with respect to headaches and complex regional pain syndrome
- describe the relationship between neuromodulation, rehabilitation, and biomedical engineering
- discuss the legal issues pertaining to neuromodulation treatments
- recognize new modalities and research in the expanding field of neuromodulation.

Accreditation and Credit Designation Statements

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 Congress of Neurological Surgeons (CNS), the North American Neuromodulation Society, and the Neural Interfaces Conference. The CNS is accredited by the ACCME to provide continuing medical education for physicians.

The CNS designates this live activity for a maximum of 26 *AMA PRA Category 1 Credits*™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Physicians of Osteopathic Medicine: The American Osteopathic Association (AOA) accepts AMA PRA Category 1 Credits™ as AOA Category 2-B credit.

Joseph J. Pancrazio, PhD
Meeting Co-Chair

Steven Falowski, MD
Meeting Co-Chair

Parag Patil, MD PhD
Meeting Co-Chair

Agenda

Saturday, June 25

7–8 am
Registration

7–8 am
Continental Breakfast

8–10 am
Chesapeake Ballroom
Plenary Session 1 (PL01)

8–8:20 am
Welcome
Parag Patil, MD PhD
Peter Konrad, MD PhD
Steven Falowski, MD

8:20–8:40 am
Fresh Outlook on FBSS
Steven Falowski, MD

8:40–9 am
Data for ESI/Injections
Salim Hayek, MD PhD

9–9:20 am
IT Therapy for Pain
Lawrence Poree, MD PhD

9:20–9:40 am
Clinical Evidence: Tonic
Richard North, MD

9:40–10 am
Clinical Evidence: Burst
Jason Pope, MD

10–10:30 am
Break

10:30 am–Noon
Chesapeake Ballroom
Plenary Session 2 (PL02)

10:30–10:48 am
Clinical Evidence: HFS
Sean Li, MD

10:48–11:06 am
Clinical Evidence: DRG
Tim Deer, MD

11:06–11:24 am
Clinical Evidence: PNS
Christopher Winfree, MD

11:24–11:42 am
Clinical Evidence: Intracranial
Parag Patil, MD PhD

11:42 am–Noon
Panel Discussion
Tim Deer, MD
Sean Li, MD
Parag Patil, MD PhD
Christopher Winfree, MD

Noon–1:30 pm
Lunch

1:30–3 pm
Chesapeake Ballroom
Plenary Session 3 (PL03)

1:30–1:48 pm
What Spine MRI Findings Are Relevant for Pain
John Carrino, MD MPH

1:48–2:06 pm
Science to Clinical Research: Bridging the Gap
Timothy Marjenin, FDA

2:06–2:24 pm
Neuromodulation at the Cellular Level
Yun Guan, MD PhD

2:24–2:42 pm
Electrical Field Modeling in Neuromodulation
Scott Lempka, MD

2:42–3 pm
Closed Loop/ECAPS
Chengyuan Wu, MD

3–3:30 pm
Break

3:30–5 pm
Chesapeake Ballroom
Plenary Session 4 (PL04)

3:30–3:48 pm
History of Neuromodulation
Tim Deer, MD

3:48–4:06 pm
Opioid Prescribing in the Context of Recent Public Policy Initiatives
Steven Stanos, MD

4:06–5 pm
Panel Discussion: Choosing Among Modalities
Moderators:
Steven Falowski, MD; Parag Patil, MD PhD; Ashwini Sharan, MD

Panel
Tim Deer, MD; Sean Li, MD; Jason Pope, MD; Lawrence Poree, MD PhD; Christopher Winfree, MD

6–8 pm
Hyatt Regency Baltimore on the Harbor
Pisces 15th Floor
Welcome Reception

Sunday, June 26

7–8 am
Continental Breakfast

8–11:40 am
Vista Labs—Baltimore
Clinical Session: Certificate of Attendance (COA)*

Opening Remarks
Parag Patil, MD PhD
Joseph Pancrazio, PhD

8–10:05 am
Cadaver Time (25 minutes at each station)
Bryan Hoelzer, MD
Eric Lee, MD
Sean Li, MD
Chengyuan Wu, MD
Michael Saulino, MD

10:05–10:20 am
Break

10:20–10:40 am
Enhancing Success with Spinal Implantable Therapies for Pain
Salim Hayek, MD PhD

10:40–11 am
Emerging Technology
Todd Sitzman, MD

11–11:20 am
Complex Cases
Jennifer Sweet, MD

11:20–11:40 am
IT Management
Lawrence Poree, MD PhD

**Non-CME session*

Agenda

8 am–Noon
Vista Labs—Baltimore
Fellows Course (RFS)*

8–8:20 am
Patient Selection
Steven Falowski, MD

8:20–8:40 am
Technique/Surgical Skills
Jennifer Sweet, MD

8:40–9 am
SCS Versus Pump
Jason Pope, MD

9–9:20 am
Enhancing Success with Implantable Therapies for Pain
Salim Hayek, MD PhD

9:20–9:40 am
Open Panel
Steven Falowski, MD
Jason Pope, MD
Jennifer Sweet, MD

9:40–10 am
Break

10 am–12:05 pm
Cadaver Time (25 minutes at each station)
Bryan Hoelzer, MD
Eric Lee, MD
Sean Li, MD
Chengyuan Wu, MD
Michael Saulino, MD

Noon–1:30 pm
Lunch

1:30–5 pm
Neuromodulation in Practice*

1:30–2 pm
Integration of Specialties
Steven Falowski, MD

2–2:30 pm
Building a Practice
Todd Sitzman, MD

2:30–3 pm
Contract Negotiation
Michael Yang, MD

3:30–4 pm
Coordinating Care with a Pain Physician/Surgeon
Jason Pope, MD

4–4:30 pm
U.S. Healthcare 2016: Where Are We Headed?
David Kloth, MD

4:30–5 pm
Open Panel
Steven Falowski, MD
David Kloth, MD
Jason Pope, MD
Michael Yang, MD

8 am–Noon
Chesapeake Ballroom I and II
Neural Engineering Session: Emergent Technology and Innovation in Neuromodulation (NIC)*

8–8:15 am
SPARC Program Introduction
Eugene Civillico, PhD

8:15–9:30 am
Deliverables: The 12 Current U18 SPARC Projects
Moderator: *Steve Lewis, PhD*

Speakers
Dominique Durand, PhD
Marthe Howard, PhD (for Jim Wells)
Brian Davis, PhD
John Hossack, PhD
Lucy Vulchanova, PhD
Timothy Bruns, PhD
Kingman Strohl, MD
Charles Horn, PhD
Aydin Farajidavar, PhD
Marthe Howard, PhD
Jeffrey Ardell, PhD
Aaron Mickle, PhD

9:30–10 am
Break

10–11 am
Data Sharing Town Hall
Moderator: *Timothy Bruns, PhD*

10–10:15 am
Data Sharing Town Hall: Goals for the Scientific Community
NIH Program Staff

10:15–10:30 am
Data Sharing Town Hall: NIH Data Coordination Center "Tool"
NIH Program Staff

10:30–10:45 am
Data Sharing Town Hall: Platforms for Data Sharing
Charles Horn, PhD
Timothy Bruns, PhD

10:45–11 am
Q&A
Grace Peng, PhD

11 am–Noon
Case Studies: Diving Into Neuromodulation Systems—A Greater Understanding of Mechanisms Will Drive Greater Clinical Benefit
Moderator: *Marthe Howard, PhD*

Speakers
Steve Lewis, PhD
Kingman Strohl, MD
Jeffrey Ardell, PhD

Noon–12:30 pm
Bus to Vista Lab

12:30–1:30 pm
Lunch at Lab

1:30–5 pm
Vista Lab
NIC/Industry Cadaver Workshop
Eric Lee, MD
Jennifer Sweet, MD

