

# ACNS Fall Courses

SEPTEMBER 28-29, 2013 • PHILADELPHIA, PENN.

DoubleTree by Hilton • Philadelphia Center City

[www.acns.org](http://www.acns.org)



# FINAL PROGRAM

AMERICAN CLINICAL  
NEUROPHYSIOLOGY SOCIETY

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Milwaukee, WI 53202

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# PRESIDENT'S MESSAGE

Dear Colleagues,

It is a pleasure to welcome you to the American Clinical Neurophysiology Society (ACNS) 2013 Fall Courses. This promises to be a weekend filled with superb educational opportunities, renewal of friendships, and networking opportunities. We are certain that you will enjoy the Courses and the weekend.

This year's program includes outstanding presentations. The Course Committee Co-Chairs, William O. Tatum, DO and Tobias Loddenkemper, MD, and their hard-working committee have put together an exceptional set of courses: ICU EEG Monitoring, and Neurophysiologic Intraoperative Monitoring (NIOM). Due to popular demand, the 2013 Fall Courses will also bring back from last year's program the popular Hands-On QEEG Workshop run by our Immediate Past President, Susan T. Herman, MD.



Frank W. Drislane, MD

We will also have an outstanding turnout of exhibitors -- some old and some new, and we encourage everyone to visit the Exhibit Hall. We have set up breakfast, lunch and coffee breaks, as well as our Welcome Reception, in the Exhibit Hall to provide everyone extra opportunities to network with the exhibitors and your colleagues, as well. Be sure to stop by and say hello, introduce yourself, and enjoy some good food!

This has been a wonderful year for me serving as your President. I've had phenomenal support and guidance from our Officers, Council, Committee Chairs (including Drs. Tatum and Loddenkemper), and of course, members. Through the work of everyone, ACNS is robustly healthy and productive; our society continues to grow and thrive.

The ACNS Council and I want to thank everyone who has worked to make the 2013 Fall Courses successful. Thank you for allowing me the honor and privilege of being your President -- and enjoy the Courses and weekend in Philadelphia!

A handwritten signature in black ink that reads "Frank W. Drislane". The signature is written in a cursive, flowing style.

Frank W. Drislane, MD

## Welcome Reception

Saturday, September 28, 2013

5:00 – 6:30 PM

Overture, Level 3

DoubleTree by Hilton Philadelphia Center City

There will be complimentary hors d'oeuvres provided and you will get a chance to see all the new and familiar Exhibitors. A cash bar will be available as well.



# MESSAGE FROM COURSE COMMITTEE CO-CHAIRS

Dear Colleagues,

Welcome to Philadelphia for the American Clinical Neurophysiology Society (ACNS) 2013 Fall Courses. September 28 & 29 promises to be a great weekend at the DoubleTree by Hilton Philadelphia Center City for an outstanding educational opportunity!

The Fall Course programs have been designed to provide a solid review of the essentials for both Intensive Care Unit (ICU) EEG and Neurophysiologic Intraoperative Monitoring (NIOM) with the latest scientific advances led by notable experts detailing both “central” and “peripheral” clinical neurophysiology.



William O. Tatum, DO



Tobias Loddenkemper, MD

This year's Fall Course program will again feature two-day, parallel courses that cover the necessary methodologies and techniques required for practitioners in the field. The ICU EEG course will be chaired by Nicholas Abend, MD and Saurabh Sinha, MD, PhD. Aatif Husain, MD and Marc Nuwer, MD, PhD will lead the NIOM course. Few practicing neurologists have adequate training in these techniques, and physicians with competence in these areas are in great demand.

The educational mission of ACNS is to foster excellence in clinical neurophysiology to improve the outcomes of patients who are affected by neurological disease preserving health through education, research, and clinical care. These courses are an important forum and excellent platform for discussion and interaction with leaders in the field of clinical neurophysiology. This year's Fall Course agendas are sure to meet this description!

We are pleased to offer a Hands-On QEEG Workshop featuring ACNS Immediate Past President Susan T. Herman, MD. Be sure not to miss it on Sunday morning, as we know you will not be disappointed!

We are looking forward to our weekend of education and looking forward to welcoming you in Philadelphia. Wherever your interests lie in clinical neurophysiology we hope that you will enjoy “take-home” pearls of wisdom at this year's ACNS meeting that will generate further interest in these exciting fields in clinical neurophysiology, foster exchange between colleagues and help improve current practice of clinical neurophysiology.

Sincerely,

William O. Tatum, DO  
Course Committee Co-Chairs

Tobias Loddenkemper, MD

## Special Thanks to Fall Course Faculty

Drs. William O. Tatum and Tobias Loddenkemper would like to recognize and thank the 2013 Fall Course Faculty.

### ICU EEG

Nicholas S. Abend, MD	William Gallentine, DO
Elizabeth Gerard, MD	Cecil D. Hahn, MD, MPH
Stephen Hantus, MD	Susan T. Herman, MD
Suzette M. LaRoche, MD	Saurabh R. Sinha, MD, PhD
Courtney J. Wusthoff, MD	

### NIOM

Ronald Emerson, MD	Aatif M. Husain, MD
Alan D. Legatt, MD, PhD	Jaime Lopez, MD
Mark R. Nuwer, MD, PhD	Eva K. Ritzl, MD
Stanley Skinner, MD	



# ACNS INFORMATION

## OFFICERS AND COUNCIL 2013 – 2014

### PRESIDENT

Frank W. Drislane, MD  
Beth Israel Deaconess Medical Center

### FIRST VICE PRESIDENT

Aatif M. Husain, MD  
Duke University Medical Center

### SECOND VICE PRESIDENT

William O. Tatum, DO  
Mayo Clinic College of Medicine/  
Mayo Clinic Florida

### SECRETARY

Jonathan C. Edwards, MD  
Medical University of South Carolina

### TREASURER

Stephan U. Schuele, MD, MPH  
Northwestern University

### IMMEDIATE PAST PRESIDENT

Susan T. Herman, MD  
Beth Israel Deaconess Medical Center

### PAST PRESIDENT

Douglas R. Nordli, Jr., MD  
Lurie Children's Epilepsy Center

### COUNCILORS-AT-LARGE

Selim R. Benbadis, MD  
University of South Florida

Jeffrey Britton, MD  
Mayo Clinic

Cecil D. Hahn, MD, MPH  
The Hospital for Sick Children

Tobias Loddenkemper, MD  
Children's Hospital Boston

Jaime Lopez, MD  
Stanford University

Suraj Muley, MD  
Barrow Neurological Institute  
St. Joseph's Hospital & Medical Center

Raj D. Sheth, MD  
Mayo Clinic / Nemours Clinic - Florida

Francis O. Walker, MD  
Wake Forest University

### AMA OFFICER

Marc R. Nuwer, MD, PhD  
UCLA

### JOURNAL EDITOR

John Ebersole, MD  
University of Chicago Medical Center

### FALL COURSE COMMITTEES (2013)

#### COURSE COMMITTEE

\*Tobias Loddenkemper, MD  
\*William O. Tatum, DO  
Nicholas S. Abend, MD  
Lawrence J. Hirsch, MD  
Daniela Minecan, MD  
Juan Ochoa, MD

#### EX-OFFICIO

Susan T. Herman, MD  
Suzette M. LaRoche, MD  
Greg Worrell, MD

#### CONTINUING MEDICAL EDUCATION COMMITTEE

\*Susan T. Herman, MD  
\*Stephan U. Schuele, MD, MPH  
Nicholas S. Abend, MD  
Jayant Acharya, MD  
Meriem Bensalem-Owen, MD  
Rohit Das, MD  
Kitti Kaiboriboon, MD  
Jong Woo Lee, MD, PhD  
Greg Worrell, MD

*\*Chair/Co-Chair*

### EXECUTIVE OFFICE

555 East Wells Street  
Suite 1100  
Milwaukee, WI 53202  
Phone (414) 918-9803  
Fax (414) 276-3349  
www.acns.org  
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### EXECUTIVE DIRECTOR

Megan M. Kelley, CMP  
mkelley@acns.org

### MEETINGS & MEMBERSHIP MANAGER

Samantha J. Surillo  
ssurillo@acns.org



## Not an ACNS Member? Join Now!

The benefits of joining are endless but here are just a few:

- Reduced fees for the Annual Meeting & Courses and In-Service Examination.
- Reduced dues for members in training and first-year practitioners.
- Access to the *Journal of Clinical Neurophysiology*.
- Access to the Online Member Directory.

Please visit the ACNS website, **www.acns.org**, for more information and ways to join!



# GENERAL MEETING INFORMATION

## VENUE INFORMATION

The DoubleTree by Hilton Philadelphia Center City is the location for the 2013 Fall Courses. Calls should be directed to the American Clinical Neurophysiology Society Registration Desk.

**DoubleTree by Hilton Philadelphia Center City**  
237 S Broad St  
Philadelphia, PA 19107  
(215) 893-1600  
<http://doubletree3.hilton.com>

## REGISTRATION DESK

### Location: Lobby

Friday, September 27 5:00 – 7:00 PM

### Location: Atrium

Saturday, September 28 7:00 AM – 5:00 PM

Sunday, September 29 6:00 AM – 4:00 PM

## INTERNET

For your convenience, there will be free Wi-Fi access offered to Fall Course delegates on the third floor meeting space of the DoubleTree by Hilton Philadelphia Center City.

