Dear Colleagues,

Welcome to the 4th Annual Institute for Engineering in Medicine (IEM) Conference and Retreat. IEM serves as a catalyst for facilitating multidisciplinary collaborations in research and education between the Academic Health Center and the College of Science and Engineering, in addition to fostering collaborations with the medical technology industry. IEM seeks to be the world leader in applying engineering solutions for improving human health and well-being, to be where medicine meets technology creating tomorrow’s innovations.

We have the privilege to represent more than 240 IEM faculty members from 63 academic departments on campus. Here at the conference and retreat we have over 400 registrants representing research efforts from these faculty members, their students and collaborators, ranging over five thematic areas including: (1) Cardiovascular Engineering, (2) Neuroengineering, (3) Cellular and Molecular Bioengineering, (4) Medical and Biological Imaging, and (5) Medical Devices.

The event opens with plenary addresses by University leaders, keynote talks by internationally recognized leaders, followed by an induction of the 2016 class of IEM Industrial Fellows and IEM Faculty Career Development Awardees. Lunch discussions aim to encourage networking and building collaborations. The luncheon presentation will provide an update of IEM activities and progresses. In the afternoon, breakout sessions are scheduled for close to 80 IEM faculty members and industrial colleagues to present research programs and opportunities, and discuss research collaborations relating to our five thematic areas. For the second consecutive year we have a student career development workshop. These breakout session discussions shall identify both institutional and thematic strengths, which can be leveraged in future basic and translational initiatives. From mid-afternoon, we will have a poster session highlighting research of IEM / University faculty and their students/postdocs, consisting of close to 150 poster presentations. About ten exhibitors from various University units will showcase their activities during the poster session.

Throughout the day, the event is designed to offer rich opportunities to learn about cutting edge research, develop collaborations bridging engineering with medicine and health sciences. We hope that you enjoy the event and look forward to your continued interest and support. Together, we will make a difference in tomorrow’s medicine and healthcare through engineering innovation.

Sincerely,

Bin He, Ph.D.
Director, Institute for Engineering in Medicine

John Bischof, Ph.D.
Associate Director for Development, Institute for Engineering in Medicine
ABOUT IEM

The Institute for Engineering in Medicine is an interdisciplinary organization that creates and supports research collaborations between engineers, scientists, and medical professionals at the University of Minnesota, and provides research and partnership opportunities to the wider medical industry. With over 240 affiliated researchers representing 63 departments across the Twin Cities campus, six affiliated research centers, IEM provides University faculty, students, and external partners with world-class resources to drive innovation in medicine and to find solutions for the great medical challenges.

ORGANIZATION

IEM hosts six research centers and organizes its members’ research into five themes. Most IEM members are from departments in the University’s Academic Health Center or College of Science and Engineering. As an organization dedicated to building partnerships with a wide variety of medical, clinical, and engineering professionals, IEM highly values the involvement of scientific and industrial advisors from outside the University.
8:30 am - 9:00 am  
Networks

9:00 am - 9:10 am  
**Welcome Remarks**  
Samuel B. Mukasa, Ph.D.  
Dean, College of Science & Engineering
  
Tucker W. LeBien, Ph.D.  
Vice Dean for Research, Medical School  
Associate Vice President for Research, Academic Health Center
  
**Moderator:** Bin He, Ph.D.  
Director, Institute for Engineering in Medicine

9:10 am - 9:45 am  
**Distinguished Keynote Talk**  
How the Value Proposition of Higher Education Relates to the Impact of Bioengineering on Societies Grand Challenges in Healthcare  
Dr. Kenneth R. Lutchen  
Dean of College of Engineering and Professor of Biomedical Engineering  
Boston University  
Past President, American Institute of Medical and Biological Engineering
  
**Moderator:** Bin He, Ph.D.  
Director, Institute for Engineering in Medicine

9:45 am - 10:20 am  
**Distinguished Keynote Talk**  
Deciphering the Dynamics of the Unconscious Brain Under General Anesthesia  
Dr. Emery N. Brown, NAE, NAS, NAM  
Warren M. Zapol Professor of Anesthesia, Harvard Medical School,  
Edward Hood Taplin Professor of Medical Engineering  
Professor of Computational Neuroscience, Health Sciences and Technology, MIT
  
**Moderator:** Timothy Ebner, M.D., Ph.D.  
Head, Department of Neuroscience

10:20 am - 10:40 am  
Coffee Break

10:40 am - 11:15 am  
**Distinguished Keynote Talk**  
Application-Driven Evolution and Innovation in X-ray Tomographic Imaging  
Dr. Xiaochuan Pan, FAAPM, FAIMBE, FIEEE, FOSA, FSPIE  
Professor of Radiology and Medical Physics  
The University of Chicago
  
**Moderator:** Robert Tranquillo, Ph.D.  
Head, Department of Biomedical Engineering

11:15 am - 11:50 am  
**Distinguished Keynote Talk**  
Engineering Discovery and Technology for Improving Human Health  
Dr. Pep Pamies  
Chief Editor of Nature Biomedical Engineering
  
**Moderator:** John Bischof, Ph.D.  
Associate Director for Development, Institute for Engineering in Medicine
11:50 am - 12:00 pm
**Award Ceremony**
Moderator: Paul Iaizzo, Ph.D.
Associate Director for Education and Outreach, Institute for Engineering in Medicine

12:00 pm - 1:00 pm
**Networking Lunch**

12:30 pm - 1:40 pm
**Luncheon Presentation - IEM: Engineering Meets Medicine**
Bin He, Ph.D.
Director, Institute for Engineering in Medicine

1:00 pm - 3:00 pm
**Break-out Sessions**

- **Cardiovascular Engineering**
  Moderators: Victor Barocas (BME), Paul Iaizzo (Surgery/IEM)