6–9 pm
American Visionary Art Museum Reception
Sponsored by St. Jude Medical

**Non-CME session*

Agenda

Monday, June 27

7–7:45 am
Continental Breakfast

8 am–3:30 pm Invitation only.
Device Access Workshop*
Peter Konrad, MD PhD

8–8:15 am
Chesapeake Ballroom
NIC Opening Plenary Session
Joseph Pancrazio, PhD
Parag Patil, MD PhD

8:15–9:20 am
Chesapeake Ballroom
Using Targeted Neuroplasticity to Trigger Widespread Beneficial Plasticity: Part 1 (PL05)

8:15–8:20 am
Introduction
Jonathan Wolpaw, MD

8:20–8:50 am
Neuroplasticity and the Negotiated Equilibrium Hypothesis
Jonathan Wolpaw, MD

8:50–9:20 am
Using Reflex Conditioning to Improve Walking in People with Spinal Cord Injury
Aiko Thompson, PhD

9:20–9:50 am
Break with Exhibitors and Posters

9:50–11:05 am
Chesapeake Ballroom
Using Targeted Neuroplasticity to Trigger Widespread Beneficial Plasticity: Part 2 (PL06)
Moderator: *Jonathan Wolpaw, MD*

9:50–10:20 am
Making Words by Changing Minds: Treating Aphasia with Noninvasive Cortical Stimulation
Roy Hamilton, MD

10:20–10:50 am
The Benefits of Targeted Neuroplasticity After Stroke: A Modeling Approach
Sumner Norman

10:50–11:05 am
Q&A
Jonathan Wolpaw, MD

11:05–11:35 am
Chesapeake Ballroom
Keynote: "Moving from Phenomena to Function—How Will Plasticity Improve Lives?"
Naomi Kleitman, PhD

11:35 am–Noon
Chesapeake Ballroom
Platform Presentations
P. Hunter Peckham, PhD

Noon–1:30 pm
Clinical Data and The Science Behind High Frequency Spinal Cord Stimulation
Lunch Sponsored by NEVRO

1:30–3:15 pm
Chesapeake Ballroom
New Stimulation Paradigms for Pain (PL07)

1:30–1:35 pm
Introduction
Zelma Kiss, MD PhD

1:35–2:05 pm
Perceptions Evoked by Different Patterns of Thalamic Stimulation
Fred Lenz, MD PhD

2:05–2:35 pm
Basic Mechanisms of Pain Suppression with Spinal Cord Burst Stimulation
Dirk De Ridder, MD PhD

2:35–3:05 pm
Mechanisms of Ultrahigh Frequency Stimulation in Spinal Cord
Jaimie Henderson, MD

3:05–3:15 pm
Q&A
Zelma Kiss, MD PhD

3:30–6 pm
Harborview Gallery, Severn Room, Potomac Room
Poster Session 1 (Non-CME)

Tuesday, June 28

7–8 am
Continental Breakfast

8–9:30 am
Chesapeake Ballroom
Closed Loop DBS for Depression: Advantages, Disadvantages, and Design Considerations (PL08)

8–8:05 am
Introduction
Eran Klein, MD PhD

8:05–8:30 am
Iterative Strategies to Refine and Optimize DBS for Depression: Is a Closed Loop System the Critical Next Step?
Helen Mayberg, MD

8:30–8:55 am
Closed-Loop DBS: Lessons from Brain-Computer Interfacing
Alik Widge, MD PhD
**Non-CME session*

8:55–9:20 am
Identifying Network Level Targets for Closed Loop DBS in Depression
Heather Dawes, PhD

9:20–9:30 am
Q&A
Eran Klein, MD PhD

9:30–9:45 am
Break with Exhibitors and Posters

9:45–11:30 am
Chesapeake Ballroom
Autonomic/Peripheral Neuromodulation Devices: Existing and Emerging Therapies (PL09)

9:45–9:50 am
Introduction
Moderators:
Kip Ludwig, PhD
Douglas Weber, PhD

9:50–10:05 am
Recent Clinical Landscape for Deployment
Kip Ludwig, PhD

10:05–10:20 am
Hypoglossal Nerve Stimulation: A New Implanted Neuromodulation Treatment for Obstructive Sleep Apnea
Quan Ni, PhD

10:20–10:35 am
Vagal Nerve Stimulation: Clinical Outcomes and Next Steps
Shivkumar Sabesan, PhD

10:35–10:50 am
GSK-Autonomic Nerve Interface Roadmap
Daniel Chew, PhD

10:50–11:05 am
Dorsal Root Ganglion Stimulation: The Past, the Present, and the Future
James Fitzgerald, PhD

Agenda

11:05–11:30 am
Q&A
Douglas Weber, PhD
Kip Ludwig, PhD

11:30 am–12:30 pm
DRG Therapy: Power to Give More Patients More Relief Clinical Review and Early Experiences
Lunch Sponsored by St. Jude Medical

12:30–1:30 pm
Harborview I
B1: Regulatory Assessments for Neural Interfaces (B01)

12:30–1:15 pm
Lost in Translation? A Discussion of Present and Future Nonclinical and Clinical Assessments for Devices Incorporating Neural
Moderator: *Eugene Civillico, PhD*

12:30–12:35 pm
Introduction
Eugene Civillico, PhD
Speakers
12:35–12:55 pm *Eric Lovett, PhD*
12:55–1:15 pm *Quan Ni, PhD*

1:15–1:30 pm
Q&A
Eugene Civillico, PhD

12:30–1:30 pm
Harborview II
B2: SBIR/STTR Funding in Neural Engineering (B02)

12:30–1:20 pm
Competing Effectively for SBIR/STTR Funding in Neural Engineering
Moderator: *Patrick Rousche, PhD*

12:30–12:35 pm
Introduction
Patrick Rousche, PhD
Speakers
12:35–12:50 pm *Stephanie Fertig, MBA*
12:50–1:05 pm *Mark Lehmkuhle, PhD*
1:05–1:20 pm *Timothy Wagner, PhD*

1:20–1:30 pm
Q&A
Patrick Rousche, PhD

1:30–3 pm
Chesapeake Ballroom
Development of an Optimal Somatosensory Neural Interface (PL10)
Moderator: *Lee Miller, PhD*

1:30–1:35 pm
Introduction
Lee Miller, PhD

1:35–1:53 pm
Peripheral Nerve Stimulation to Restore Sensation to Human Amputees
Dustin Tyler, PhD

1:53–2:11 pm
Cortical Stimulation to Restore Touch in Paralyzed Human Patients
Robert Gaunt, PhD

2:11–2:29 pm
All-Optical Manipulation and Interrogation of Mouse Visual Sensory Circuits
James Marshel, PhD

2:29–2:47 pm
A Biomimetic Cortical Interface to Restore Proprioception
Lee Miller, PhD

2:47–3 pm
Q&A
Lee Miller, PhD

3–3:15 pm
Break with Exhibitors and Posters

3:15–4:45 pm
Chesapeake Ballroom
Ultrahigh Density Neural Interfaces (PL11)
Moderator: *Florian Solzbacher, PhD*

3:15–3:20 pm
Introduction
Florian Solzbacher, PhD

3:20–3:45 pm
Big Is Just the Beginning: The Challenges of Heterogeneous Neural Data
Zachary Ives, PhD

3:45–4:10 pm
Visual Exploration for Situational Awareness
Yarden Livnat, PhD

4:10–4:35 pm
Scaling Neural Interface Hardware to 1,000 Channels and Beyond
Shawn Kelly, PhD

4:35–4:45 pm
Q&A
Florian Solzbacher, PhD

5–7:30 pm
Harborview Gallery, Severn Room, Potomac Room
Poster Session 2 (Non-CME)

Wednesday, June 29

7–8 am
Continental Breakfast

8–10 am
Chesapeake Ballroom
Emerging Methods of Wireless Neuromodulation (PL12)
Moderator: *Daniel Freeman, PhD*