## CERTIFICATE OF ATTENDANCE

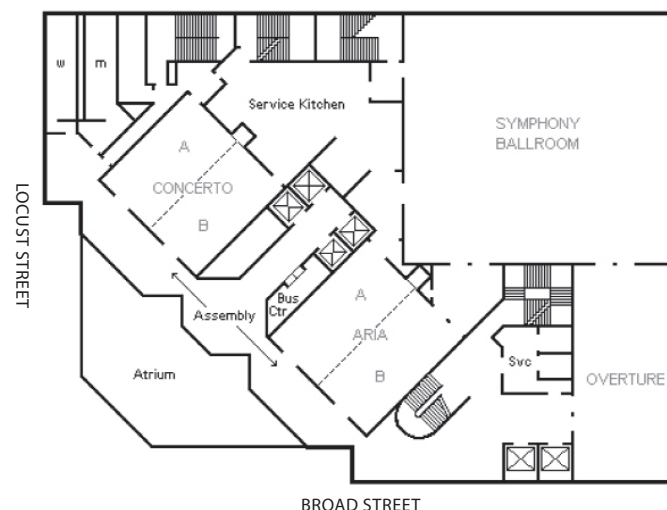
Certificates of Attendance will be provided online. CME certificates will be available to pre-registered delegates immediately upon the close of the meeting at [www.acns.org](http://www.acns.org). Delegates who registered on-site will be able to obtain a CME certificate at [www.acns.org](http://www.acns.org) starting November 1, 2013.

Delegates are **REQUIRED** to complete session evaluations to obtain a CME Certificate or Certificate of Attendance. Delegates should log on to the website listed above and enter their last name and the ID# listed at the top of their Fall Courses confirmation form (included in this packet). The system will then ask delegates to indicate which sessions they attended, to complete evaluation forms for each of those sessions, and then will generate a PDF certificate which may be printed or saved to the delegate's computer. Session attendance and evaluation information are saved in the database, and certificates may be accessed again, in the event the certificate is lost or another copy is required.

Please note that certificates will not be mailed or emailed after the meeting. The online certificate program is the only source for this documentation. Please contact ACNS at [info@acns.org](mailto:info@acns.org) for any questions. ACNS asks that all CME certificates be claimed no later than December 31, 2013.

## DOUBLETREE BY HILTON PHILADELPHIA CENTER CITY HOTEL FLOOR PLAN

### THIRD FLOOR



## KEY DATES

CME Certificate Program Opens (pre-registered delegates)  
September 28, 2013

CME Certificate Program Opens (delegates registering onsite)  
November 1, 2013

CME Certificate Claim Deadline  
December 31, 2013

## COMPLIMENTARY DINING

For your convenience, ACNS will provide the following complimentary dining options to Fall Course delegates.

### Saturday, September 28, 2013

7:00 – 8:00 AM Breakfast  
12:00 – 1:00 PM Lunch  
5:00 – 6:30 PM Reception (hors d'oeuvres and cash bar)

### Sunday, September 29, 2013

6:30 – 9:00 AM Breakfast  
12:00 – 1:00 PM Lunch

*\*Beverages and light snacks will be offered both Saturday and Sunday during scheduled breaks.*



# GENERAL MEETING INFORMATION

## NEARBY RESTAURANT OPTIONS

For your convenience, ACNS has compiled the following list of nearby restaurants for which Fall Course delegates may choose if leaving the hotel for dinner.

The DoubleTree by Hilton Philadelphia Center City and surrounding area offers a wide array of dining options. Listed below are nearby restaurants. \*All Restaurants are within 20 minutes walking distance from the hotel.

**Entrée Prices**    \$ = 10 – 20    \$\$ = 20 – 30    \$\$\$ = 30 – 40

<b>American</b>		
Ruth's Chris Steak House \$\$\$	260 South Broad St.	(215) 790-1515
SBRAGA \$\$\$	440 South Broad St.	(215) 735-1913
Russet \$\$	1521 Spruce St.	(215) 546-1521
The Farm and Fisherman \$	1120 Pine St.	(267) 687-1555
The Happy Rooster \$	118 South 16th St.	(215) 963-9311
<b>Asian</b>		
Buddakan \$\$\$	325 Chestnut St.	(215) 574-9440
Morimoto \$	723 Chestnut St.	(215) 413-9070
SAMPAN \$	124 South 13th St.	(215) 732-3501
<b>European</b>		
Valanni \$	1229 Spruce St.	(215) 790-9494
A.Kitchen \$	135 South 18th St.	(215) 825-7030
Audrey Claire \$	276 South 20th St.	(215) 731-1222
<b>French</b>		
Caribou Café \$	1126 Walnut St.	(215) 625-9535
Parc \$	227 South 18th St.	(215) 545-2262
<b>Gastropub</b>		
Fado Irish Pub \$	1500 Locust St.	(215) 893-9700
Good Dog Bar \$	224 South 15th St.	(215) 985-9600
The Dandelion \$	124 South 18th St.	(215) 558-2500
McGillin's Olde Ale House \$	1310 Drury St.	(215) 735-5562
<b>Greek</b>		
Estia Restaurant \$	1405 Locust St.	(215) 735-7700
Dmitri's \$	2227 Pine St.	(215) 985-3680
<b>Indian</b>		
Minar Palace \$	1304 Walnut St.	(215) 546-9443
Indian Restaurant \$	1634 South St.	(215) 964-9451
Philadelphia Chutney Company \$	1628 Sansom St.	(215) 564-6446
Spice End \$	1634 South St.	(267) 639-9405
<b>Italian</b>		
13th Street Gourmet Pizza \$	209 South 13th St.	(215) 546-4453
Marabella Meatball \$	1211 Walnut St.	(215) 238-1833
Mama Angelina's Pizza \$	1337 Locust St.	(215) 735-4987
Bella Cena \$	1506 Spruce St.	(267) 858-4600
Girasole \$	440 South Broad St.	(215) 732-2728
Varalli Restaurant \$	231 South Broad St.	(215) 546-6800
La Fontana Della Citta \$	1701 Spruce St.	(215) 875-9990
Giorgio on Pine \$	1328 Pine St.	(215) 545-6265
Vetri \$\$\$	1312 Spruce St.	(215) 732-3478
La Viola (East) \$\$\$	253 South 16th St.	(215) 735-8630



# GENERAL MEETING INFORMATION

## NEARBY RESTAURANT OPTIONS — CONTINUED

Entrée Prices \$ = 10 – 20 \$\$ = 20 – 30 \$\$\$ = 30 – 40

La Viola (West) \$\$\$	252 South 16th St.	(215) 735-8631
<b>Latin American</b>		
Mixto Restaurant \$\$	1141 Pine St.	(215) 592-0363
Alma De Cuba \$\$\$	1623 Walnut St.	(215) 988-1799
<b>Mediterranean</b>		
Tietra \$	231 South 15th St.	(267) 687-2237
Byblo's \$	114 South 18th St.	(215) 568-3050
La Va's Café \$	2100 South St	(215) 545-1508
<b>Mexican</b>		
Lolita \$\$	106 South 13th St.	(215) 546-7100
El Vez \$	121 South 13th St.	(215) 928-9800
Mexico on the Square \$	1511 Pine St.	(215) 732-1907
Jose Pistola's \$	263 South 15th St.	(215) 545-4101
<b>Middle Eastern</b>		
Sahara Grill \$\$	1334 Walnut St.	(215) 985-4155
<b>New Age Café</b>		
FUEL \$	1225 Walnut St.	(215) 922-3835
<b>Seafood</b>		
Butcher and Singer \$\$\$	1500 Walnut St.	(215) 732-4444
The Prime Rib \$\$\$	1701 Locust St.	(215) 772-1701
FISH \$\$	1234 Locust St.	(215) 545-9600
Oyster House \$\$	1516 Sansom St.	(215) 567-7683
<b>Steakhouse</b>		
Davio's Northern Italian Steakhouse \$\$\$	111 South 17th St.	(215) 563-4810
Del Frisco's Double Eagle Steakhouse \$\$\$	1426-28 Chestnut St.	(215) 246-0533
FOGO DE CHAO Churrascaria Brazilian Steakhouse \$\$\$	1337 Chestnut St.	(215) 636-9700
<b>Sushi Bar</b>		
Makiman Sushi \$\$	1326 Spruce St.	(215) 546-0180
SUMO SUSHI \$	337 South Broad St.	(215) 985-1111
RAW Sushi & Sake Lounge \$\$	1225 Sansom St.	(215) 238-1903
<b>Tapas</b>		
Jamonera \$	105 South 13th St.	(215) 922-6061
Tinto \$\$	114 South 20th St.	(215) 665-9150
<b>Thai</b>		
Jasmine Rice \$	306 South 16th St.	(215) 546-0818
Erawan Thai Cuisine \$	123 South 23rd St.	(215) 567-2542
Smile Café \$	105 South 22nd St.	(215) 564-2502
Bangkok Thai 9 \$	2028 Chestnut St.	(215) 568-7058
<b>Vegan</b>		
VEDGE \$	1221 Locust St.	(215) 320-7500
HipCityVeg \$	127 South 18th St.	(215) 278-7605
Mi Lah Vegetarian \$\$	218 South 16th St.	(215) 732-8888





# CME INFORMATION

## EDUCATIONAL MISSION STATEMENT

### PURPOSE

The American Clinical Neurophysiology Society (ACNS) is a professional association dedicated to fostering excellence in clinical neurophysiology and furthering the understanding of central and peripheral nervous system function in health and disease through education, research, and the provision of a forum for discussion and interaction.

### CONTENT

ACNS is committed to providing continuing medical education to its members and others interested in clinical neurophysiology. Educational objectives include 1) Reviewing current knowledge of clinical neurophysiology including: electroencephalography, evoked potentials, electromyography, nerve conduction studies, intraoperative monitoring, polysomnography and other sleep technology, quantitative neurophysiological methods, magnetoencephalography, sleep disorders, epilepsy, neuromuscular disorders, brain stimulation, brain-computer interfacing, and related areas; and 2) Informing course and meeting attendees of recent technological developments and their implications for clinical practice.

### TARGET AUDIENCE

The Society's educational activities are directed to clinical neurophysiologists, neurologists, psychiatrists, physiatrists, neurosurgeons, trainees in these disciplines and other physicians and researchers who utilize clinical neurophysiological techniques and knowledge in the diagnosis and management of patients with disorders of the nervous system.

### EXPECTED RESULT

Attendees will improve competence in clinical neurophysiology procedures and incorporate new technological advancements into their practice.