- **Cellular and Molecular Bioengineering**
  Moderators: Kalpna Gupta (Medicine), David Odde (BME)

- **Medical and Biological Imaging**
  Moderators: Wei Chen (Radiology), Steve Engel (Psychology)

- **Medical Devices**
  Moderators: John Bischof (ME/IEM), Art Erdman (ME), Christy Haynes (Chemistry), Jianping Wang (ECE)

- **Neuroengineering**
  Moderators: Bin He (IEM/BME), Kelvin Lim (Psychiatry)

- **Career Development**
  Moderator: Brenda Ogle (BME)

*Please see IEM website for a complete list of presenters*

3:00 pm - 5:00 pm
**Poster Session and Networking**

**Poster Presentations**
Session 1: Cardiovascular Engineering
Session 2: Cellular and Molecular Bioengineering
Session 3: Medical and Biological Imaging
Session 4: Medical Devices
Session 5: Neuroengineering

**Exhibitors**
Clinical and Translational Science Institute
Institute for Engineering in Medicine
Medical Devices Center and DMD
MN-REACH
Office of University Economic Development
Department of Biomedical Engineering
Medical Alley Association
MnDRIVE Brain Conditions
Office for Technology Commercialization
Visible Heart Lab

5:00 pm - 5:30 pm
**Poster Award Announcements**
John Bischof, Ph.D.
Associate Director for Development, Institute for Engineering in Medicine
DISTINGUISHED KEYNOTE SPEAKERS

EMERY N. BROWN, PH.D.
Warren M. Zapol Professor of Anesthesia, Harvard Medical School
Edward Hood Taplin Professor of Medical Engineering
Institute for Medical Engineering and Science
Professor of Computational Neuroscience,
Department of Brain and Cognitive Sciences, MIT
Professor of Health Sciences and Technology,
Harvard/MIT Division of Health Sciences and Technology, MIT

Dr. Brown is the Edward Hood Taplin Professor of Medical Engineering and professor of computational neuroscience at MIT, the Associate Director of the Institute for Medical Engineering and Science, and the Director of the Harvard-MIT Health Sciences and Technology Program at MIT.

He is the Warren M. Zapol Professor of Anesthesia at Harvard Medical School and at MGH, and an anesthesiologist at MGH. Dr. Brown was a member of the National Institutes of Health (NIH) BRAIN Initiative Working Group. He is a member of the Burroughs-Wellcome Fund Board of Directors, the National Science Foundation Mathematical and Physical Sciences Advisory Committee, the NIH Council of Councils, the Board of Trustees of the International Anesthesia Research Society and the Governing Council of the American Academy of Arts and Sciences.

Dr. Brown is the recipient of a National Institute of Mental Health Independent Scientist Award, the Jerome Sacks Award from the National Institute of Statistical Sciences, an NIH Director’s Pioneer Award, and an NIH Director’s Transformative Research Award. Dr. Brown is a fellow of the American Institute for Medical and Biological Engineering, the American Statistical Association, the IEEE, the American Association for the Advancement of Science, the American Academy of Arts and Sciences, a member of the Institute of Medicine and a member of the National Academy of Sciences, and of the National Academy of Engineering.

KENNETH R. LUTCHEN, PH.D.
Dean, College of Engineering
Professor of Biomedical Engineering
Boston University
Past President, American Institute of Medical and Biological Engineering

Dr. Kenneth R. Lutchen, is Dean of the College of Engineering and Professor of Biomedical Engineering at Boston University. He received his B.S. from the University of Virginia and Ph.D. from Case Western Reserve University. He has published over 135 peer-reviewed journal articles cited over 6200 times. Dean Lutchen was Chair of Biomedical Engineering from 1998-2006 over which the department ranking improved from 18th to 6th in the nation. He was the chief architect of their $14 million dollar Leadership Award from the Whitaker Foundation. Dr. Lutchen is Past-President of the American Institute of Medical and Biological Engineering (AIMBE). Since becoming Dean, the College’s Graduate Ranking in US News and World Report has improved from 54th to 35th, the largest improvement of any school in the top 54 over that time. He has orchestrated the creation of a new Division of Materials Science and Engineering and a new Division of Systems Engineering and Masters programs in Robotics, Cybersecurity and Data Analytics. Recently, he oversaw the creation of a new 20,000 sq. ft Engineering Product Innovation Center (EPIC). Dean Lutchen’s focus is to transform engineering education to create the Societal Engineer™, an individual who
DISTINGUISHED KEYNOTE SPEAKERS

PEP PAMIES, PH.D.

Chief Editor of Nature Biomedical Engineering

Pep is leading the editorial team of Nature Biomedical Engineering, a new journal from the Nature family that will launch in January 2017. Pep was an editor for Nature Materials for more than 5 years, where he championed the biomaterials content, handling manuscripts and commissioning articles in a wide variety of subjects, including tissue engineering, medical imaging, regenerative medicine, cancer therapy and diagnostics. Previously, Pep conducted research in computational soft matter and biophysics at Columbia University’s Chemistry Department in New York City, at the Max Planck Institute of Colloids and Interfaces in Potsdam, and at the Atomic and Molecular Physics Institute in Amsterdam. Pep obtained a Ph.D. in Chemical Engineering in December 2003 from Rovira i Virgili University in Catalonia, Spain.

XIAOCHUAN PAN, PH.D.

FAAPM, FAIMBE, FIAMBE, FIEEE, FOSA, FSPIE
Professor of Radiology and Medical Physics
The University of Chicago

Xiaochuan Pan is a Professor with tenure in the Departments of Radiology and Radiation & Cellular Oncology, the College, the Committee on Medical Physics, and the Comprehensive Cancer Center at The University of Chicago. His research interest centers on systems, physics, algorithms, and applications of advanced tomographic imaging. He is a Fellow of AAPM, AIMBE, IAMBE, IEEE, OSA, and SPIE. Awards received by Dr. Pan include IEEE NPSS Early Achievement Award and IEEE EMBS Technical Award for his contributions to advanced medical imaging. Dr. Pan has served as the chair, a charter member, and/or a grant reviewer for review panels of funding agencies and foundations such as NIH, NSF, NSERC, and NSFC, and is currently an associate editor, or an editorial board member, for a number of leading journals in the field.