8–8:05 am
Introduction
Daniel Freeman, PhD

8:05–8:30 am
A Transistor-Less, Wireless Neural Stimulator
Daniel Freeman, PhD

8:30–8:55 am
Acoustic Neuromodulation Using Focused Ultrasound: Experiences from Animals to Humans
Seung Schik Yoo, PhD MBA

8:55–9:20 am
Remote Neural Modulation Using Electromagnetic Waves
Sarah Stanley, PhD

9:20–9:45 am
Medical Devices Incorporating Nanotechnology: An Overview and Challenges
Girish Kumar, PhD

Agenda

9:45–10 am
Q&A
Daniel Freeman, PhD

10–10:20 am
Break with Exhibitors

10:20 am–Noon
Chesapeake Ballroom
Optical Interfaces: Optogenetic and Infrared Modalities for Modulating the Nervous System (PL13)
Moderators:
Cristin Welle, PhD
Hillel Chiel, PhD

10:20–10:25 am
Introduction
Cristin Welle, PhD
Hillel Chiel, PhD

10:25–10:45 am
Optical Perturbation of the Nervous System with Pulsed Infrared Light: Progress Toward In Vivo Clinical Implementation
Anita Mahadevan-Jansen, PhD

10:45–11:05 am
Optical Cochlear Implants: Challenges for a Clinical Translation
Claus-Peter Richter, MD PhD

11:05–11:25 am
Looking Toward Clinical Use of Optogenetic Technology for Therapeutics
Chris Towne, PhD

11:25–11:45 am
Multifunctional Fibers: Flexible Tools for Neural Tissue Interrogation
Polina Anikeeva, PhD

11:45 am–Noon
Q&A
Cristin Welle, PhD
Hillel Chiel, PhD

Noon–12:30 pm
Lunch

12:30–1:30 pm
Harborview I
B3: Maximizing the Value of Neural Interface Data (B03)
Moderator: *Richard North, MD*

12:30–12:35 pm
Introduction
Richard North, MD

Speaker
12:35–1:20 pm *Jane Shipley*

1:20–1:30 pm
Q&A
Richard North, MD

12:30–1:30 pm
Harborview II
B4: Funding Neuroprostheses Technology and Translation
Moderator: *Kevin Otto, PhD*

12:30–12:35 pm
Introduction
Kevin Otto, PhD

Speakers
12:35–12:40 pm *Stephanie Fertig, MBA*
12:40–12:45 pm *Felipe Aguel, PhD*
12:45–12:50 pm *Nick Langhals, PhD*
12:50–12:55 pm *Douglas Weber, PhD*
12:55–1 pm *Roy Katso, PhD*
1–1:05 pm *Tracey Wheeler, PhD*

1:05–1:30 pm
Q&A
Kevin Otto, PhD

1:30–3:15 pm
Chesapeake Ballroom
Unconventional Neural Interfaces (PL14)
Moderator: *Douglas Weber, PhD*

1:30–1:35 pm
Introduction
Douglas Weber, PhD

1:35–1:52 pm
Neural Interface Engineering: Roadmap to Emerging Solutions
TK Kozai, PhD

1:52–2:09 pm
Recent Advances in Neural Dust, a Platform for Peripheral and Central Nervous System Recording
Michel Maharbiz, PhD

2:09–2:26 pm
Measurement of Neural Activity by Ramen Scattering and Phase Detection
Kevin Young, PhD

2:26–2:43 pm
Conducting Polymer Nanowires as Neural Interfaces
Christine Payne, PhD

2:43–3 pm
Engineering Biomolecules for Noninvasive Imaging and Control
Mikhail Shapiro, PhD

3–3:15 pm
Q&A
Douglas Weber, PhD

3:15–3:30 pm
Closing Remarks: Adjournment
Joseph Pancrazio, PhD
Parag Patil, MD PhD

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Zelma HT Kiss, MD PhD[P]
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Peter Konrad, MD PhD[P]
Ownership Interest—Neurotargeting (7)

Mark Lehmkuhle, PhD
Ownership Interest—Epitel, Inc. (1)*; Salary*—Epitel, Inc. (1)

Sean Li, MD
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Patent to be submitted by U of M—University of Minnesota (10)

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Joshua Prager, MD[P]
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Ashwini Dayal Sharan, MD[P]
Ownership Interest—Cerebral Therapeutics (8), Mudjala (8), Tiger Labs (8)

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Salary—The Neuromodulation Foundation, Incorporated (5)

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Steven P. Stanos, DO
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Timothy Wagner, PhD
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Kevin W. Young, PhD
Intellectual Property Rights—Rehabilitation Institute of Chicago (10)

Nothing to Disclose

The following individuals have disclosed that they do not have a relationship with commercial companies whose products may have a relevance to their participation in the meeting. Faculty who are also considered Planners are designated by P.

Felipe Aguel, PhD
Polina Anikeeva, PhD
Kevin Bodkin, BS
John A. Carrino, MD MPH
Hillel J. Chiel, PhD
Eugene Civillico, PhD
Jennifer Collinger, PhD
Heather Dawes, PhD
Alan Dorval, PhD
Steven M. Falowski, MD[P]
Stephanie Fertig, MBA
Stephen Foldes
Daniel Freeman, PhD
Juan Alvaro Gallego, PhD
Robert Gaunt, PhD
Warren Grill, PhD[P]
Olli Grohn, PhD
Yun Guan, MD PhD
Roy Hamilton, MD
Marc Huntoon, MD PhD[P]
Matthew D. Johnson, PhD
Roy Katso, PhD
Ava Kellogg, MPA[P]
Eran Klein, MD PhD
TK Kozai, PhD
Nick Langhals, PhD
Steve T. Lanier, MD
Lauri J. Lehto
Scott Lempka, MD
Yarden Livnat, PhD
Kip Ludwig, PhD[P]
Anita Mahadevan-Jansen, PhD
Michel Maharbiz, PhD
Timothy Marjenin, FD
Helen Mayberg, MD
Lee Miller, PhD
Stephanie Naufel
Daria Nesterovich
Sumner L. Norman, MS
Braxton Osting, PhD
Kevin Otto, PhD
Joseph J. Pancrazio, PhD[P]
Parag G. Patil, MD PhD[P]
Christine Payne, PhD
Mikhail G. Shapiro, PhD
Todd Sitzman, MD[P]
Julia Slopsema
Sarah Stanley, PhD
Lily Talan[P]
Aiko Thompson, PhD
Dustin J. Tyler, PhD
Douglas Weber, PhD
Chris Welber, MBA[P]
Cristin Welle, PhD[P]
Tracey Wheeler, PhD
Alik S. Widge, MD PhD
Christopher J. Winfree, MD FACS
Jonathan Wolpaw, MD
Chengyuan Wu, MD MSBmE
Seung Schik Yoo, PhD MBA

Poster Presentations

Monday

Clinical Neuromodulation

Room: Potomac

(1) Noninvasive Treatment of Postoperative Cauda Equina Syndrome Pelvic Pain and Urinary Incontinence: A Case Series
Yuriy Ivanov

(2) Mapping Threshold Response of Cortical Neurons to Pulsed Uniform Electric Field
Aman Aberra ***(Diversity Travel Award winner)***

(3) Novel Predictive Spinal Cord Stimulation Algorithm for Chronic Pain
Haigreeva Yedla

(4) Effects of Alternating Current Trans-Cranial Stimulation on Pain Related Depression and Neuropathic Pain
Kenan Gungor

(5) Outcomes of 1 kHz Subperception Spinal Cord Stimulation in Patients with Failed Paresthesia Based Stimulation
Kyung Soo Hong

(6) Safe Direct Current Stimulation for the Treatment of Asthma Attack
Gene Fridman