## GAPS AND NEEDS

In compliance with the Updated Accreditation Criteria of the Accreditation Council for Continuing Medical Education (ACCME), the Continuing Medical Education Committee of the ACNS has identified "professional practice gaps."

Definition: A "professional practice gap" is the difference between what a health professional is doing or accomplishing compared to what is achievable on the basis of current professional knowledge.

The following professional practice gaps and educational needs were identified by a combined effort of the Program, Course and CME Committees.

## IDENTIFIED GAPS AND NEEDS

### Gap 1. Emerging Areas of Practice

Neurological intraoperative monitoring (NIOM) and intensive care unit EEG monitoring (ICU EEG) are new and rapidly evolving areas of clinical neurophysiology. Few practicing neurologists have adequate training in these techniques, and physicians with competence in these areas are in great demand. Educational activities should cover both basic methodologies for those practitioners new to ICU EEG and NIOM, and innovative techniques.

### Gap 2. General Practice of Clinical Neurophysiology

Clinical neurophysiology procedures are performed by a large proportion of practicing US neurologists, many of whom have little or no formal training in clinical neurophysiology. Many clinical neurophysiology procedures (e.g. evoked potentials, invasive EEG) are performed at low volume at most centers, and a forum for review and hands-on interpretation are essential to maintain competence in these areas.

Several specific topics with significant gaps between current practice and ideal practice have been identified via review of the literature, review of clinical neurophysiology fellowship curricula, and surveys of ACNS members and Annual Meeting attendees.

These include:

- Peripheral neurophysiology, Pediatric EMG, critical illness related neurophysiology, and muscle ultrasound
- Basic EEG: Identification of normal variants, identification of artifacts, clinical correlation
- Pediatric EEG, especially neonatal EEG
- Digital EEG processing, e.g. quantitative EEG and trends for use in the intensive care unit, source localization, coregistration with neuroimaging, etc.
- Full band EEG, Ultrafast and ultraslow EEG
- NIOM: Motor evoked potentials, guidelines and standards of care for NIOM (e.g. indications, cost effectiveness)
- Evoked potentials: Current role of short-and long-latency EPs
- Video-EEG monitoring, especially invasive EEG
- Sleep, Use of new scoring system, implications for patient care

### CHANGES IN BEHAVIOR/OBJECTIVES

It is intended that, as a result of attending the meeting and/or courses, physician attendees will be able to identify changes in competence or performance that are desirable.

Definitions: "Competence" is knowing how to do something. "Performance" is what the physician would do in practice, if given the opportunity.



## CME INFORMATION — CONTINUED

### EVALUATION

The updated ACCME accreditation criteria are designed to integrate with the new requirements for maintenance of certification (for more information see [www.ABPN.org](http://www.ABPN.org)). Physicians are expected to perform self assessments of their practice, but the ACNS, as an organization accredited by the ACCME, is expected to measure how its educational activities assist physicians in this activity. Thus, there are new questions in the evaluation form. These questions address your intended changes in competence or performance. In a few months, we will contact all physician meeting attendees to ask you if you actually HAVE experienced changes in competence or performance. Your responses, now and in the future, will assist us and ultimately you in determining educational activities that are most useful to you.

### POLICY ON FINANCIAL DISCLOSURES

It is the policy of ACNS to ensure balance, independence, objectivity and scientific rigor in all its individually sponsored or jointly sponsored educational programs. In order to comply with the ACCME's Updated Standards for Commercial

Support, ACNS requires that anyone who is in a position to control the content of an educational activity discloses all relevant financial relationships with any commercial interest pertaining to the content of the presentation. Should it be determined that a conflict of interest exists as a result of a financial relationship of a planner of the CME activity, the planner must recuse himself or herself from the planning for that activity or relevant portion of that activity. All presentations for which the presenter disclosed a potential conflict of interest are peer reviewed by two members of the ACNS CME Committee with no relationships. If bias is found, the presenter is asked to make changes to the presentation and it is re-reviewed for bias before final approval. Refusal to disclose a conflict or the inability to resolve an identified conflict precludes participation in the CME activity. Complete conflict of interest disclosure information is printed in the final program for the activity. A learner may request additional information regarding the nature of a planner or speaker's disclosure if "No Relevant Relationships" has been indicated below. To request additional information, contact the ACNS Executive office at [info@acns.org](mailto:info@acns.org).

### CONFLICTS OF INTEREST

**Key:** a. Grants/Research Support; b. Consultant; c. Stock/Shareholder (self-managed); d. Speaker's Bureau; e. Advisory Board or Panel; f. Salary, Contractual Services; g. Other Financial or Material Support (royalties, patents, etc.)

Council		
Selim Benbadis, MD	University of South Florida	Cyberonics (a,b,d,e); Lundbeck (a,b,d,e); GSK (b,d,e); Supernus (b,d,e)
Jeffrey Britton, MD	Mayo Clinic	No Relationships
Frank W. Drislane, MD	Beth Israel Deaconess Medical Center	LWW (g)
John Ebersole, MD	University of Chicago Medical Center	Compumedics USA (d)
Jonathan C. Edwards, MD	Medical University of South Carolina	No Relationships
Cecil Hahn, MD, MPH	Hospital for Sick Children	No Relationships
Susan T. Herman, MD	Beth Israel Deaconess Medical Center	Lundbeck (a); UCB Pharma (a); Electrical Geodesics (a)
Aatif Husain, MD	Duke University Medical Center	UCB Pharma (a,d,e); Jazz Pharma (b,d)
Tobias Loddenkemper, MD	Children's Hospital Boston	NIH/NINDS (a); Program for Quality and Safety. BCH (a); Payer Provider Quality Initiative (a); Lundbeck/investigator initiated (a); Eisai/investigator initiated (a); AES/EFA (a); CURE (a); PERF (a); Seizure/Associate Editor (g)
Jaime Lopez, MD	Stanford University	No Relationships
Suraj Muley, MD	Barrow Neurological Institute	CSL Behring (e); Baxter (e); TEVA (d)
Douglas Nordli, Jr., MD	Children's Epilepsy Center	No Relationships



## CME INFORMATION — CONTINUED

### CONFLICTS OF INTEREST

**Key:** a. Grants/Research Support; b. Consultant; c. Stock/Shareholder (self-managed); d. Speaker's Bureau; e. Advisory Board or Panel; f. Salary, Contractual Services; g. Other Financial or Material Support (royalties, patents, etc.)

Marc Nuwer, MD, PhD	UCLA	Corticare (c); SleepMed (g)
Stephan Schuele, MD, MPH	Northwestern University	GSK (d); Lundbeck (d,e)
Raj Sheth, MD	Mayo Clinic/ Nemours Clinic – Florida	No Relationships
William O. Tatum, DO	Mayo Clinic College of Medicine/Mayo Clinic Florida	Mayo Clinic (a); Demos Publishing (g)
Francis Walker, MD	Wake Forest University	Ipsen (e,g); Siena Biotech (a,g); Navidea (b,g)
CME Committee (if not listed above)		
Nicholas Abend, MD	Children's Hospital of Philadelphia	NIH (NINDS) (a)
Jayant Acharya, MD	Penn State Hershey Medical Center	Cyberonics (d)
Meriem Bensalem-Owen, MD	University of Kentucky	UCB (a); Eisai (a); Sunovion(a); Lundbeck (a)
Rohit Das, MD	Indiana University	Satellite Healthcare (a,g)
Kitti Kaiboriboon, MD	University Hospitals Case Medical Center	No Relationships
Jong Woo Lee, MD	Brigham & Women's Hospital	UCB (a); Cephalon/TEVA (a); SleepMed/DigiTrace (f)
Gregory Worrell, MD	Mayo Clinic	NIH (NINDS) (a)
Course Committee (if not listed above)		
Suzette LaRoche, MD	Emory University School of Medicine	Demos Publishing (g); UCB (a)
Juan Ochoa, MD	University of South Alabama	No Relationships
Course Faculty (if not listed above)		
Ronald Emerson, MD	New York Presbyterian Hospital	No Relevant Relationships
William Gallentine, DO	Duke University Medical Center	No Relationships
Elizabeth Gerard, MD	Northwestern Medical w Foundation	No Relationships
Stephen Hantus, MD	Cleveland Clinic	No Relationships
Alan Legatt, MD, PhD	Montefiore Medical Center	No Relevant Relationships
Eva Ritzl, MD	Johns Hopkins University	No Relationships
Saurabh R. Sinha, MD	Duke University Medical Center	UCB Pharmaceuticals (a); Lundbeck Pharmaceuticals (e); Cyberonics (a,d)
Stanley Skinner, MD	Abbott Northwestern Hospital	Medtronic (g)
Courtney Wusthoff, MD	Lucile Packard Children's Hospital at Stanford	No Relationships
Executive Office Staff		
Megan M. Kelley, CMP	ACNS	No Relationships
Samantha Surillo	ACNS	No Relationships



# CME INFORMATION

## PROGRAM DESCRIPTION

The Society's educational activities are directed to clinical neurophysiologists, neurologists, psychiatrists, physiatrists, neurosurgeons, trainees in these disciplines and other physicians and researchers who utilize clinical neurophysiological techniques and knowledge in the diagnosis and management of patients with disorders of the peripheral and central nervous system.

The 2013 Fall Courses are designed around two of the new and rapidly-evolving areas of clinical neurophysiology, Neurological Intraoperative Monitoring (NIOM) and Intensive Care Unit EEG Monitoring (ICU EEG). Few practicing neurologists have adequate training in these techniques, and physicians with competence in these are in great demand. Educational activities will cover both basic methodologies for those practitioners new to ICU EEG and NIOM, and innovative techniques.

## LEARNING OBJECTIVES

### Intensive Care Unit EEG Monitoring (ICU EEG)

At the conclusion of this course, participants will be able to:

1. Recognize common indications for CEEG in the ICU setting;
2. Interpret EEG patterns encountered in the ICU, including seizures and periodic patterns;
3. Utilize quantitative EEG methods for data reduction and real-time detection of EEG changes in the ICU;
4. Select appropriate equipment for ICU-EEG monitoring, including networking and data storage options, and;
5. Determine optimal staffing, data review, and reporting of results.