Dr. Lutchen has been the recipient of the AIMBE Pierre Galletti Award, AIMBE’s highest honor, and the College of Engineering’s Professor of the Year Award and the Biomedical Engineering Professor of the Year Award – twice.
CA01 Novel Multiscale Frequency Approach to Identify the Pivot Point of the Rotor
Shivaram Poigai Arunachalam, Elizabeth M. Annoni, Siva K. Mulpuru, Paul A. Friedman, Elena G. Tolkachev; UMN

CA02 Activation Recovery Interval Imaging for Premature Ventricular Contraction Patients - A Pilot Study
Ting Yang; Long Yu, UMN; Qi Jin, Shanghai Ruijin Hospital, China; Liqun Wu, Shanghai Ruijin Hospital, China; Bin He; UMN

CA03 Reduced Platelet Binding By Conditioned Adipose-Derived Stem Cells
Anh La, Brenda Ogle and Robert T. Tranquillo; UMN

CA04 Three Dimensional Cardiac Electrical Imaging: In-Procedural Clinical Study
Long Yu, UMN; Steve Pogwizd, Medicine, UAB; Tom McElderry, Medicine, UAB; Ting Yang, UMN; Bin He, UMN

CA05 3D Printing Bioinstructive Scaffolds for Cardiac Regeneration
Jeanette Caronia, Francisco Pelaez, Samira Azarin; UMN

CA06 Anti Arrhythmic Effect of Intermittent Vagal Nerve Stimulation in Hypertensive Rats
James Schultz and Alena Talkachova; UMN

CA07 A Microthermal Sensor for Pulmonary Vein (PV) Ablation
Harishankar Natesan, UMN; Wyatt Hodges, UC; Limei Tian, UIUC; Sean Lubner, UCB; John Rogers, Northwestern University, Chris Dames, UCB, John Bischof, UMN

CA08 An Educational Database of Congenital Heart Defects Derived from Clinical MRI Scans Obtained Pre-and Post-operatively
Megan Schmidt, UMN; Brian Howard, UMN; Charles Shepard, Masonic Children’s Hospital, UMN; Robroy Maclver, Masonic Children’s Hospital, UMN; Paul Iaizzo, UMN

CA09 Predicting Hemodynamics from Metabolic Measurements using Support Vector Regression in an Isolated Ex-Vivo Four-Chamber Working Heart Model
EN. Gaasedelen, MS. Seewald, TL. Iles, LM. Mattson, AR. Mattson, MM. Schmidt, PA. Iaizzo; UMN

CA10 3D Bioprinting of Perfusable Cardiac Tissue
Didarul B. Bhuiyan, Kaiyan Qui, Michael McAlpine and Brenda M. Ogle; UMN

CM01 In Utero Stem Cell Transplantation as a Method to Generate Future Humanised Skeletal Muscle in Mice
Neeladri Chowdhury, Yusaku Kodaka, Yoko Asakura, Atsushi Asakura; UMN

CM02 Development of Stable, Multivalent Protein-Conjugated GNPs as Viral Entry Inhibitors
Allison Siehr, Bin Xu, Wei Shen, Ronald Siegel; UMN

CM03 Alignment of hPSC-derived Myogenic Cells in Response to Nanotopographical Cues and Biochemical Ligands
Bin Xu, Alessandro Mali, Yoshka Anugrah Liu, Steven J. Koester, Rita Perlingeiro, Wei Shen; UMN

CM04 Insight into the Mechanism of Action of Bacteriocins through Molecular Simulations
Panagioti K. Kyriakou, Viannis N. Kaznessis; UMN

CM05 High Supersaturation and Rapid Transcellular Permeation of Benzodiazepines using Prodrugs
Davin Rautiola, Mamta Kapoor, Narsihmulu Cheryala, Gunda I. Georg, James C. Cloyd, Ronald A. Siegel; UMN

CM06 Effect of Nectin-4 on Ovarian Cancer Cell Proliferation and Migration
Cody Bruggemeyer, Dave Odde, Dip Shukla, Rory Manion, Petra Buchanan, Kristin Boylan, Amy P.N. Skubitz; UMN

CM07 Rapid Generation of Collagen Microtissues to Study Cell-Matrix Interactions
Alexandra L. Crampton, Marie-Elena Brett, David K. Wood; UMN

CM08 Role of Microtubules in a Motor-Clutch Model for Cell Traction
Louis S Prahl, Patrick F Bangasser, Mahya Hemmat, Steven S. Rosenfeld, Dept. of Cancer Biology, Cleveland Clinic; David J Odde; UMN

CM09 Controlled Biomolecule Release from a Liposomal Nanocarrier Modulated with Pulsed NIR Light
Jeongeun Shin, Joseph A. Zasadzinski; UMN

CM10 Acetylgalactosamine Block-co-Polycations Form Stable Polyplexes with Plasmids and Promote Liver-Targeted Delivery
Yogesh Dhande, Bharat Wagh, Zhe Tan, Dustin Sprouse, Bryan Hall, Perry Hackett, Theresa Reineke; UMN

CM11 Cellular-Based Selections Aid Translational Binding in Ligand Selection
Lawrence A. Stern, Alexandra C. Kobe, Benjamin J. Hackel; UMN
CM12  Computational Modeling of Tubulin-Tubulin Interactions  
Mahya Hemmat, David J. Odde; UMN