(7) Quantification of Beta Oscillatory Activity in the EEG with Progression of Parkinson's Disease
Christina Behrend

(8) Subthreshold Stimulation of the Dorsal Root Ganglia Yields Paresthesia-Free Analgesia
William Cusack

(9) L2-L3 Dorsal Root Ganglia Stimulation Induces Low Back Pain Relief: A Preliminary Report
William Cusack

(10) Dorsal Root Ganglia Stimulation for Painful Diabetic Peripheral Neuropathy: A Preliminary Report
William Cusack

(11) Real-World Clinical Outcomes of Multiple Waveform Spinal Cord Stimulation: A Prospective Global Registry
Nitzan Mekel-Bobrov

(12) Assessment of Patient Experience: Data Analytic Approaches Combining New and Established Pain Outcome Measures
Nitzan Mekel-Bobrov

(13) Real-World Outcomes Study of Multimodal Spinal Cord Stimulation Using New 32-Contact Surgical Lead Paddle
Nitzan Mekel-Bobrov

(14) Differential Mechanisms of Action Between Paresthesia and Paresthesia-Free SCS: A PET Study
Nitzan Mekel-Bobrov

(15) Real World Utilization of Subperception (<= 1.2 khz) Spinal Cord Stimulation
Nitzan Mekel-Bobrov

(16) Cervical Sympathetic Stimulation of the Cervical Sympathetic Nervous System for Treatment of Atypical Face Pain
Frank McDonnell

(17) Ultrasound Neuromodulation: Is It Direct Neural Activation or Vibratory Cochlear Activation of the Brain?
Hubert Lim

(18) Comparison of Neural Activity During Tonic and Burst Spinal Cord Stimulation: A SUNBURST Substudy
Lalit Venkatesan

(19) Thoracic Radiculopathy Following Spinal Cord Stimulator Implantation Treated with Corticosteroids
Ryan Holland

(20) Safe Direct Current Stimulation for the Treatment of Chronic Peripheral Pain
Gene Fridman

(21) Comparing Changes in Healthcare Utilization Following Back Surgery and Spinal Cord Stimulation for Chronic Pain
Alexander Kent

(22) Spinal Cord Stimulator Outcomes: The Rutgers Experience
Ryan Holland

(23) Analgesic Effectiveness of Intrathecal Pump Therapy for Chronic Pancreatitis: Case Series
Edgar Martinez

(24) Peripheral Nerve Stimulation Restores Proprioceptive Sensation
Ivana Cuberovic

Deep Brain Stimulation

Room: Potomac

(25) A Biophysical Model to Predict Electrical Stimulation Evoked Response in Cortical and Subcortical Brain Regions
Ishita Basu

(26) Multimodal Exploration of Closed-Loop DBS
Shaun Patel

(27) Are Directional Deep Brain Stimulation Leads Safe? An Updated Assessment of Stimulation Safety
Ashley Kapron

(28) Cerebral Vasculature and Heterogeneity Outside the Brain Impact Predictions in Models of Deep Brain Stimulation
Bryan Howell

(29) Paired Electrical Stimulation to Alter Low-Frequency Brain Oscillation Synchrony in Fear Circuits
Meng-Chen Lo

(30) 17T Diffusion Tensor Imaging Elucidates Targets of Deep Brain Stimulation
Katie Warthen

(31) Advanced Stimulation Patterns for Directional Activation in DBS
Julia Slopsema

(32) A Multichannel System for Controlling Neurochemical Activity in the Nonhuman Primate Brain
Erika Ross

(33) Interactive Meshing and Simulation of Deep Brain Stimulation with Patient Specific Models
Andrew Janson

(34) Rapidly Reversible Behavioral Arrest During Fasciculus Retroflexus Deep Brain Stimulation in a Healthy Non-Human Primate
Jonathan Baker

(35) Spatial Characterization of Stimulation-Induced Neuronal Activity Around a Chronically Implanted Thalamic Deep Brain Stimulation Array
Matt Johnson

(36) Particle Swarm Optimization for Programming Deep Brain Stimulation Arrays
Edgar Pena ***(Diversity Travel Award winner)***

(37) VIM DBS Spatial Summation Effects Along Horizontal Axis in ET Patients
Changqing Kao

(38) A Real-Time 'Neurotransmitter Clamp' for Systematically Probing Brain Networks by Controlling In Vivo Dopamine Release
James Trevathan

(39) Neurovascular Coupling During Deep Brain Stimulation
Sohail Noor

(40) Deep Brain Stimulation for Neuropathic Pain: Connectivity Analysis Within the Sensory Thalamus
Yagna Pathak

(41) Dbs Creates Impulse Control Disorders and Fails to Restore Parkinsonian Apathy and Action Selection Deficits
Collin Anderson

(42) Decoding Cognitive and Emotional States from Local Field Potentials Using a Bayesian Approach
Ali Yousefi

(43) Mapping the Functional Circuitry Effect of Ventral Tegmental Area Deep Brain Stimulation
Megan Settell

(44) Optimized Programming Algorithm for Cylindrical and Directionally Segmented Deep Brain Stimulation Electrodes
Daria Nesterovich

Deep Brain Stimulation

Room: Harbor Gallery

(45) Nonlinear Atlas Creation for Retrospective DBS Cohort Analysis
Gordon Duffley

(46) Influence of Diffusion-Tensor Based Axon Orientation on the Prediction of Deep Brain Stimulation Effects
Johannes Vorwerk

(47) Reinforcement Learning for Phasic Disruption of Pathological Oscillations in a Model of Parkinson's Disease
Logan Grado

Models and Stimulation Paradigms

Room: Harbor Gallery

(48) Computational Evidence of Saphenous Nerve Recruitment During Percutaneous Tibial Nerve Stimulation for Overactive Bladder
Christopher Elder

(49) Developing a Three-Dimensional Atlas of Intraspinal Microstimulation-Evoked Muscle Activity in a Swine Model
Jonathan Calvert

(50) Comparing Burst SCS Paradigms on Acute Spinal Neural Activity in a Rat Model of Painful Radiculopathy
Beth Winkelstein

(51) Spinal Neuronal Activity Varies for SCS Modes After Painful Radiculopathy
Beth Winkelstein

(52) Development and Validation of a Computational Model to Investigate Dorsal Root Ganglion Stimulation
Alexander Kent

(53) Optimization of Genetic Algorithms for Design of Temporal Patterns of Stimulation
Isaac Cassar

(54) Development of Coupled Finite Element Analysis and Cellular Models for Dorsal Root Ganglion Stimulation
Xiaoyi Min

(55) Effect of Lead Position on Neural Recruitment During Dorsal Root Ganglion Stimulation: Computational Modeling Analysis
Alexander Kent

(56) Optimization of Return Electrodes in Neurostimulating Arrays
Thomas Flores

(57) Application of Musculoskeletal Modeling and Static Optimization to Prosthetic Hand Control
Misagh Mansouri

(58) Spike Activity in Somatosensory Cortex Due to Ultrasound Stimulation
Mark Hamilton

(59) Characterization of Spontaneous Activity in Adult DRG Neurons Cultured on Micro-Electrode Array
Bryan Black

(60) The Role of Sensory Adaptation in Artificial Tactile Intensity
Emily Graczyk

Bioelectronic Medicine

Room: Harbor Gallery

(61) Composition of Tears Induced by Electrical Stimulation of the Anterior Ethmoid Nerve
Mark Brinton

(62) Phasic Activation of the External Urethral Sphincter Increases Voiding Efficiency in Rat and Cat
Warren Grill

(63) Evaluating Sexual Arousal in a Female Rat Model with Pudendal and Tibial Nerve Stimulation
Lauren Zimmerman ***(Diversity Travel Award winner)***

(64) Computational Model of the Effects of Kilohertz Frequency Waveform on Small Myelinated Model Axons
Nicole Pelot