### Neurologic Intraoperative Monitoring (NIOM)

At the conclusion of this course, participants will be able to:

1. Identify the various types of NIOM;
2. Interpret NIOM Case based presentations;
3. Utilize NIOM Case based presentations to differentiate between typical and atypical changes that can occur;
4. Illustrate the technical challenges associated with NIOM;
5. Describe contemporary issues relevant to NIOM, including legal, practice, and equipment issues.

## TARGET AUDIENCE

Clinical neurophysiologists, neurologists, physiatrists, neurosurgeons, technologists, trainees in these disciplines and other physicians and researchers who specialize in clinical neurophysiology.

## ACCREDITATION STATEMENT

This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education (ACCME) through the sponsorship of ACNS. ACNS is accredited by the ACCME to provide continuing medical education for physicians.

## CREDIT DESIGNATION

ACNS designates the Fall Courses for the maximum number of *AMA PRA Category 1 Credit(s)*<sup>TM</sup> indicated below:

- Intensive Care Unit EEG Monitoring (ICU EEG): 13.75 *AMA PRA Category 1 Credit(s)*<sup>TM</sup>
- Neurologic Intraoperative Monitoring (NIOM): 14.25 *AMA PRA Category 1 Credit(s)*<sup>TM</sup>

Physicians should claim only credit commensurate with the extent of their participation in the activity.





# PROGRAM AGENDA – ICU EEG

## INTENSIVE CARE UNIT ELECTROENCEPHALOGRAPHY (ICU EEG)

Location: Aria AB

Course Directors: Nicholas S. Abend, MD and Saurabh Sinha, MD, PhD

### SATURDAY, SEPTEMBER 28, 2013

8:00 – 8:10 AM	<b>Welcome and Introduction</b> <i>Nicholas S. Abend, MD</i>
8:10 – 10:00 AM	<b>Seizures – Indications and Outcome:</b> <b>Pediatric</b> <i>Nicholas S. Abend, MD</i> <b>Neonatal</b> <i>Courtney J. Wusthoff, MD</i> <b>Adult</b> <i>Saurabh Sinha, MD, PhD</i>
10:00 – 10:30 AM	Break & Visit Exhibits (Overture)
10:30 AM – 12:00 PM	<b>Other Indications:</b> <b>Ischemia Identification</b> <i>Susan T. Herman, MD</i> <b>Prognosis – Neonatal and Pediatric</b> <i>William Gallentine, DO</i> <b>Prognosis – Adult</b> <i>Susan T. Herman, MD</i>
12:00 – 1:00 PM	Lunch & Visit Exhibits (Overture)
1:00 – 3:00 PM	<b>EEG Interpretation:</b> <b>Background – Neonatal and Pediatric</b> <i>Courtney J. Wusthoff, MD</i> <b>Background – Adult</b> <i>Saurabh Sinha, MD, PhD</i> <b>Electrographic Seizures</b> <i>Suzette M. LaRoche, MD</i> <b>Periodic and Rhythmic Patterns</b> <i>Elizabeth E. Gerard, M</i>
3:00 – 3:30 PM	Break & Visit Exhibits (Overture)
3:30 – 5:00 PM	<b>Quantitative EEG:</b> <b>Intro and Utility</b> <i>Cecil D. Hahn, MD, MPH</i> <b>Cases – Seizures</b> <i>Cecil D. Hahn, MD, MPH</i> <i>Susan T. Herman, MD</i> <i>Courtney J. Wusthoff, MD</i> <b>Cases – Ischemia</b> <i>Susan T. Herman, MD</i>
5:00 – 6:30 PM	Reception & Visit Exhibits (Overture)

### SUNDAY, SEPTEMBER 29, 2013

7:30 – 8:45 AM	<b>Hands on Quantitative EEG Workshop:</b> <i>Susan T. Herman, MD</i>
9:00 – 10:45 AM	<b>Administrative Issues:</b> <b>Equipment, Networking, Electrodes, Montages</b> <i>Saurabh Sinha, MD, PhD</i> <b>Staffing/Personnel, Team Approach</b> <i>Cecil D. Hahn, MD, MPH</i> <b>Billing, Coding, and Epilepsy Center Guidelines</b> <i>Stephen Hantus, MD</i>
10:45 – 11:00 AM	Break
11:00 AM – 12:00 PM	<b>Developing a CEEG Program, Current Practices:</b> <b>Developing a Program and Business Plan</b> <i>Stephen Hantus, MD</i> <b>Panel Discussion and Q&amp;A</b> <i>Panel</i>
12:00 – 1:00 PM	Lunch
1:00 – 2:15 PM	<b>Seizure and Status Epilepticus Management:</b> <b>Neonatal</b> <i>Courtney J. Wusthoff, MD</i> <b>Pediatric</b> <i>William Gallentine, DO</i> <b>Adult</b> <i>Elizabeth E. Gerard, MD</i> <b>Novel Treatments</b> <i>Elizabeth E. Gerard, MD</i>
2:15 – 2:30 PM	Break
2:30 – 4:00 PM	<b>Other Topics:</b> <b>Multi-Modal Monitoring</b> <i>Suzette M. LaRoche, MD</i> <b>ICU EEG Guidelines</b> <i>Nicholas S. Abend, MD</i> <b>Impact on Management and Outcome</b> <i>Suzette M. LaRoche, MD</i> <b>Q &amp; A Panel Discussion</b> <i>Panel</i>
4:00 – 4:05 PM	<b>Closing Remarks</b> <i>Saurabh Sinha, MD, PhD</i>



# PROGRAM AGENDA – NIOM

## NEUROLOGICAL INTRAOPERATIVE MONITORING (NIOM)

Location: Concerto AB

Course Directors: Aatif Husain, MD and Marc R. Nuwer, MD, PhD

### SATURDAY, SEPTEMBER 28, 2013

8:00 – 8:05 AM	<b>Introduction and Welcome</b> <i>Aatif M. Husain, MD</i>
8:05 – 10:05 AM	<b>SEP</b> <i>Aatif M. Husain, MD</i> <b>MEP</b> <i>Ronald Emerson, MD</i> <b>EMG</b> <i>Stanley Skinner, MD</i>
10:05 – 10:20 AM	Break & Visit Exhibits (Overture)
10:20 AM – 12:00 PM	<b>Case Discussion: Vertebral Column Surgery</b> <i>Ronald Emerson, MD</i> <b>Case Discussion: Spinal Cord Surgery</b> <i>Eva K. Ritzl, MD</i> <b>Q &amp; A Panel Discussion</b> <i>Panel</i>
12:00 – 1:00 PM	Lunch & Visit Exhibits (Overture)
1:00 – 3:00 PM	<b>BAEP</b> <i>Alan D. Legatt, MD, PhD</i> <b>EEG</b> <i>Jaime Lopez, MD</i> <b>Case Discussion: CPA Surgery</b> <i>Alan D. Legatt, MD, PhD</i>
3:00 – 3:15 AM	Break & Visit Exhibits (Overture)
3:15 – 5:00 PM	<b>Case Discussion: Carotid Endarterctomy</b> <i>Eva K. Ritzl, MD</i> <b>Case Discussion: Intracranial Aneurysm Surgery</b> <i>Jaime Lopez, MD</i> <b>Q &amp; A Panel Discussion</b> <i>Panel</i>
5:00 – 6:30 PM	Reception & Visit Exhibits (Overture)

### SUNDAY, SEPTEMBER 29, 2013

8:00 – 8:05 AM	<b>Welcome</b> <i>Marc R. Nuwer, MD, PhD</i>
8:05 – 10:05 AM	<b>Anesthesia</b> <i>Ronald Emerson, MD</i> <b>Cranial Nerves 3, 4, 6</b> <i>Jaime Lopez, MD</i> <b>Cranial Nerves 5, 7, 9 - 12</b> <i>Alan D. Legatt, MD, PhD</i>
10:05 – 10:20 AM	Break
10:20 AM – 12:00 PM	<b>Case Discussion: Brainstem Surgery</b> <i>Jaime Lopez, MD</i> <b>Case Discussion: Lower Spinal Surgery</b> <i>Stanley Skinner, MD</i> <b>Q &amp; A Panel Discussion</b> <i>Panel</i>
12:00 – 1:00 PM	Lunch & Business of NIOM
1:00 – 2:20 PM	<b>Billing and Regulatory Issues</b> <i>Marc R. Nuwer, MD, PhD</i> <b>Cortical Mapping and Stimulation</b> <i>Marc R. Nuwer, MD, PhD</i>
2:20 – 2:35 PM	Break
2:35 – 4:15 PM	<b>Case Discussion: Brain Tumor Surgery</b> <i>Eva K. Ritzl, MD</i> <b>Case Discussion: Aortic Surgery</b> <i>Aatif M. Husain, MD</i> <b>Q &amp; A Panel Discussion</b> <i>Panel</i>



# PRESENTATION ABSTRACTS

## INTENSIVE CARE UNIT ELECTROENCEPHALOGRAPHY (ICU EEG)

### SEIZURES – INDICATIONS AND OUTCOME

#### PEDIATRIC

*Nicholas S. Abend, MD*

Electrographic seizures refer to seizures evident on electroencephalographic (EEG) monitoring, and they are common in critically ill children with acute encephalopathy. Most electrographic seizures have no associated clinical changes; EEG monitoring is required for identification. In current clinical practice, most clinicians monitor for 1-2 days when screening for seizures. The impact of electrographic seizures on outcome is an area of active investigation. There is evidence that electrographic seizures are biomarkers of more severe brain injuries and are associated with worse outcomes. Additionally, studies have demonstrated that high electrographic seizure burdens are associated with worse clinical outcomes after adjustment for brain injury aetiology and severity, indicating that a high electrographic seizure burden may independently contribute to secondary brain injury. Seizures can often be managed with existing anticonvulsants, but further study is needed to determine whether identifying and managing electrographic seizures reduces secondary brain injury and improves outcome in critically ill children and neonates.