CM13  Classification of Glioblastoma Invasion  
Andrew M. Gardeck, Steven S. Rosenfeld, Dept, of Cancer Biology, Lerner Research Institute of the Cleveland Clinic Foundation; Matthew A. Hunt, David J. Odde; UMN

CM14  Smart Magnetic Nanoparticles for Multiplex Detection of Diseases  
Kai Wu, Jian-Ping Wang; UMN

CM15  Generating Exogenic Ocular Lens in Gene Edited Animals  
Jennifer Winters, Vibha H. Savanur, Feng Xiao, Joseph Voth, Kyle Schaible, James Dutton, Andrew Crane, Walter Low; UMN

CM16  In Vitro Model for Tauopathy and Traumatic Brain Injury  
Nicholas J. Braun, Patrick W. Alford, Dezhi Liao, UMN

CM17  Engineering Antimicrobial Proteins and Probiotic Secretion Systems  
Kathryn Geldart, Seth Ritter, Brittany Forkus, Yiannis N. Kaznessis; UMN

CM18  Unveiling the Roadblocks to Stem Cell Differentiations through Cross-Species Transcriptome Analysis  
David Chau, Raval Raju, Wei-Shou Hu; UMN

CM19  Microfluidic Model to Investigate the Roles of Tissue Resident Macrophages on Breast Cancer Cell Extravasation  
Geneva Doak, Marie-Elena Brett, Kaylee Schwertleger, David Wood; UMN

CM20  Elucidating Glycosylation Patterns of Protein Produced in Mammalian Cells  
Tung Sy Le, Andrew Yongky, Simmon Grimm, Guilherme Costa De Sousa, Wei-Shou Hu; UMN

CM21  Centromere Mechanical Maturation: a New Theory for Regulating Mechanical Signaling During Mitotic Progression  
Lauren Harasymiw, Melissa Gardner; UMN

CM22  Systems Approach to Bio-Molecular Investigation  
Shreyas Bhaban and Murti Salapaka; UMN; Subhrajit Roychowdhury, GE Global Research, General Electric; Mingang Li and Thomas Hays; UMN

CM23  Porcine to Porcine Blastocyst Complementation in an Attempt to Generate Oligodendrocytes  
Joseph Voth, Walter C. Low, and Ann M. Parr; UMN

CM24  Modeling the Influence of Substrate Young’s Modulus, Adhesion Size, and Cell Geometry on Cell Traction  
Ghaidan Shamsan and David J. Odde; UMN

CM25  Cell Propagation on Solvent-Casted Thermoresponsive Films  
Kevin J. Ortiz-Rivera, Yonsil Park, Wei-Shou Hu, Chun Wang; UMN

CM26  In vitro platform to isolate and study dormancy-capable cancer cells  
Julian Preciado, Samira Azarin, Emil Lou, Alptekin Aksan; UMN

CM27  Fast, efficient and gentle transfection of human adherent cells in suspension  
Pranav Agrawal, Nilesh P. Ingle, William S. Boyle, Emily Ward, Jakub Tolar, Kevin D. Dorfman, Theresa M. Reineke; UMN

CM28  HINT1 Activity Dependent Formation of Supramolecular Hydrogels  
Harrison T. West, Clifford Cizmar, and Carston R. Wagner; UMN

CM29  Development of a Mass Cytometry Methodology to Measure Prenylation and Comparison to Flow Cytometry  
Elyse Krautkramer, Heather Grundhofer, Edgar Arriaga, Mark Distefano; UMN

CM30  Segment Scanning and Assembly as an Alternative Strategy to Engineering Protein Stability  
Yandon T. Duong, Varun R. Sagi, Daniel R. Woldring, Max A. Kruzik Benjamin J. Hackel; UMN

CM31  Utilizing Prosthetic Antigen Receptors for Anti-EpCAM Cell-directed Immunotherapy  
Jacob Petersburg, Kari Gabrielse, Carston R. Wagner; UMN

CM32  Halofuginone as a Stromal-Targeting Therapy Agent in Pancreatic Ductal Adenocarcinoma  
Kianna Ealahi Gedwillo, Marjorie Carlson, Paolo P. Provenzano; UMN

CM33  Human-porcine chimera and the use of blastocyst complementation to generate a source of nigral dopamine precursors suitable for transplantation  
Andrew T Crane, Preethi Swaminathan, Holly Hewitt, Feng Xiao, Vibha Savanur, Joe Voth, Zach Schultz, Dan Carlson, Recombinetics Inc; Scott Fahrenkrug, UMN, Recombinetics Inc.; James Dutton, UMN; Walter C Low, UMN

CM34  Down Regulation of Hyaluronan Synthesis Decreases Extracellular Coat Formation and Inhibits Extravasation of Triple Negative Breast Cancer Epithelial Cells  
Marie-Elena Brett, Mathew Price, James B. McCarthy, and David K. Wood; UMN
POSTERS

MEDICAL AND BIOLOGICAL IMAGING

**IM01** Magnetic Resonance Oximetry Sensing with Perfluorocarbon-Loaded Nanoparticles

**IM03** Brain Anatomical Network Alteration in Adolescent Major Depressive Disorder
Shu-Hsien Chu, Kathryn R. Cullen, Christophe Lenglet, Keshab K. Parhi; UMN

**IM04** Imaging Brain Electrical Activity Noninvasively using EEG Source Imaging : Sparse Measurements Call for Sparse Measures
Abbas Sohrabpour, Yunfeng Lu, Gregory Worrell, Dept. of Neurology, Mayo Clinic; Bin He; UMN

**IM05** Identifying Chronic Pain Biomarkers using EEG Informed fMRI on Sickle Cell Patients during Resting State
Michelle Case, Clara Huishi Zhang, Yvonne Datta, Stephen Nelson, Children's Hospitals and Clinics of Minnesota; Kalpna Gupta, Bin He; UMN