(65) Neuronix Enables Continuous, Simultaneous Neural Recording and Electrical Stimulation
Zhi Yang

(66) Spinal Cord Stimulation in Sheep Models of Chronic Neuropathic Pain and Spinal Cord Injury-Induced Spasticity
John Miller

(67) Vagus Nerve Stimulation Reduces Traumatic Hemorrhage Via Spleen and alpha7 nAChR Signaling in Platelets
Jason Fritz

(68) Multimodal Recording and Stimulating System for Bioelectronic Medicine
Chunyan Li

Peripheral Nerve Interfaces

Room: Harbor Gallery

(69) Closed-Loop Control of a Virtual Prosthetic Hand by a Human Subject After Prior Amputation
David Kluger

(70) Motor Decoding and Sensory Stimulation for Upper-Limb Prostheses Using Implanted Neural and Muscular Electrode Arrays
Suzanne Wendelken

Peripheral Nerve Interfaces

Room: Severn

(71) Harnessing Normal Tissue Response to Create a Stable Neural Interface
Amitabha Lahiri

(72) Peripheral Nerve Stimulator Implant for Postherpetic Trigeminal Neuralgia
Arpit Patel

(73) Predicted Effect of Electrode Position on the Amplitude of Recorded Neural Signals Using Cuff-Like Technologies
Iian Black

(74) Microneurography as a Tool for Testing Limb Prosthetics
Changqing Kao

(75) EMG-Bridge for Motor Function Rebuilding of Paralyzed Limbs
Zhi-Gong Wang

(76) Suppression of Scarring in Peripheral Nerve Implants by Drug Elution
James Fitzgerald

(77) Extracting Neuroprosthetic Control Signals from Regenerative Peripheral Nerve Interfaces in Human Subjects
Philip Vu

(78) Performance Metrics in Animals of a Peripheral Nerve Electrode Array
Srikanth Vasudevan

(79) Saphenous Nerve Stimulation: A Potential Therapeutic Option for Overactive Bladder Symptoms
Zainab Moazzam

(80) Pathway Discrimination in Peripheral Recordings Using Spatiotemporal Templates: A Simulation Study
Ryan Koh

(81) A Parylene Cuff Electrode for Peripheral Nerve Recording and Stimulation
Ellis Meng

(82) Directionally Sensitive Peripheral Nerve Recording Using Bipolar Nerve Cuff Electrode
Parisa Sabetian

(83) Detecting Intestinal Inflammation: A Step Toward Developing Closed-Loop Technology for the Treatment of Inflammatory Bowel Disease
Sophie Payne

(84) Surface Electrical Stimulation to Evoke Realistic Sensations
Katharine Polasek

(85) Multi- and Single-Joint Selectivity Optimization of 8-Contact Composite Flat-Interface Nerve Electrodes on Human Femoral Nerves
Max Freeberg

(86) Selectivity of Afferent Microstimulation at the DRG Using Epineural and Penetrating Electrode Arrays
Ameya Nanivadekar

(87) Investigating Ultrasound Suppression and Activation Effects on Sciatic Nerve In Vivo
Hongsun Guo

(88) High-Frequency Neuromodulation with Intrafascicular Nerve Interface for Brachial Plexus Injury
Christopher Duncan

(89) In Vitro Electrical Activity Characterization of Dissociated Dorsal Root Ganglia Neurons
Kemal Bayat

(90) Physical Configuration of a Peripheral Nerve Interface for Chronic Use
Samuel Bredeson

(91) Chronic High Density Longitudinal Intra-Fascicular Electrode Arrays for Peripheral Nerves
John Lachapelle

(92) Combining Tissue-Engineering and Neural Interface Technologies to Control Prosthetic Devices
Vidhi Desai

(93) Motor-Evoked Responses via Epidural Spinal Cord Stimulation Evaluated at Inter- and Intrasegmental Resolution
Peter Grahn ***(Diversity Travel Award winner)***

Tuesday

Auditory Prosthesis

Room: Harbor Gallery

(1) Evaluation of Focused Multipolar Stimulation for Cochlear Implants in Acute and Long-Term Deafened Animals
Rob Shepherd

(2) Using Multiplanar CT, OCT, and IVUS to Locate Rhesus Vestibular Nerve for Single Unit Recording
Shiyao Dong

(3) Towards Clinical Translation of Penetrating Multisite Microelectrode Arrays for the Brainstem
Martin Han

(4) A MEMS Parylene Tube Cochlear Implant Device for Use in a Rat Model of Tinnitus
Eric Kim

(5) Safe Direct Current Stimulation Increases the Dynamic Range of Head Velocities Encoded by Vestibular Prosthesis
Dilawer Singh

Brain Computer/Machine Interface

Room: Harbor Gallery

(6) Incorporating Initial Polarization for Accurate Modeling of Extracellular Neural Stimulation
Boshuo Wang

(7) Enhancement of Cortico-Cortical Evoked Potentials by Beta-Oscillation Triggered Direct Electrical Stimulation in Humans
David Caldwell

(8) Topographical Approaches for Improved Neural Electrode Biocompatibility
Evon Ereifej

(9) Blueprint for Implantable Brain Computer Interfaces Made of Commercial Off-the-Shelf Components
Christian Bentler

(10) Implanted BCI for Cortical Control of Hand Movements in a Human with Quadriplegia
David Friedenberg

(11) Removal of Targeted Pathways on Blood-Derived and Not Brain-Derived Immune Cells Improves Intracortical Recordings
Hillary Bedell

(12) ECoG-Based Identification of Motor Imagery-Associated Cortex: Application for Motor Rehabilitation
Milena Korostenskaja

(13) Robust Online Control of a Humanoid Robot Using Electrocorticography and CSPs in a Motor-Imagery BCI
William Coon

(14) Encoding of Cursor and Hand Shaping Velocities by Primary Motor and Somatosensory Cortices
John Downey

(15) Bimanual Coordination of Natural Movement with Electrocorticographic Brain-Computer Interface Control by Individual with Hemiparesis
Devapratim Sarma

(16) Platinum-Iridium Electroplated Deep Brain Stimulation Electrodes
Artin Petrossians

(17) Closed-Loop ECoG Stimulation Induces Hebbian Plasticity in Sensorimotor Cortex of Awake Monkeys
Stavros Zanos

(18) Spatiotemporal Localization of Direction-Distinguishing Movement Planning Electrocorticographic Features
Jing Wu

(19) Chronic In Vivo Cortical Interface Health Monitoring Using an Automatic Electrode Test Instrument (MET16)
Glenn Demichele

(20) Deep Brain Targeting Strategy for Bare Parylene Neural Probe Array
Ellis Meng

Electrodes

Room: Severn

(21) Laser Pyrolyzed Carbon-Based Electrodes for Neural Interfaces
Ana Oliveira

(22) Dual Purpose Carbon Fiber Electrode Array for the Detection of Electrophysiological and Dopaminergic Activity
Paras Patel

(23) Flexible Boron Doped Polycrystalline Diamond Electrodes for Detection of Neurochemical and Electrophysiological Signals
Wen Li

(24) Nanostructured Platinum—A Competitive Material for Neural Stimulation and Recording
Maria Asplund

(25) Electrodeposited Platinum-Iridium Films with Tailorable Pt:Ir Ratios for Improved Mechanical Properties
Curtis Lee

(26) Fully Integrated Amorphous Silicon Carbide Ultramicroelectrode Array for Neural Stimulation and Recording
Felix Deku ***(Diversity Travel Award winner)***

(27) Viability of a Novel Micro-Electrocorticography Design for Intrasulcal Implantation in Macaca Mulatta Primary Somatosensory Cortex
Taylor Hearn

(28) Dorsal Root Ganglia Neural Recordings and Source Localization with a Novel Nonpenetrating Thin-Film Microelectrode Array
Zachariah Sperry