#### NEONATAL

*Courtney J. Wusthoff, MD*

The ACNS Guideline on Continuous EEG Monitoring in Neonates synthesized available evidence to suggest indications for continuous EEG monitoring for seizure detection in neonates. These indications and their supporting evidence will be considered, with an update on studies published since the 2011 Guideline. This session reviews the epidemiology of neonatal seizures, common clinical presentations, and the role of EEG in diagnosis. Emerging data regarding the clinical impact of neonatal seizures will be weighed, as well as studies regarding long-term clinical outcomes.

#### ADULT

*Saurabh R. Sinha, MD, PhD*

Seizure detection is by far the most common indication for ICU EEG monitoring. The incidence of seizure in this population is high: ranging from approximately 10-30% depending on the diagnosis. It is higher for diagnosis such as history of epilepsy and CNS infections and lowest for hemorrhage and ischemic infarcts, although it is still above 10%. Moreover, most seizures in this population are non-convulsive, meaning that they would not be easily detected without the use of EEGs. Routine EEGs miss a substantial portion of seizures in these patients while 24-48 hours of ICU

EEG will capture most of them. The relevance of detecting such seizures is somewhat less certain. ICU EEG used to detect seizures or to rule out seizures has a significant impact on clinical decision-making. Furthermore, there is evidence to suggest that the occurrence of seizures leads to poorer outcomes, although it is difficult to rule out confounding factor. Experimental evidence suggests that non-convulsive seizures may lead to additional damage in the injured brain. In this presentation, we will discuss specific clinical indications for ICU EEG in adult patients, emphasizing the likelihood of seizures and the impact of ICU EEG and seizures on outcome.

### OTHER INDICATIONS

#### ISCHEMIA IDENTIFICATION

*Susan T. Herman, MD*

EEG is a useful tool for detection of brain ischemia. With decreasing cerebral blood flow (CBF), EEG shows a sequence of changes characterized by loss of fast activity (beta and alpha frequencies) and increase in slow frequencies (polymorphic theta and delta activity). Quantitative EEG (QEEG) techniques can highlight these EEG changes. QEEG is most commonly used for the detection of delayed cerebral ischemia (DCI) after subarachnoid hemorrhage (SAH), but may also be helpful for diagnosis, monitoring, and prognosis of acute ischemic stroke and for the detection of acute ischemia during and after neurosurgical or interventional neuroradiology procedures.

This lecture will review commonly used QEEG measures for ischemia detection, including alpha variability, alpha delta ratios (ADR), and asymmetry indices. QEEG trends should include electrodes corresponding to the major supratentorial cerebral vascular territories. Since quantitative EEG trends are susceptible to artifacts, review of raw EEG tracings is imperative to confirm QEEG changes. The session will conclude with a discussion of limitations, current controversies, and future research directions.

#### PROGNOSIS – NEONATAL AND PEDIATRIC

*William Gallentine, DO*

The use of continuous EEG monitoring (cEEG) in the intensive care setting has become increasingly common in recent years, not only in adults but also in pediatrics. Along with its diagnostic capabilities, cEEG may also serve as a valuable tool in regards to prognosis in critically ill neonates and children. Studies in both patient populations with various underlying pathologies have consistently found certain EEG features to be predictors of outcome. In this presentation we will be reviewing those EEG features which have been found to have prognostic value. Clinical variables which may impact the prognostic value of these features will also be discussed. Lastly, the prognostic implications of rhythmic coma patterns in children will be reviewed.



# PRESENTATION ABSTRACTS

## PROGNOSIS - ADULT

*Susan T. Herman, MD*

EEG has long been used as a tool to aid in prediction of outcome after injuries to the central nervous system. Since EEG only evaluates current brain functioning, serial studies are often required for accurate prognostication. Continuous EEG monitoring may have better utility, as it can monitor brain function over a more prolonged time period. EEG findings must be interpreted in light of several clinical factors that also influence outcome: patient age, etiology of the brain insult, time elapsed since the brain insult, and presence of drugs, hypothermia, or metabolic abnormalities that may affect the EEG. In adults, EEG is most useful for prediction of outcome after cardiac arrest (with or without therapeutic hypothermia), traumatic brain injury, intracerebral hemorrhage, subarachnoid hemorrhage, and status epilepticus, including nonconvulsive status epilepticus.

This lecture will review the EEG findings which best predict either poor or good neurologic outcome after each brain insult. EEG findings commonly associated with poor outcome include electrocerebral inactivity, burst suppression, absence of reactivity, periodic patterns, and nonconvulsive seizures, but none of these findings in isolation have adequate sensitivity or specificity for accurate prediction of outcome. Large prospective studies of CEEG monitoring will be required for multivariate analysis of EEG utility.

## EEG INTERPRETATION

### BACKGROUND - NEONATAL AND PEDIATRIC

*Courtney J. Wusthoff, MD*

The normal EEG background evolves rapidly throughout the neonatal period, and continues to mature in early childhood. This is reflected by the expected normal features and commonly encountered abnormal patterns seen on EEG in critically ill children. The range of normal findings at various gestational ages will be defined for preterm and term neonates. Background features with prognostic significance will be highlighted. Commonly troublesome neonatal patterns will be analyzed and contrasted for easier recognition. Discussion of background EEG in pediatric patients will review standards for normal maturation across the age span, contrasted with common coma and encephalopathy patterns from critically ill children.

### BACKGROUND - ADULT

*Saurabh R. Sinha, MD, PhD*

Although much of ICU EEG monitoring is performed for seizure detection and management, careful interpretation of ICU EEG can provide other important information to aid in management of these patients. Like routine EEGs, the background can speak to focal and diffuse disturbances in cerebral function as well as the potential for epileptic seizures.

In addition, there are other background patterns frequently seen in ICU EEG (both due to the patient population and the prolonged recording period) such as periodic discharges, rhythmic activity, and stimulus-induced activity that are less common in routine EEGs. In prolonged recordings, it is also important to note how the background changes and fluctuates over time. Observed changes in background EEG over time supplement the clinical exam and inform the ICU team about the patient's condition and the impact of manipulations on cerebral function. It can be an indicator of worsening function, like delayed cerebral ischemia in patients with subarachnoid hemorrhages. In certain clinical situations, for example post-cardiac arrest, the background EEG and how it changes with time/manipulation can aid in prognosis. In this presentation, we will review important aspects of the background EEG in adult patients, including terminology and the implications of specific patterns.

## ELECTROGRAPHIC SEIZURES

*Suzette M. LaRoche, MD*

Electrographic seizures can manifest as a variety of EEG signatures in the critically ill population. Rhythmic, clearly evolving fast frequencies typical of seizures in patients electively admitted to the Epilepsy Monitoring Unit are uncommon and clinical signs are often absent. Seizures often present as slowly evolving, low frequency activity with ill-defined onset which makes identification more difficult. Extremely focal ictal activity, confined to one or two channels is also encountered emphasizing the importance of maintaining artifact free electrodes and utilizing full 10-20 montage electrode placement whenever possible. In addition, physiological and electrical artifacts are abundant in the ICU environment which can mimic seizures. Finally, there are a host of periodic and rhythmic patterns, both generalized and lateralized, that do not meet conventional criteria for electrographic seizures but still warrant consideration of treatment. This discussion will review a wide array of electrographic seizure presentations seen in the critically ill and include many patient case discussions to illustrate some of the challenges of seizure identification in this population.

## PERIODIC AND RHYTHMIC PATTERNS

*Elizabeth Gerard, MD*

The expansion of continuous EEG monitoring in critically ill patients has shed light on a myriad of rhythmic and periodic electrographic patterns are difficult to interpret and even harder to manage. These patterns include Lateralized Periodic Discharges (LPDs aka PLEDs), Generalized Periodic Discharges (GPDs aka GPEDs), Generalized Rhythmic Delta Activity (GRDA) and Lateralized Rhythmic Delta Activity (LRDA). The ACNS nomenclature for these patterns will be reviewed as will the controversies about their clinical significance and approaches to management.





# PRESENTATION ABSTRACTS

## QUANTITATIVE EEG

### OVERVIEW: INTRO AND UTILITY

*Cecil D. Hahn, MD, MPH*

This presentation will provide an introduction to available techniques for quantitative EEG (QEEG) trending. I will review the concepts underlying various methods of quantitative EEG transformation, and discuss the potential applications of a variety of QEEG trends for seizure identification and ischemia detection. I will review available data on the sensitivity and false positive rates of QEEG trends for seizure identification by expert neurophysiologists and ICU bedside caregivers. Finally, I will discuss how QEEG trends may be incorporated into a ICU EEG monitoring program to complement both live and post-hoc EEG review.

## HANDS ON QUANTITATIVE EEG WORKSHOP

### HANDS ON WORKSHOP

*Susan T. Herman, MD*

Continuous EEG monitoring (CEEG) in the ICU is an evolving technology which offers the potential to continuously monitor brain function in critically ill patients, detect neurological injuries at a reversible stage, and facilitate early treatment. ICU CEEG generates a large amount of data which must be reviewed quickly and reliably, with results conveyed to the clinical care team as quickly as possible. Quantitative EEG techniques can be used to create graphical displays of EEG information over time, allowing the electroencephalographer to quickly detect a variety of EEG changes, including seizures and ischemia.

This workshop will be a hands-on interactive session. Attendees should bring their laptops (either Windows PC or Mac running Windows as virtual machine), as software and sample EEGs will be provided for hands-on experience. The session will focus on understanding the most commonly employed QEEG trends, optimizing trends for the individual patient, and identifying and reducing artifact. At the conclusion of this session, attendees will be able to use quantitative EEG software for detection of seizures and ischemia in critically ill patients.