**IM06** Improving EPI Phase Correction for Breast DWI
Jessica A McKay, Steen Moeller, Sudhir Ramanna, Edward J Auerbach, Michael T Nelson, Kamil Ugurbil, Essa Yacoub, Patrick J Bolan; UMN

**IM07** VR for Health: Patient-Specific Virtual Reality Environments for Mindfulness-Based Healing
Daniel F. Keefe, Gert Bronfort, Roni Evans, Alex Haley, Lana Yarosh, Joseph Jofton, Independent Artist; Francis J. Keefe, Duke University; Anna Taberko, Independent Artist; Jung Nam, Linda Hanson, Haiwei Ma; UMN

**IM08** Machine Learning-based Model for Diagnosis of Prostate Cancer on Multiparametric MRI
Ethan Leng and Greg Metzger; UMN

**IM09** Imaging with a portable, Head-Only 1.5T MRI System
Michael Mullen, Jinjin Zhang, Di Xiao, Alex Gutierrez, Bert Wang, Wang NMR, INC; Bob Wahrer, Wang NMR, INC; Jon Zbasnik, Wang NMR, INC; Robert Wagner, Wang NMR, INC; Djaudal Idiyatullin, Sungmin Sohn, Albert Jang, Mohan Jayatilaka, Steen Moeller, Christoph Juchem, Yale University School of Medicine; Robin A. de Graaf, Yale University School of Medicine; Gregor Adriany Lance Delabarre, Jarvis Haupt, J. Thomas Vaughan, Michael Garwood; UMN

**IM10** Electromagnetic Source Localization Using Deep Brain Stimulation (DBS) Electrodes
Seyed Hossein Hosseini, Abbas Sohrabpour, Bin He; UMN

**IM11** Imaging the Cerebellum and adjacent brainstem using Serial Optical Coherence Scanner
Chao J. Liu, Kristen E. Williams, Harry T. Orr, Taner Akkin; UMN

**IM12** Multimodal Photoacoustic Lifetime and Ultrasound Imaging System
Ekaterina Ippolito, Shai Ashkenazi; UMN

**IM13** Fabrication, Characterization and Performance Improvement of a Single Element Forward-Viewing Opto-Acoustic Imaging Device
Supriya Thathachary, Shai Ashkenazi; UMN

**IM14** Brain Tissue Micro-structure Imaging in Multiple Fiber Orientations using Diffusion MRI
Hamza Farooq, Jungqian Xu, Dept. of Radiology, Icahn School of Medicine at Mount Sinai, New York; Essa Yacoub, Tryphon Georgiou, Christophe Lenglet; UMN

**IM15** Fully-Automated Segmentation of Fluid/Cyst Regions in Optical Coherence Tomography Images with Diabetic Macular Edema using Neutrosophic Sets and Graph Algorithms
Abdolreza Rashno, Keshab K. Parhi, Dara D. Kooozekhani, Paul M. Drayna; UMN, Behzad Nazari and Saeed Sadri, Isfahan University of Technology, Iran, Hossein Rabbani, Isfahan University of Medical Sciences, Isfahan, Iran

**IM16** Deciphering the juxtavascular niche of satellite cells through skeletal muscle tissue clearing
Mayank Verma, Bhavani Sai Rohit Murkonda, Yoko Asakura, Atsushi Asakura; UMN

**IM17** Determining the Effect of Combined Neuromodulation and Cognitive Training on Functional Connectivity Networks Associated with Relapse in Alcohol Use Disorder
Y. Jazmin Camchong, Matt Kushner, Angus W. MacDonald III, Kelvin O. Lim; UMN

**IM18** Axonal Sprouting in Commissurally Projecting Parvalbumin-Expressing Interneurons
Zoe Christenson Wick, Caara Leintz, Casey Xamonthiene, Bin Huang, Esther Krook-Magnuson; UMN

**IM19** Classification of Obsessive Compulsive Disorder from Resting State fMRI
Bhaskar Sen, Gail Bernstein, Tingting Xu, Bryon Mueller, Melinda Westlund Schreiner, Kathryn R. Cullen, Keshab Parhi; UMN

**IM20** Implementing a radial scan method for the scanning thin-sheet laser imaging microscope (sTSLIM)
Julian Wüster, Technische Universität Ilmenau, Germany; Adrian Grewe, Technische Universität Ilmenau, Germany; Peter Santi; UMN

**IM21** Functional Connectivity between TMS Hotspot and Task fMRI Activations in People with Spasmodic Dysphonia
Mo Chen, Cecilia N. Prudente, Rebekah L.S. Summers, Teresa J. Kimberley; UMN

**IM22** Tuning Ligand Biophysics to Improve Tumor Delivery
Brett Case, Benjamin Hackel; UMN
Magnetic Resonance Imaging Oxygen Sensors via Perfluorocarbon Loaded Nanoparticles

16 channel Loop-Dipole coil for monkey imaging at 10.5T
Myung Kyun Woo, Arcan Erturk, Russell Lagore, Gregor Adriany; UMN

Ex vivo Heating and Imaging of Iron Oxide Nano-therapeutics: Opportunities and Limitations
Hattie L. Ring, Jinjin Zhang, Navid Manucherabadi, Katie R. Hurley, Qi Shao, Djaudat Idiyatullin, Christy L. Haynes, John C. Bischof, Michael Garwood; UMN

Sensing Curvature: Lipids Arrangement at Curved Interface
Amit Kumar Sachan, Joseph Anthony Zasadzinski; UMN

Assessment of Neurodegeneration in ALS using Diffusion MRI
Pramod Kumar Pisharady, David Walk, Gaurav Guliani, Georgios Manousakis, Christophe Lenglet; UMN