(29) A Super Long MEMS Neural Probe for Recording Neural Spiking in Deep Brain Structures
Eric Kim

(30) Shape Memory Polymer Cuff Electrodes for Peripheral Nerve Interfacing
Yogi Patel

(31) Development of Nano Electrode Array for Functional Imaging of Neural Network Using Electrical Impedance Tomography
Min Kim

Materials and Devices

Room: Severn

(32) A Platform Development Strategy for Implantable Neuro-stimulator Devices
Andrew Kelly

(33) Conductive Nanoparticle Electrocorticography Grid for MR-Safe Imaging
Husam Katnani

(34) Sterilization of Softening Shape Memory Polymers Used as Substrate for Neural Devices
Melanie Ecker

(35) Design and Testing of a 96-Channel Neural Interface Module for the Networked Neuroprosthesis System
Autumnm Bullard

(36) Electrochemical Evaluation of Shape Memory Polymer Electrodes
Christopher Frewin

(37) Electrical Performance of Single Material Silicon Carbide (SiC) Microelectrodes
Christopher Frewin

(38) Recent Advances in Photolithographically Defined Neural Interfaces on Softening Substrates
Romil Modi

(39) Highly Stable and Low Impedance IrOx for Recording and Stimulation with Silicon Microelectrode Arrays
Loren Rieth

(40) Modification of a Neural Electrode Implantation Instrument for Surgical Use
Samuel Bredeson

(41) Demonstration of NCA/MCMB Chemistry and 3mAh Microcell for Implantable Medical Device Applications Involving Neurostimulation
Som Mohanty

Neural Prosthesis

Room: Potomac

(42) Six-Year Follow-Up on Implanted Neuroprostheses for Upright Mobility After Paralysis
Stephanie Bailey

(43) Center of Pressure Feedback Control of Task-Dependent Postures with an Implanted Standing Neuroprosthesis
Brooke Odle ***(Diversity Travel Award winner)***

(44) Chronic Implantation of PDMS-Based Optical Waveguides for Powering Wireless Microelectrode Array
Ali Ersen

(45) Quantification of Dorsal Column Fiber Responses in a Model of Kilohertz-Frequency Spinal Cord Stimulation
Leonel Medina ***(Diversity Travel Award winner)***

(46) Functional Organization of Motoneuronal Pools in the Lumbar Spinal Cord of Monkeys: Intraspinal Microstimulation Targets
Amirali Toossi

(47) An Adaptable Intraspinal Microstimulation Controller to Restore Walking After a Hemisection Spinal Cord Injury
Ashley Dalrymple

(48) Effective Cortical Activation with Implanted Micro-coils
Shelley Fried

(49) Long-Term Stability of Stimulating Multicontact Nerve Cuff Electrodes on Human Peripheral Nerves
Breanne Christie

(50) Decoding Bladder Activity with Dorsal Root Ganglia Neural Signals Using a Kalman Filter
Aileen Ouyang

(51) Alteration of Efferent and Afferent Firing Patterns by Nerve Stimulation in Neural Regulatory Systems
Patrick Crago

(52) Chronic Monitoring and Excitation of Lower Urinary Tract Function
Shani Ross ***(Diversity Travel Award winner)***

(53) Volitional Electromyographic Signals in Lower Extremity After Motor Complete SCI: A Potential Neuroprosthetic Control Source
Elizabeth Heald

(54) Upper Extremity Prosthesis User Perspectives on Innovative Neural Interface Devices
Heather Benz

(55) Neurophysiological, Psychophysical, and Electrochemical Assessment of Intracortical Microstimulation Stability in Human Somatosensory Cortex
Sharlene Flesher

(56) Developing a Microfluidic Device for Safe DC Stimulation
Patrick Ou

(57) Versatile Stimulation Circuitry for Neural Applications: Implementation in Vestibular and Cochlear Stimulation
Kristin Hageman

(58) Method for Restoring Coordinated Multi-Joint Movements After Paralysis by Direct Cortical Control of Muscle Stimulators
Dawn Taylor

(59) Comparison of Robotic Exoskeleton and Surface Stimulation for Treatment of Crouch Gait from Cerebral Palsy
Thomas Bulea

(60) DRG Stimulation Elicits Behavioral Response During Translational Postural Perturbation
Kevin King

(61) Electrical Stimulation of the Cervical Dorsal Root Ganglia (DRG) for Sensory Restoration in Upper-Limb Amputee
Santosh Chandrasekaran

(62) A System for Inducing Artificial Hand Embodiment Using Concurrent Visual and Tactile Stimuli
Mahsa Alborz

(63) Creating a Localized and Dynamic Facial Somatotopic Map of Area 3b Using Cutaneous Vibratory Stimulation
Justin Tanner

(64) Five-Week Case Study on Home Use of a Sensory Restoration System for Upper Limb Amputees
Emily Graczyk

Neural Signal Processing

Room: Potomac

(65) MEA-Based Quantitative Measurement of Electrophysiological State of Quiescent Neuronal Networks
Xiao-Ying Lü

(66) Dynamic Training of Multilayer SVM for Seizure Onset Detection
Daniel Ehrens

(67) Measurement of Norepinephrine via Fast Scan Cyclic Voltammetry in Whole Blood
Evan Nicolai

(68) Extracting Chronically Stable Features from Intracortical Recordings for Robust BCI Applications in Humans
Mingming Zhang

(69) Analyzing Coherence in Local Field Potentials with Manifold Learning
Amit Sinha

(70) Data-Driven Identification of Fine-Wire Intramuscular Electrode Locations
Carl Beringer

(71) A Multivariate Approach for Seizure Localization Using High Frequency Coupling
Bahareh Elahian

Neuroplasticity and Rehabilitation

Room: Potomac

(72) MEG-Based Neurofeedback for Grasp Rehabilitation After Cervical Spinal Cord Injury
Stephen Foldes

(73) recoveriX: BCI-Based Rehabilitation Therapy for Persons with Stroke
William Coon

(74) A Framework for Combining rTMS with Behavioral Therapy
Zoe Tsagaris

(75) Multisensory Neuromodulation: Activating Peripheral Nerves to Induce Brain Plasticity
Cory Gloeckner

Optical Stimulation/Recording

Room: Potomac

(76) Simultaneous Optical and Electrical In Vivo Analysis of the Enteric Nervous System
Nikolai Rakhilin

(77) 3D Printed Microdrive for Chronic Neural Recording and Optogenetic Stimulation in the Rat Brain
Min Kim

Visual Prosthesis

Room: Severn

(78) Low-Cost, Compact Current Source for Chronic Stimulation of Rat Retin
Sahar Elyahoodayan ***(Diversity Travel Award winner)***

(79) Interactions of Prosthetic and Natural Vision in Animals with Local Retinal Degeneration
Henri Lorach

(80) Evaluating a High Resolution Retinal Resistivity Probe with Calibrated Multilayer Agarose Gel Phantoms
Christopher Girard

Wireless Systems

Room: Potomac

(81) Implantable Neural Recording and Stimulation Technologies for In Vivo Electrophysiology for Rodents
James Morizio

(82) Frequency-Dependent Urodynamic Changes During Tibial Nerve Stimulation Using a Wirelessly Powered System in Anesthetized Cats
Zainab Moazzam

83 A Minimal, Low-Cost Voltage Controlled Wireless Stimulator
Vishnoukumaar Sivaji

(84) A Fully Wireless System for Long-Term Cortically Controlled Functional Electrical Stimulation
Stephanie Naufel

(85) Evaluation of the Invisible Spinal Cord Stimulation Trial System
Adil Raza

(86) Evaluation of the Wireless Floating Microelectrode Array (WFMA) for Intracortical Stimulation
Phil Troyk

(87) Wireless Arrays Reliably Evoke Stable, Graded and Selective Stimulation in Peripheral Nerves for Over 14 Months
Aswini Kanneganti

(88) Development of a Wireless Neuromodulation System for the Bladder
Thomas Richner

Acknowledgments

The North American Neuromodulation Society and the Neural Interfaces Conference wishes to thank the following companies for their sponsorship of the 2016 NANS²-NIC: A Joint Meeting.