## ADMINISTRATIVE ISSUES

### EQUIPMENT, NETWORKING, ELECTRODES, MONTAGES

*Saurabh R. Sinha, MD, PhD*

The equipment and software needed for a successful ICU EEG program shares many similarities with the equipment needed for long-term monitoring and event routine EEGs. The actual recording machine today is almost always a digital EEG system. Appropriate networking infrastructure is needed to allow for obtaining recording in different parts of the hospital

while ideally allowing review of the data continuous and even from remote locations. Beyond routine EEG collection and review software, software for quantitative analysis of the EEG is often desirable.

Standard cup metal electrodes are often used; however, the clinical, safety and practical concerns often dictate the use of special electrodes such as disposable, needle or MRI/CT-compatible electrodes. Although there are concerns about the quality of such recordings, the need for rapid application of the electrodes and application by personnel who are not trained EEG technologists have led to the use of templates for electrode placement to exploration of reduced montages or simplified electrode placements. In this presentation, we will review specific considerations and requirements for equipment, networking infrastructure, electrodes and electrode montages as they relate to ICU EEG.

### STAFFING, PERSONNEL, AND TEAM APPROACH

*Cecil D. Hahn, MD, MPH*

This presentation will provide an overview of strategies for staffing a successful ICU EEG monitoring program. I will review data on current EEG technologist and physician staffing practices for electrode application, troubleshooting and EEG interpretation across North America, including various solutions for after-hours coverage. I will illustrate the benefits of developing a team approach with educational outreach to ICU nurses and physicians in order to facilitate collaborative multidisciplinary care.

### BILLING, CODING, AND EPILEPSY CENTER GUIDELINES

*Stephen Hantus, MD*

The detection of EEG seizures in the critical care population has changed the way we practice medicine. EEGs are ordered on patients for more diverse indications and the use of frequent monitoring and quantitative technology has become apparent. Finding the appropriate billing/coding strategies in this changing environment is vital to supporting an ICU-EEG program. In this session, we review the existing coding and billing structures and how it applies to ICU-EEG practice.

### DEVELOPING A PROGRAM AND BUSINESS PLAN

*Stephen Hantus, MD*

Many hospitals across the country have patients with altered mental status, acute neurologic lesions and unexplained comas. Finding a way to build an ICU EEG program to support these patients requires planning and cooperation among departments. In addition to building clinical expertise and efficiency, a program must make business sense if it is to survive in the modern era of health care. In this session we discuss the process of building an ICU EEG program and developing a business model.



# PRESENTATION ABSTRACTS

## SEIZURE AND STATUS EPILEPTICUS MANAGEMENT

### NEONATAL

*Courtney J. Wusthoff, MD*

This session will evaluate conventional and emerging treatment strategies for neonatal seizures and status epilepticus. The unique challenges of managing neonatal seizures will be defined in the context of newborn brain physiology. Controversies regarding goals of management will be considered using the framework of EEG monitoring. The evidence basis for medication use will be examined as it applies to developing treatment protocols for neonates. Special consideration will be given to pharmacokinetics during therapeutic hypothermia, and the role of empiric treatment for vitamin-responsive epilepsy in refractory neonatal seizures.

### PEDIATRIC

*William Gallentine, DO*

Status epilepticus is the most common neurologic emergency in childhood. This life threatening condition carries a reported mortality rate of 1-3% in children. It has also been associated with substantial morbidity including cognitive impairment, developmental delay, and epilepsy. Continuous EEG monitoring plays a vital role in the management of status epilepticus in determining therapeutic effect and adequacy of treatment.

This presentation will discuss the role of continuous EEG monitoring in the management of seizures and status epilepticus in the pediatric intensive care unit. We will also provide an overview of current antiepileptic drug usage in the management of seizures and status epilepticus in children.

### ADULT

*Elizabeth Gerard, MD*

This lecture will present the definitions and management of convulsive status epilepticus, refractory status epilepticus, non-convulsive status epilepticus and recurrent seizures. An evidenced-based algorithm for the management of convulsive status epilepticus will be reviewed. In addition, the lecture will cover the challenges of managing refractory status epilepticus and various types of non-convulsive status epilepticus.

### NOVEL TREATMENTS

*Elizabeth Gerard, MD*

Refractory status epilepticus is a troubling clinical challenge for which there are no prospective treatment trials to direct treatment. First-line therapies include intubation and treatment with anesthetic agents and additional anti-epileptic drugs. After this the neurologist is often left wondering what to do next. This lecture will review first-line treatment as well as a handful of novel second and third-line therapies that have been tried when traditional measures fail. These include ketamine, hypothermia, immunotherapy, diet therapy and ECT.

## OTHER TOPICS

### MULTI-MODAL MONITORING

*Suzette M. LaRoche, MD*

Many advances have been made in the ability to monitor various physiological parameters in critically ill patients through both invasive and non-invasive means. These monitoring modalities are designed to assess function of both injured and uninjured brain regions with the ultimate goal of detection of causes of secondary injury such as seizures and ischemia in order to allow for intervention prior to the onset of irreversible damage. For the electroencephalographer, correlation of these neurophysiological parameters can also offer insight into the pathological significance of many of the rhythmic and period patterns encountered in the critically ill. These findings can then shed light on which EEG patterns should be considered for more aggressive treatment even if they do not meet current criteria for electrographic seizures.

In this session, we will discuss the various multi-modality monitoring techniques in current use including microdialysis, measures of cerebral oxygenation, cerebral blood flow and use of intracortical electrodes as well as neuroimaging. Cases will be presented demonstrating how these modalities can detect potential causes of secondary injury and impact treatment decisions.

### ICU EEG GUIDELINES

*Nicholas S. Abend, MD*

Evidence regarding the role for EEG monitoring in the intensive care unit has expanded. Since it is not practical for every clinician to review all of the evidence, clinicians commonly use clinical practice guidelines to support their decisions. This lecture will first review processes related to guideline development including PRISM (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) and GRADE (Grading of Recommendations Assessment, Development, and Evaluation). The lecture will then review the recent guidelines and consensus statements related to EEG monitoring from the American Clinical Neurophysiology Society (Guideline on Continuous EEG Monitoring in Neonates), Neurocritical Care Society (Guideline for the Evaluation and Management of Status Epilepticus), and the European Society of Intensive Care Medicine (Recommendations on the Use of EEG Monitoring in Critically Ill Patients).

### IMPACT ON MANAGEMENT AND OUTCOME

*Suzette M. LaRoche, MD*

Over the past decade, there has been considerable increase in the utilization of continuous EEG monitoring in critically ill patients, particularly in patients with acute brain injury. However, in the age of rising healthcare costs, many administrators demand evidence of "return on investment" prior to funding evolving technologies. Unfortunately, it



# PRESENTATION ABSTRACTS

remains unclear exactly what influence EEG monitoring and potential detection of secondary injuries such as seizures and ischemia has on outcome. Retrospective studies have shown that electrographic seizures are common, yet clear data on how treatment of seizures affects outcome measures such as length of stay and functional recovery is lacking. Nonetheless, findings on EEG frequently result in treatment changes and can have a large impact on clinical decision making. Therefore, the challenge is to devise clinical trials that might provide better outcome data but also for clinicians to strive to provide more efficient and cost-effective EEG monitoring. This session will discuss these controversies and explore potential solutions.

## NEUROLOGIC INTRAOPERATIVE MONITORING (NIOM)

### SEP

*Aatif M. Husain, MD*

This lecture will cover the basics of somatosensory evoked potentials. Methods of obtaining and interpreting SEP will be reviewed. Effect of anesthetics will be covered. Interpretation will also be reviewed.

### MEP

*Ronald Emerson, MD*

Whereas SEP monitoring, particularly for spinal cord monitoring, serves as a proxy for global function, MEP monitoring provides direct surveillance of descending motor pathway integrity. Even when, in principle, SEPs might be sufficient, MEP monitoring provides additional safety though redundancy; if one system fails for whatever reason, the other continues to function. The physiology and application of MEP monitoring will be discussed.

### EMG

*Stanley Skinner, MD*

In the laboratory, motor conduction studies are recorded using surface electrodes over the target muscle. Supramaximal stimulation of can synchronously depolarize all of the nerve's functioning motor axons with minimal temporal dispersion. Therefore, a well-placed surface electrode should capture a large, reproducible compound muscle action potential (CMAP). Needle electromyography (EMG) can effectively record a restricted field of a few cubic millimeters nearest the electrode tip. A few motor units can be assayed with each new passage of the needle. Near field recording makes possible motor unit analysis and acquisition of pathologic spontaneous activity. Therefore, typical EMG electrodes are not well suited to record CMAPs; not surprisingly, surface electrodes (including short "EEG" needles) often fail to record intraoperative neurotonics.

In the OR, compromises are made. In the past, one could justify extra amplifiers to record both surface and intramuscular derivations to record both CMAPs and neurotonics, respectively. That is rarely possible now. Nevertheless, intraoperative navigation about cranial nerves, for example, depends on reliable neurotonic surveillance and acquisition of amply summated CMAPs after stimulation. Robust conduction studies (and neurotonic recording) can usually be performed if a sufficient length of bare wire (a partially denuded monopolar EMG electrode) can be implanted intramuscularly.

## CASE DISCUSSION

### VERTEBRAL COLUMN SURGERY

*Ronald Emerson, MD*

A series of cases will be presented, illustrating the principles of SEP and MEP monitoring during spinal column surgery.

### SPINAL CORD SURGERY

*Eva K. Ritzl, MD*

This session will focus on the monitoring set up for spinal cord tumor surgery. The principles, indications and limitations of D-wave monitoring will be discussed. Case studies will demonstrate the relationship between D-waves and myogenic MEPs and how the monitoring data can be used to predict surgical outcomes in spinal cord tumor cases.

### BAEP

*Alan D. Legatt, MD, PhD*

BAEPs are useful for intraoperative monitoring of the ears, auditory nerves, and the brainstem auditory pathways up through the level of the mesencephalon. They are relatively unaffected by anesthesia, though they are affected by hypothermia. Technical aspects of auditory stimulation of recording of BAEPs will be reviewed. During BAEP monitoring, each patient serves as his/her own control. Both amplitude and latency measurements should be followed. Wave I is generated in the distal eighth nerve. Subsequent components are composites of contributions from multiple generators, but wave III predominantly reflects activity in the caudal pons and wave V predominantly reflects activity in the mesencephalon. Adverse intraoperative changes in BAEPs can be caused by technical factors (including artifacts), hypothermia, acoustic masking, and localized dysfunction within the infratentorial auditory system. Possible causes of the latter include direct mechanical or thermal injury, compromise of the blood supply to a structure, and stretch of or traction on the eighth nerve.