Neurodevelopmental Assessment of Tuberous Sclerosis Complex using Diffusion MRI
Pramod Kumar Pisharady, UMN, Wenbo Zhang, Minnesota Epilepsy Group; Mike Frost, Minnesota Epilepsy Group; Christophe Lenglet, UMN

Cortical Excitability is Not Different Between Healthy Individuals and People with Laryngeal Dystonia
Cecilia N. Prudente, Mo Chen, Rebekah L. Schmidt, George S. Goding; UMN, Sharyl Samargia, UWRF; Christy L. Ludlow, JMU; Teresa J. Kimberley, UMN

Institute for Engineering in Medicine 3D Printing Core
Davis Fay, UMN; Art Erdman, UMN; Paul Iaizzo, UMN; Will Durfee, UMN
DE01 A Comparison of Physiological Response of Muscle Tissues to Electroporation
Lars Mattison, Matt Yoder, Jeremy Stimack, Paul Iaizzo, UMN

DE02 In-vitro Evaluations of Cardiac Mapping Catheter Designs and Utilities: Employing Visible Heart Methodologies
Megan Schmidt, UMN; Michael Franz, Veteran Affairs and Georgetown University Medical Center; Timothy Laske, CRHF, Medtronic; Mark Stewart, CRHF, Medtronic; Paul Iaizzo, UMN

DE03 Inverse Design Process: New Methodology to Design Medical Devices with BIG DATA
Bethany Tourek, UMN; Daniel Orban, UMN; Bogden Tanasoiu, University of Chicago; Hakizumwami Birali Runesha, University of Chicago; Daniel Keefe, UMN; Arthur Erdman, UMN

DE04 Demonstration of a Passive Wireless Radiation Detector using Fully-Depleted Silicon-on-Insulator Variable Capacitors
Yulong Li, VR Saran Kumar Chaganti, Margaret A. Reynolds, Bruce J. Gerbi, and Steven J. Koester; UMN

DE05 Quantitative Analyses of the Relative Distributions of Epicardial Adipose on Human Hearts
Alexander Mattson, Mario Soto, Paul Iaizzo; UMN

DE06 High Signal-to-Noise-Ratio Detection of Neuronal Activity Using Novel Multi-Channel Microfabricated Electrode Arrays
Abhimanyu Ravindranath, UMN; Joshua G. Puhl, UMN; Morgan Newhoff, UMN; Kang Xiong-Hang, UMN; Christy L. Haynes, UMN; Karen A. Mesce, UMN; Stephen A. Campbell, UMN

DE07 Cryopreservation of Zebrafish Embryos
Kanav Khosla, John Bischof, UMN

DE08 Gold Nanoparticle Plugs - A Novel use of Siderophores as an Antibiotic
Nick M. Livezey, Dept. of Chemistry, UMN; Sylvie L. Pailloux, Dept. of Chemistry, UMN; Valérie C. Pierre, Dept. of Chemistry, UMN

DE09 Evaluating Reading Performance With a Head Mounted Aid for Central Visual Field Loss
Anshul Gupta, Juraj Mesik, Stephen Engel, Frederik J van Kuijk, Aurelie Calabrese, Jacob Sanders, Arthur Erdman, Gordon E. Legge; UMN

DE10 Development of Instrumented Socks with Novel Sensors for Prediction of Acute Decompensated Heart Failure
Song Zhang, Brant Axt, Rajesh Rajamani, Lee Alexander, A. Serdar Sezen, UMN; and Bruce D. Johnson, Mayo Clinic

DE11 A Platform-Agnostic Variant of the 4-Choice Reversal Learning Task
Elias Boroda, Brent G. Nelson, Jazmin Camchong, Kelvin O. Lim, UMN

DE12 Rupture-Type Osmotic Device
Krutila Harish Jain, Ronald A. Siegel; UMN

DE13 Affordable and Disposable Ion-Sensing Platform Based on Paper
Jinbo Hu, UMN; Andreas Stein, UMN; Philippe Buhlmann, UMN

DE14 New Fluorous-Phase Ion-Selective pH Electrode for the Physiological pH Range
Xin(Sean) Chen, Maral Mousavi, Philippe Buhlmann, UMN

DE15 Thoracic Volume Software Applied to Follow-up Adolescent Idiopathic Scoliosis Patients
Po-Chih Lee, UMN; Charles G.T. Ledonio, UMN; A. Noelle Larson, Mayo Clinic, Rochester, MN; Arthur G. Erdman, UMN; David W. Polly, UMN

DE16 Mucoadhesive Polymer Wafers for Preservation and Sublingual Delivery of Vaccines
Samuel Hanson, UMN; Shailbala Singh, MD Anderson Cancer Center, Houston, TX; Jagannadha K. Sastry, MD Anderson Cancer Center, Houston, TX; Michael Barry, Mayo Clinic, Rochester, MN; Chun Wang, UMN

DE17 Rheological behavior of Sickle Cell Blood in Response to Oxygen Tension
Xinran Lu, UMN; John M Higgins, Dept. of Systems Biology, Harvard; David K Wood, UMN

DE18 A Thermal Contrast Amplification Reader Yielding 8-fold Analytical Improvement for Disease Detection with Lateral Flow Assays
Yiru Wang, UMN; Zhenpeng Qin, UMN; David R. Boulware, UMN; Warren C. W. Chan, University of Toronto; John C. Bischof, UMN

DE19 Novel Biomaterial Scaffolds for Application of Focal Hyperthermia to Disseminating Tumor Cells
Francisco Pelaez, Navid Manuchehrabadi, Heather Fong, Kevin Zeng, John C. Bischof, Samira Azarin, UMN

DE20 A device to quantify Sweat from Single Sweat Glands For Diagnosis of Neuropathy
Gwen Wendelschafer-Crab, UMN; William R. Kennedy, UMN; Mona Selim, UMN; Fabio Suter, Maugeri FoundationMedical Center of Telese Terme, IT; Maria Nolano, Maugeri FoundationMedical Center of Telese Terme, IT; Vincenzo Provitera, Maugeri FoundationMedical Center of Telese Terme, IT

DE21 Ultra-Low-Power Nanogap Electrodes for Biomolecule Manipulation and Detection
Avijit Barik, Xiaoshu Chen, Sang-Hyun Oh; UMN

DE22 Instrumented urethral catheter for measuring urethral pressure distribution in patients with urinary incontinence
Mahdi Ahmadi, Ye Zhang, Rajesh Rajamani, Gerald Timm, Bhaskar Ravishankar, UMN
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MEDICAL DEVICES (CONT.)