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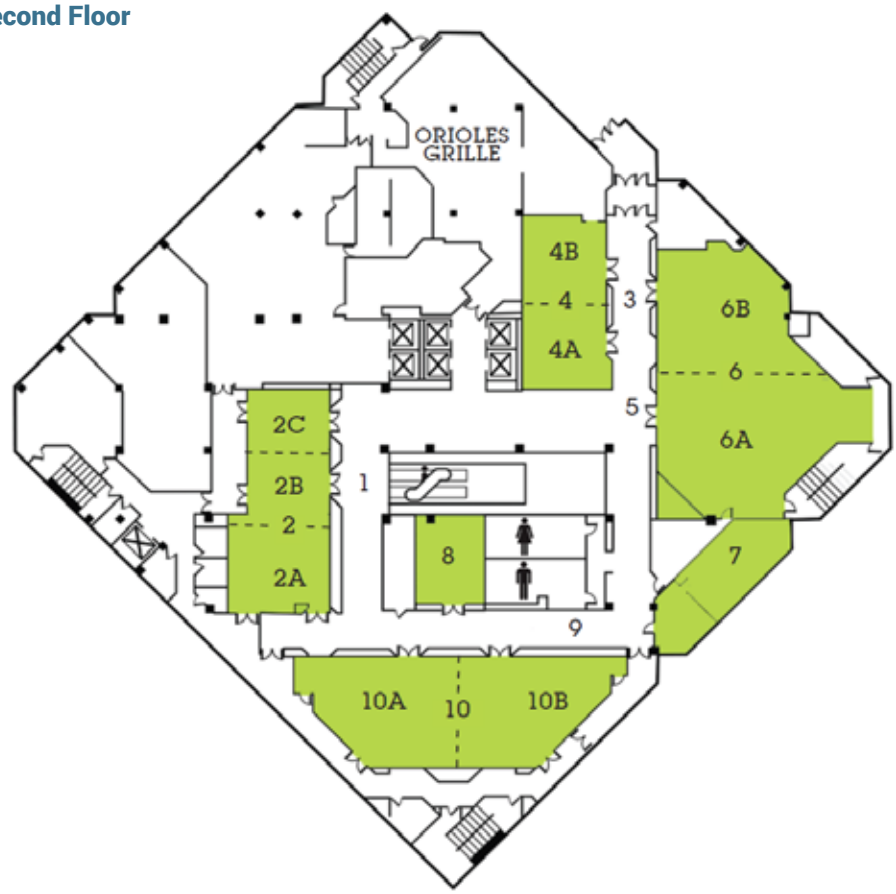
The Exhibit Hall will be in the Chesapeake Ballroom (C) and the Severn Room (S).

Company	Booth	Company	Booth
Alpha Omega	S2	Neuralynx, Inc	S1
APT Center	C6	Neuro News	S8
Blackrock Microsystems	S6	NeuroNexus	C1
Boston Scientific	C5	Nevro	C12
Cleveland FES Center	C10	Nuvectra	C9
Clint Pharmaceuticals	S4	Pain Pathways	S10
CorTec	S7	Plexon	C7
g. tec medical engineering GmbH	S5	Ripple	C3
IOP Publishing	S3	St. Jude Medical	C4
Jazz Pharmaceuticals	S9	Suture Concepts	C8
Medtronic	C11		

Hotel Floor Plan

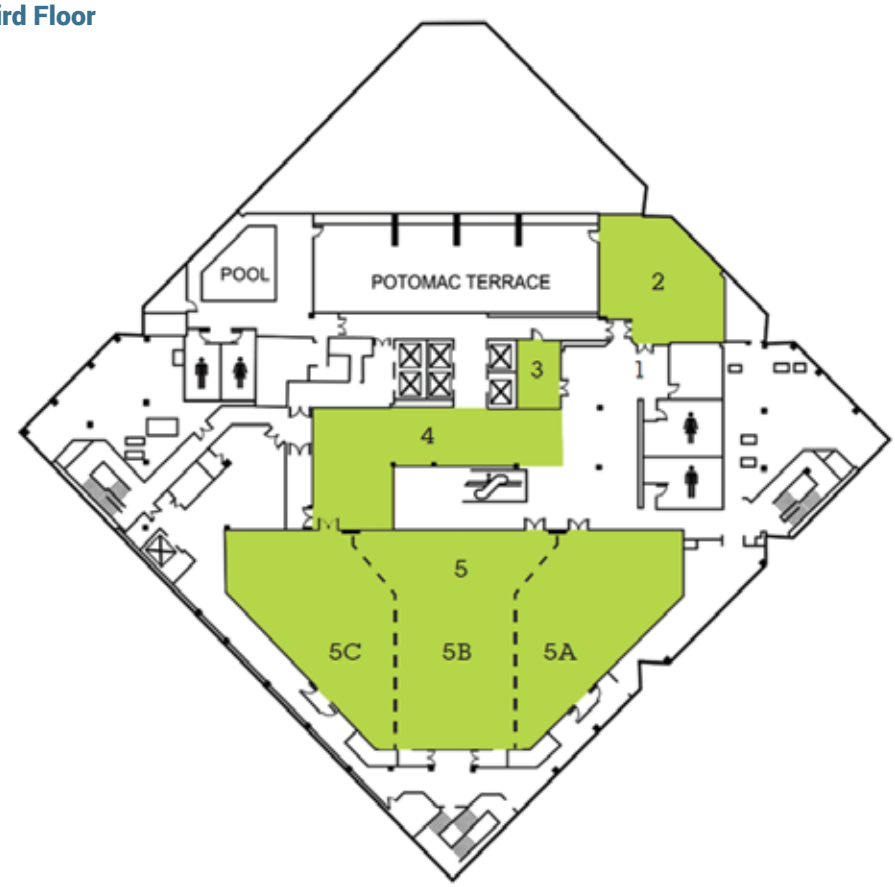
Second Floor



KEY

Room 1 - Severn Gallery
Room 2 - Severn Room
Room 2A - Severn Room I
Room 2B - Severn Room II
Room 2C - Severn Room III
Room 3 - Camden Gallery
Room 4 - Camden Room
Room 4A - Camden Room I
Room 4B - Camden Room II
Room 5 - Harborview Gallery
Room 6 - Harborview Ballroom
Room 6A - Harborview Ballroom I
Room 6B - Harborview Ballroom II
Room 7 - Board Room
Room 8 - Sassafras
Room 9 - Loch Raven Gallery
Room 10 - Loch Raven Room
Room 10A - Loch Raven Room I
Room 10B - Loch Raven Room II

Third Floor



KEY

Room 1- Potomac Gallery
Room 2 - Potomac Room
Room 3 - Patapsco
Room4 - Chesapeake Gallery
Room 5 - Chesapeake Ballroom
Room 5A - Chesapeake Ballroom I
Room 5B - Chesapeake Ballroom II
Room 5C - Chesapeake Ballroom III

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HF10 therapy statistics and competitive information are supported by this randomized clinical trial: Kapural L, Yu C, Doust MW, et al. Novel 10-kHz high-frequency therapy (HF10 therapy) is superior to traditional low-frequency spinal cord stimulation for the treatment of chronic back and leg pain: the SENZA-RCT randomized controlled trial. *Anesthesiology.* 2015;123:851-860.

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Protected by Medtronic SureScan® MRI Technology

*Under specific conditions. Neurostimulation systems require SureScan MRI implantable neurostimulator and leads. Refer to product labeling for full list of conditions.