# PRESENTATION ABSTRACTS

## CASE DISCUSSION

### CPA SURGERY

*Alan D. Legatt, MD, PhD*

Neurophysiologic intraoperative monitoring data recorded during several different cerebellopontine angle surgeries will be presented in an interactive session; the audience will be asked to analyze the NIOM findings and to discuss possible causes of the observed changes in the evoked potential data and their clinical significance.

### CAROTID ENDARTERECTOMY

*Eva K. Ritzl, MD*

This session consists of a series of case presentations illustrating the use of intraoperative neuromonitoring in carotid endarterectomies. Advantages and limitations of EEG monitoring will be presented. The teaching points also include the complementary nature of EEG and SEPs for these types of cases.

### ANESTHESIA

*Ronald Emerson, MD*

Anesthetic agents can have profound effects on the physiological signals monitored during IOM. An understanding these effects is critical to the optimal monitoring. It is essential to effective interaction with the anesthesiologist, and also provides the monitorist with the ability to flexibly adapt the monitoring strategy to accommodate different anesthetic protocols.

### CRANIAL NERVES 5, 7, 9-12

*Alan D. Legatt, MD, PhD*

The anatomy of cranial nerves 5, 7, and 9-12 and the techniques used to monitor them during surgery will be described. Motor cranial nerves are monitored by recording EMG from appropriate muscle groups. Somatosensory evoked potentials to stimulation of trigeminal nerve branches can be recorded, but this is technically challenging. The patient cannot be pharmacologically paralyzed during EMG recordings; the absence of neuromuscular blockade should be verified. Spontaneous EMG activity may reflect mechanical stimulation and irritation of cranial nerves. Repetitive neurotonic EMG discharges are more worrisome than isolated discharges, but can also be caused by irrigation with cold fluids. Recording of EMG elicited by stimulation within the surgical field can be used to localize and identify cranial nerves within the surgical field. When monitoring cranial nerve 7, EMG should be recorded from multiple facial nerve-innervated muscles, in case the nerve is splayed into separate fascicles by a tumor. During surgery, conduction blocks may develop in nerves that remain in anatomic continuity, and will interfere with intraoperative monitoring of the nerves. A variety of artifacts may appear during EMG monitoring of motor cranial nerves; several examples will be shown.

## CASE DISCUSSION

### LOWER SPINAL SURGERY

*Stanley Skinner, MD*

A reliable intraoperative bulbocavernosus reflex (BCR) may be recorded after train (or double train) stimulation at the genitalia. BCR is contingent upon somatic sensory and motor fibers of the pudendal nerve as well as Onuf's nucleus (conus medullaris). Therefore, BCR testing elaborates other IONM recordings (SEP, MEP, EMG).

External anal sphincter (EAS) recording may be included in low thoracic and lumbosacral settings. Free-running EAS EMG, EAS recording after sacral root stimulation (M wave), and BCR are suggested during cauda equina/conus level approaches. MEPs may include the EAS as a specific measure of corticospinal, sacral root, and pudendal efferent function. At cauda equina level, BCR and EAS MEP become surrogate tests for pelvic parasympathetic function (parasympathetic fibers associated with sacral somatic roots at cauda level).

Lateral approaches to the upper lumbar spine place the lumbar plexus and genitofemoral nerve at risk. Men may complain of postoperative "dropped" testicle or pain referred to the testicle (or labium major in women). The cremaster is accessed by needle electrode insertion at the inguinal ring. Testing permits: 1) observation of the recruitment of genitofemoral neurotonic ("injury") discharges and 2) threshold stimulation to determine nerve proximity to electrified instruments.

### BILLING AND REGULATORY ISSUES

*Marc R. Nuwer, MD, PhD*

Three CPT codes for IOM are 95940, 95941 and G0453. Code 95940 is used for monitoring personally in the OR, per 15 minute. Code 95941 is used for monitoring remotely or monitoring more than one case simultaneously, per 60 minutes. Code G0453 is used for monitoring for certain carriers, such as for Medicare patients; it is used for remote monitoring, per 15 minutes. When monitoring, one also codes for the base codes such as SEP, MEP or EEG. In special circumstances, other codes may be used such as 95961 for localization of eloquent cortex.

As of 2013, no technical component exists for IOM services in the Medicare professional fee schedule, leading to a variety of approaches for mobile companies who provide outsourced services. A variety of other regulations are reviewed regarding regulations and coding instructions.





# PRESENTATION ABSTRACTS

## CORTICAL MAPPING AND STIMULATION

*Marc R. Nuwer, MD, PhD*

Direct cortical stimulation is used to localize cortical function. Testing most commonly is used for language functions, both for receptive and expressive regions. Cortical regions active in language extend beyond the traditional Broca's and Wernicke's areas, and these extended regions can be defined for intraoperative testing in individual patients. This requires the patient to be awake during the craniotomy. Testing protocols include several approaches to stimulation protocols. Safety limits have been defined so as not to damage cortex during electrical stimulations. Seizures can be provoked by cortical electrical stimulation, so monitoring EEG for after-discharges and seizures is needed. In some patients, direct cortical stimulation is used to identify motor regions.

Occasionally in awake patients sensory regions are localized. In epileptic patients, stimulations may localize their epileptic auras. Some techniques resemble the stimulations as carried out during subdural grid placement in epilepsy units.

## CASE DISCUSSION

### BRAIN TUMOR SURGERY

*Eva K. Ritzl, MD*

The session consists of a series of case presentations demonstrating some principles and pitfalls of intraoperative monitoring for brain tumor surgeries. Topics will include the application of various modalities (including SEPs, MEPs and EEG) for these surgeries. Limitation of transcranial MEP and pitfalls of cortical MEP monitoring will be illustrated. Mapping techniques, like SEP phase reversal and direct cortical stimulation mapping will also be touched upon.

### AORTIC SURGERY

*Aatif M. Husain, MD*

Cases involving surgery on the aorta will be reviewed. The various monitoring modalities used for ascending aorta, arch of aorta and descending aorta surgery will be reviewed. Special attention will be on interpretation of changes in monitoring data. Audience participation will be encouraged.

## LECTURE HANDOUTS

The ACNS 2013 Fall Courses Handouts are now available online!

To access handouts for the 2013 Fall Courses, please visit <http://www.acns.org/meetings/fall-courses/2013>, choose "Course Handouts" and enter the following:

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Password: FC13

The username and password are case-sensitive. Once logged in to the site, click the name of the Course, and then choose from the available faculty members' lectures. If handouts for a particular presentation do not appear, they have not been provided by the presenter and are not available.

Each faculty member's lectures are available in two formats:

- Handouts (indicated by an "H") are formatted three slides to a page.
- Slides (indicated by an "S") are one slide to a page, allowing for larger, clearer images.

Please note: Wi-Fi access will be available in the Course session rooms, we strongly encourage you to print or save handouts to your laptop, if you wish to follow along during the Course presentations. **Hardcopy handouts will not be provided onsite.**



# EXHIBIT HALL INFORMATION

## EXHIBIT HOURS

Saturday, September 28, 2013

8:00 AM – 6:30 PM

10:00 – 10:30 AM

12:00 – 1:00 PM

3:00 – 3:30 PM

5:00 – 6:30 PM

Exhibit Hall Open

Morning Break

Lunch

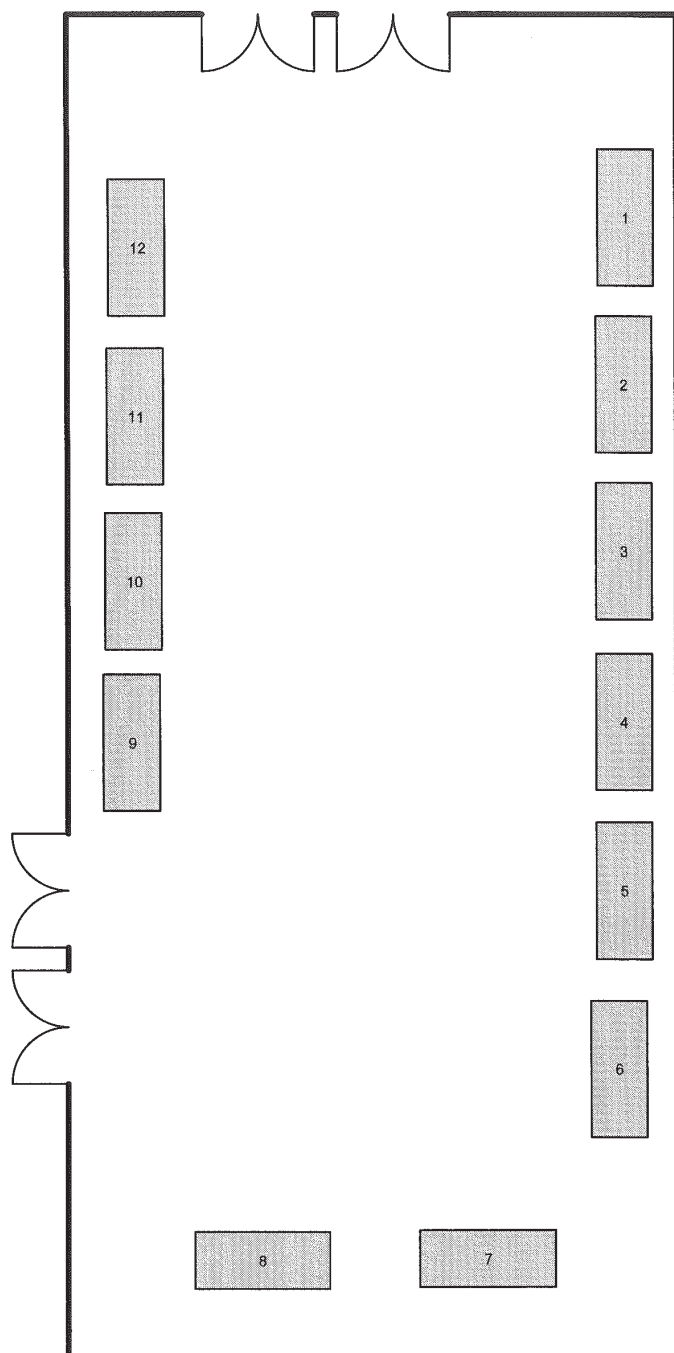
Afternoon Break

Reception

ACNS provides exhibit space at scientific meetings for commercial exhibits related to the fields of basic and clinical neurophysiology. The Society makes no attempt to evaluate any aspect of the material exhibited. Noncompliance with guidelines published by the ACNS has not been considered by the Society in allotting commercial space. Hence, acceptance of these commercial exhibits should not be construed as indicating sponsorship or approval of their products by ACNS.