DE23 Shear-Reversible Nonaqueous Nanocomposites for Local Delivery of Combination Drugs
Anthony Tabet, Vinh Tran, Macallum Brabender, Chun Wang, UMN

DE24 Flexible Giant Magnetoresistive Sensors for Biomedical Applications
Diqing Su, UMN

DE25 Laser Assisted Gold Nanoparticle Warming for Zebrafish Cryopreservation
Kanav Khosla, John Bischof, UMN

DE26 Investigation of Protein Change during Heat, Cryo and IRE Focal Therapies on Cardiovascular Cells
Feng Liu, Priyatanu Roy, Qi Shao, Jeunghwan Choi, Chunjian Jiang and John Bischof, UMN

DE27 Crystallization behavior of high molar (~6M) cryoprotective agents for organ preservation
Shaunak Phatak, Harishankar Natesan, John Bischof, UMN

DE28 Ultra-high resolution magnetic sensor array as an alternative tool for neuroimaging
Yinglong Feng, Jinyang Chen, Diqing Su, Jianping Wang, UMN

DE29 A Simplified Model for the Assessment of Ex-Vivo Lung Perfusion Methodologies and Treatments
Lars Mattison, John Spratt, Brian Howard, Shancy Augustine, Gabriel Loor, Paul A laizzo, PhD, UMN

DE30 Novel Diagnostics of Bacterial Infections: UTI
Sylvie L. Pailloux, Fiona Armstrong-Pavlik, Melissa J. Karau, Mayo Clinic; Greenwood Quantance, Kerryl, Mayo Clinic; Robin Patel, Mayo Clinic; Valérie C. Pierre, UMN

DE31 Guided Vasculatization via 3D Printed Programmable Release Capsules
Fanben Meng, Carolyn Meyer, Angéla Panoskaltsis-Mortari, Michael McAlpine, UMN

DE32 Understanding Brain Reorganization through Neuroexcitability and Neuroimaging in Infant with Perinatal Stroke: Modifications from Adult to Pediatric Protocols
Chao-Ying Chen, UMN; Michael Georgieff, UMN; Jed Elison, UMN; Mo Chen, UMN; Bryan Mueller, UMN; Raghavendra Rao, UMN; Kyle Rudser, UMN, James Stinear, Department of Exercise Sciences, University of Auckland, New Zealand; Bernadette Gillick, UMN

NEO1 Improving Motor Recovery after Stroke by Combined rTMS and BCI Training
Nessa Johnson, Albert You, James Carey, Ann Van de Winckel, Andrew Grande, Bin He, UMN

NEO2 Sensorimotor Rhythm BCI with Simultaneous High Definition-Transcranial Direct Current Stimulation Alters Task Performance
B. Baxter, B. Edelman, N. Nesbitt, B. He, UMN

NEO3 Investigating Ultrasonic Suppression and Activation Effects on Scialt Nerve in vivo
Hongsun Guo, UMN; Mark Hamilton, UMN; Sarah Orlutt, Medtronic; Yohan Kim, Medtronic; Cory Gloeckner, UMN; Jamu Alford, Medtronic; Hubert H. Lim, UMN

NEO5 Effects of Short-Term Mind-Body Awareness Training on Sensorimotor Based Brain Computer Interface
James R. Stieger, Christopher C. Cline, Andy Huynh, Angeliki Beyko, Stephen A. Engel, Bin He, UMN

NEO6 Source Imaging Analysis of Sickle Cell Disease Patients using Resting State EEG
Sina Shirinpour, UMN; Michelle Case, UMN; Yvonne Datta, UMN; Stephen Nelson, Children’s Hospitals and Clinics of Minnesota; Kalpna Gupta, UMN; Bin He, UMN

NEO7 MEG Source Imaging of Epileptic Activity
Shuai Ye, UMN; Abbass Sohrabpour, UMN; Wenbo Zhang, Minnesota Epilepsy Group; Bin He, UMN

NEO8 Noninvasive Electrophysiological Imaging of Brain Activation by Low-intensity Transcranial Focused Ultrasound
Kai Yu, Abbass Sohrabpour, Bin He, UMN

NEO9 Differential activation of the default mode network during bistable perception: insights from simultaneous EEG-fMRI
Abhrajeet Roy, Keith Jamison, Sheng He, Steve Engel, Bin He, UMN

NEO10 Characterization and quantification of tonic thermal pain using EEG data
Vishal Vijayakumar, D’Michelle Case, ; Sina Shirinpour, Clara Huishi Zhang, Bin He, UMN

NEO11 Decoding natural motor imagination tasks through cortical currents for intuitive brain-computer interface use
Bradley J. Edelman, Bryan S. Baxter, Bin He, UMN

NEO12 Electrophysiological changes in motor imagery after 1 Hz rTMS - A pilot study
Christopher C.. Cline, Nessa N. Johnson, Bin He, UMN

NEO13 Transcranial Current Stimulation Alters Brain Computer Interface Performance
Bryan S. Baxter, Bradley J. Edelman, Nicholas Nesbitt, and Bin He, UMN