NEUROSTIMULATION SYSTEMS FOR PAIN THERAPY
Brief Summary: Product Technical Manuals and Programming Guides must be reviewed prior to use for detailed disclosure. Indication for Use: Chronic, intractable pain of the trunk and/or limbs-including unilateral or bilateral pain. **Contraindications:** Diathermy. **Warnings**: Defibrillation, diathermy, electrocautery, MRI, RF ablation, and therapeutic ultrasound can result in unexpected changes in stimulation, serious patient injury or death. Rupture/piercing of neurostimulator can result in severe burns. Electrical pulses from the neurostimulator may result in an inappropriate response of the cardiac device. **Precautions:** The safety and effectiveness of this therapy has not been established for: pediatric use, pregnancy, unborn fetus, or delivery. Follow programming guidelines and precautions in product manuals. Avoid activities that stress the implanted neurostimulation system. EMI, postural changes, and other activities may cause shocking/jolting. Patients using a rechargeable neurostimulator should check for skin irritation or redness near the neurostimulator during or after recharging. **Adverse Events:** Undesirable change in stimulation; hematoma, epidural hemorrhage, paralysis, seroma, CSF leakage, infection, erosion, allergic response, hardware malfunction or migration, pain at implant site, loss of pain relief, chest wall stimulation, and surgical risks. For full prescribing information, please call Medtronic at 1-800-328-0810 and/or consult Medtronic's website at www.medtronic.com. USA Rx Only Rev 0313

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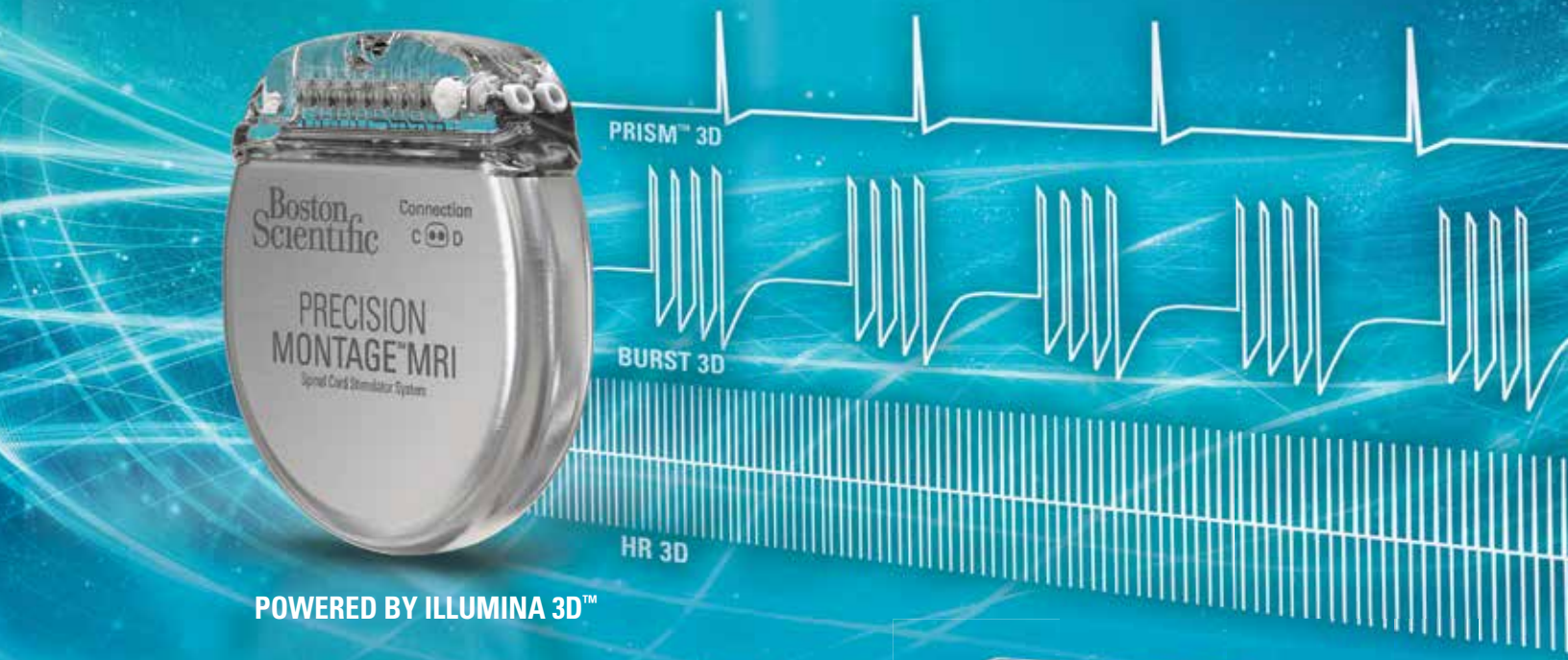
Boston Scientific
Advancing science for life™

INTRODUCING
PRECISION MONTAGE™ MRI

Full-Body MRI. Multiple Waveforms.



POWERED BY ILLUMINA 3D™

Precision Montage MRI powered by Illumina 3D offers proven pain relief by delivering multiple waveforms to a precise neural target — together with safe access to full-body MRI scans.*

Illumina 3D Programming

*The Precision Montage™ MRI SCS System provides safe access to Full-Body MRI Scans only when used with the Avista MRI Leads and exposed to the MRI environment under the specific conditions defined in the MRI Guidelines for Precision Montage™ Spinal Cord Stimulator System.

Indications for Use. Boston Scientific's Precision Montage MRI Spinal Cord Stimulator System is indicated as an aid in the management of chronic intractable pain of the trunk and/or limbs, including unilateral or bilateral pain associated with the following: failed back surgery syndrome, intractable low back pain and leg pain. Contraindications. The Precision Montage MRI Spinal Cord Stimulator System is not for patients who are unable to operate the system, have failed trial stimulation by failing to receive effective pain relief, are poor surgical risks, or are pregnant. Patients implanted with the Precision Montage MRI Spinal Cord Stimulator System with ImageReady MRI Technology are "MR Conditional" only when exposed to the MRI environment under the specific conditions defined in the ImageReady MRI Guidelines for Precision Montage MRI Spinal Cord Stimulator System manual. Warnings. Patients implanted with the Precision Montage MRI Spinal Cord Stimulator System without ImageReady MRI Technology should not be exposed to Magnetic Resonance Imaging (MRI). Exposure to MRI may result in dislodgement of the stimulator or leads, heating of the stimulator, severe damage to the stimulator electronics and an uncomfortable or jolting sensation. As a Spinal Cord Stimulation patient, you should not have diathermy as either a treatment for a medical condition or as part of a surgical procedure. Strong electromagnetic fields, such as power generators or theft detection systems, can potentially turn the stimulator off, or cause uncomfortable jolting stimulation. The system should not be charged while sleeping. The Precision Montage MRI Spinal Cord Stimulator System may interfere with the operation of implanted sensing stimulators such as pacemakers or implanted cardiac defibrillators. Advise your physician that you have a Spinal Cord Stimulator before going through with other implantable device therapies so that medical decisions can be made and appropriate safety measures taken. Patients should not operate motorized vehicles or potentially dangerous machinery with therapeutic stimulation switched "on." Your doctor may be able to provide additional information on the Precision Montage MRI Spinal Cord Stimulator System. For a copy of the Precision Spinal Cord Stimulator System Patient Handbook, including the indications for use, contraindications, warnings, precautions, and side effects, call 866.360.4747. Caution: Federal (U.S.) law restricts this device to sale by or on the order of a physician.

Outside the US Indications for Use. For further information refer to the product labeling and Instructions for Use provided with each product which includes indications, contraindications, warnings and precautions. Information for use only in countries with applicable health authority registrations. Not for distribution in France.