## EXHIBIT HALL FLOORPLAN

Location: Overture



## EXHIBIT HALL DIRECTORY

### TABLE # COMPANY NAME

14	American Board of Clinical Neurophysiology (ABCN)*
13	The American Board of Registration of EEG and EP Technologists (ABRET)*
1	Cadwell Laboratories, Inc.
10	CortiCare, Inc.
11	Demos Medical Publishing
8	Ideal Health Careers, Inc.
12	Moberg - CNS
5	mytaMed, inc
3	Nihon-Kohden America, Inc.
4	Persyst Development Corporation
2	PMT Corporation
6	RhythmLink International, LLC
9	Rochester Electro-Medical, Inc.
7	UCB, Inc.

\* Tables 13 – 14 will be located in the Atrium.



# EXHIBIT HALL INFORMATION

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**Table #14****American Board of Clinical Neurophysiology (ABCN)**

2908 Greenbriar Dr., Suite A

Springfield, IL 62704

Phone: (217) 726 - 7980

Fax: (217) 726 - 7989

Email: [abcn@att.net](mailto:abcn@att.net)

[www.abcn.org](http://www.abcn.org)

Subspecialty Clinical Neurophysiology credentialing for physicians.

---

**Table #13****The American Board of Registration of EEG and EP Technologists (ABRET)**

2908 Greenbriar Dr., Suite A

Springfield, IL 62704

Phone: (217) 726 - 7980

Fax: (217) 726 - 7989

Email: [abret@att.net](mailto:abret@att.net)

[www.abret.org](http://www.abret.org)

Credentialing and Accreditation for neurodiagnostic technologists and laboratories.

---

**Table #1****Cadwell Laboratories, Inc.**

909 N Kellogg St

Kennewick, WA 99336

Phone: (509) 735 - 6481

Fax: (509) 783 - 6503

Email: [allisonc@cadwell.com](mailto:allisonc@cadwell.com)

[www.cadwell.com](http://www.cadwell.com)

Established by brothers Carl Cadwell, DDS and John Cadwell, MD, BSEE in 1979, Cadwell designs, manufactures and sells neurodiagnostic and neurophysiological monitoring instruments to laboratories, hospitals, physicians, and others worldwide. Clinical diagnostic products include the Sierra® Wave EMG/NCV/EP, the Easy® III EEG for clinical EEG, ICU Neurological and Epilepsy Monitoring, Easy III PSG, Easy Ambulatory EEG & PSG. For Intraoperative neuromonitoring, the Cascade line features the 32 channel Cascade Elite and the Cascade Pro 16 or 32 channel system.

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**Table #10****CortiCare, Inc.**

Headquarters: Carlsbad, CA

Coverage throughout the U.S.,

Phone: (888) 482 - 2334

Fax: (888) 482 - 2334

Email: [info@corticare.com](mailto:info@corticare.com)

[www.corticare.com](http://www.corticare.com)

CortiCare is an award-winning provider of Neurotelemetry services to patients in the ICU, NICU and EMU. Our EEG Monitoring and Reading services utilize Registered Technologists and Board-Certified Neurophysiologists, and work in conjunction with existing in-house EEG programs. Services include: Remote Monitoring: Continuous: for critical care patients (24/7 or just overnight gap coverage); and Intermittent: for EMU and Hypothermia patients. Remote Reading: Long Term: for critical care; Stat On-Call: for emergency coverage; and Routine. Our secure interface software makes it easy for both Techs and Physicians to view EEG data simultaneously utilizing just an internet connection. Visit our website at [www.corticare.com](http://www.corticare.com).

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**Table #11****Demos Medical Publishing**

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New York, NY 10036

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Fax: (212) 941 - 7842

Email: [info@demomedpub.com](mailto:info@demomedpub.com)

[www.demosmedpub.com](http://www.demosmedpub.com)

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## EXHIBIT HALL INFORMATION

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### Table #8

#### **Ideal Health Careers, Inc.**

3455 Peachtree Rd #500  
Atlanta, GA 30326  
Phone: (404) 816-9988  
Email: [dcruz@idealhealthcareers.com](mailto:dcruz@idealhealthcareers.com)  
[www.idealhealthcareers.com](http://www.idealhealthcareers.com)

Ideal Health Careers is a professional search firm that develops long-term relationships with our clients in order to help them source, hire, and retain neurodiagnostic talent. Our sole focus is the neurodiagnostic market, which enable us to become key strategic assets for our clients. Would you like to have a pipeline of clinical or managerial talent at your disposal? Please ask how we can help you dominate the battle for talent. Neurologists seeking opportunities are welcome to contact us at anytime. [www.idealhealthcareers.com](http://www.idealhealthcareers.com) or 404-816-9988.

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### Table #12

#### **Moberg - CNS**

224 S. Maple St.  
Ambler, PA 19002  
Phone: (215) 283 - 0860  
Fax: (215) 283 - 0859  
Email: [info@moberg.com](mailto:info@moberg.com)  
[www.moberg.com](http://www.moberg.com)

The Component Neuromonitoring System (CNS Monitor) is the only EEG system specifically designed for the needs of the ICU. It is a full-function video/EEG monitor with remote review of EEG and other physiology using Persyst software. Only the CNS Monitor can collect data from over 25 other monitoring and therapeutic devices and accurately synchronize it in real time with quantitative EEG trends. The future of integrated neurophysiological monitoring is available today with the CNS Monitor.

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### Table #5

#### **mytaMed, inc**

137 Grubb Road  
Malvern, PA 19355  
Phone: (877) 444 - myta (6982)  
Fax: (610) 647 - 459  
Email: [customerservice@mytamed.com](mailto:customerservice@mytamed.com)  
[www.neurostimprobes.com](http://www.neurostimprobes.com)

We founded mytaMed, inc. in 2006 to provide great products to the IONM community at great prices. Providing off the charts value is our number one goal each and every day, and we live by the following formula: Value = Quality / Price. To increase value one of the following has to happen: quality increases or price decreases. All of our neuro stimulation probes are very well made right here in the USA. We also run a lean operation, so you won't find any mahogany desks or big expense accounts at mytaMed. Please stop by our booth. If you miss us in Philadelphia, feel free to call us at 877.444.6982, email us at [info@mytamed.com](mailto:info@mytamed.com) or visit our online store at [www.neurostimprobes.com](http://www.neurostimprobes.com).

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### Table #3

#### **Nihon-Kohden America, Inc.**

90 Icon St  
Foothill Ranch, CA 92610  
Phone: (800) 325 - 0283  
Fax: (949) 271 - 5319  
Email: [info@nkusa.com](mailto:info@nkusa.com)  
[www.nkusa.com](http://www.nkusa.com)

Nihon Kohden's Neurology product and portfolio includes instrumentation for Epilepsy Monitoring, Electroencephalography, EEG & PSG Ambulatory Recording, Polysomnography, Wireless EEG & PSG, Home Sleep Testing/PSG, Electromyography, Evoked Potentials, Intra-operative and cEEG ICU monitoring. Nihon Kohden's instrumentation offers the flexibility and expandability needed to meet the changing demands of today's neurodiagnostic field.

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### Table #4

#### **Persyst Development Corporation**

12625 High Bluff Drive, Suite 213  
San Diego, CA 92130  
Phone: (858) 461 - 4542  
Fax: (858) 461 - 4531  
Email: [sales@persyst.com](mailto:sales@persyst.com)  
[www.pers0.08.inyst.com](http://www.pers0.08.inyst.com)

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## EXHIBIT HALL INFORMATION

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### Table #2

#### **PMT Corporation**

1500 Park Rd  
Chanhassen, MN 55317  
Phone: (952) 470 - 0866  
Fax: (952) 470 - 0865  
Email: [info@pmtcorp.com](mailto:info@pmtcorp.com)  
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### Table #6

#### **RhythmLink International, LLC**

1140 First St. South  
Columbia, SC 29209  
Phone: (803) 252 - 1222  
Fax: (803) 252 - 1111  
Email: [sales@rhythmLink.com](mailto:sales@rhythmLink.com)  
[www.rhythmLink.com](http://www.rhythmLink.com)

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### Table #9

#### **Rochester Electro-Medical, Inc.**

4212 Cypress Gulch Dr.  
Lutz, FL 33559  
Phone: (800) 328-5544; (813) 963-2933  
Fax: (800) 545-0845; (813) 994-8793  
Email: [info@rochestermed.com](mailto:info@rochestermed.com)  
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### Table #7

#### **UCB, Inc.**

1950 Lake Park Dr.  
Smyrna, GA 30080  
Phone: (800) 477-7877  
[www.ucb.com](http://www.ucb.com)



This image shows a full page of blank, lined paper. It features approximately 28 horizontal blue or grey lines spaced evenly apart, typical of notebook paper. The lines extend across the entire width of the page, leaving small margins at the top and bottom. There are no vertical lines, text, or other markings on the page.



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