NEO15 Advanced Stimulation Patterns for Directional Activation in DBS
Julia P. Slopsema, UMN; Lauri J. Lehto, UMN; Matthew D. Johnson, UMN; Olli Grohn, UMN, University of Eastern Finland; Shalom Michaeli, UMN
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NE16 Effects of Ultrasonic Neuromodulation on Single Neurons in a Functioning Neural Network
Morgan Newhoff, Jerel K. Mueller, Wynn Legon, Karen A. Mesce, UMN

NE17 Multisensory Neuromodulation: Activating Peripheral Nerves to Induce Brain Plasticity
Cory D. Gloeckner, Jio C. Nocon, Hubert H. Lim, UMN

NE18 Fabrication of Flexible Neural Probes for use in Magnetic Resonance Brain Research
Corey Cruttenden, Xiao-Hong Zhu, Wei Chen, Rajesh Rajamani, UMN

NE19 Ultrasound modulation of the vagus nerve: A new noninvasive approach for potentially treating health disorders
Pooja Mehta, UMN; Hongsun Guo, UMN; Daniel Zachs, UMN; Sarah Offutt, Medtronic; Yohan Kim, Medtronic; Jamu Alford, Medtronic; Hubert Lim, UMN;

NE20 Particle Swarm Optimization for Programming Deep Brain Stimulation Arrays
Edgar Peña*, Simeng Zhang*, YiZi Xiao, Steven Deyo, Matthew Johnson, UMN

NE21 Behavioral Correlates of Model-based and Model-free Decisions are Revealed by a Two-step Decision-task for Rats
Brendan Hasz, David Redish, UMN

NE22 Reinforcement learning for phasic disruption of oscillations in a model of Parkinson’s disease
Logan Grado, Matt Johnson, Theoden Setoff, UMN

NE23 3D Mapping of Ultrasonic Pressure through the Ex-Vivo Rat Skull: Methodology and Results
John Basile, Xiaodan Niu, Kai Yu, Maryam Zhian, Bin He, UMN

NE25 Changes of alpha oscillations during binocular rivalry reflect interocular neural competition
Petruk V., S. Engel, B. He, S. He, UMN

NE26 Oculomotor Dysfunction in Parkinson’s Disease and Freezing of Gait
Samuel Nemanich and Gammon Earhart, Washington University School of Medicine in St. Louis

NE27 VC-based Signal Denoising for iEEG Data
Hsiang-Han Chen, Han-Tai Shiao, Vladimir Cherkassky, UMN

NE29 Comparing MEP responses following TMS at two locations: EEG and TMS-Derived Hotspot
Maira Lixandrão, Chao-ying Chen, Gregg Meekins, Tonya Rich, Tim Fayma, Bernadette Gillick, UMN

NE31 A Streaming PCA based VLSI Chip for Neural Data Compression
Tong Wu; Wenfeng Zhao; Hongsun Guo; Hubert Lim; Zhi Yang; UMN

NE32 Model based control of neuronal local field potentials in rats using electrical stimulation
Vivek Nagaraj, Andrew Lamperski, Theoden I Netoff, UMN

NE33 Massively parallel neural signal processing
Wing-kin Tam, Zhi Yang, UMN

NE34 A Programmable Fully-Integrated Microstimulator for Neural Implants and Instrumentation
Anh Tuan Nguyen, Jian Xu, Wing-kin Tam, Wenfeng Zhao, Tong Wu, Zhi Yang, UMN

NE35 Neuronix Enables Continuous, Simultaneous Neural Recording and Electrical Stimulation
Jian Xu, Anh Tuan Nguyen, Tong Wu, Wing-Kin Tam, Wenfeng Zhao, Zhi Yang, UMN

NE36 A Bio-inspired Redundant Sensing Architecture
Anh Tuan Nguyen, Jian Xu, Zhi Yang, UMN

NE37 Autonomic nervous system monitoring during transcranial magnetic stimulation: Making a difference in monitoring responses and adverse events in children with hemiparetic cerebral palsy
M Keller-Ross, UMN; D Chantigian, UMN; C-Y Chen, UMN; G Meekins, UMN; T Feyma, Gillette Children’s Specialty Healthcare; L Krach, Courage Kenny Rehabilitation Institute; BT Gillick, UMN

NE38 Stability of the Autonomic Nervous System during Transcranial Magnetic Stimulation in Pediatric Stroke: Combining Neuroengineering and Biomedical Resources
Daniel Chantigian, Tonya Rich, Chao-Ying Chen, Maira Lixandroa, Bernadette Gillick, Manda Keller-Ross, UMN

NE39 Ultrasound Neuromodulation: Is it Direct Neural Activation or Vibratory Cochlear Activation of the Brain?
Mark Hamilton II, Hongsun Guo, Sarah Offutt, Medtronic; Yohan Kim, Medtronic; Cory Gloeckner, Jamu Alford, Medtronic; Hubert Lim, UMN

NE40 The learning effect with respect to decoding method for online brain-computer interface
Jianjun Meng, Jarom Olson, Gabriel Jacob, Shuying Zhang, Angeliki Beyko, Bradley J. Edelman, and Bin He, UMN

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Call For Papers

5th Minnesota Neuromodulation Symposium
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Neuromodulation is a rapidly-growing field, encompassing a wide spectrum of implantable and non-invasive technology-based approaches for the treatment of neurological and psychiatric disorders. Advancing the field of neuromodulation represents challenges in developing engineering methodologies, understanding mechanisms of neuromodulation at cellular and system levels, clinical translation to treat patients, and shaping the regulatory process for emerging technologies and approaches. The Symposium is aimed at bringing together basic scientists, engineers, clinicians, industrial practitioners and entrepreneurs to discuss challenges and opportunities in neuromodulation, including but not limiting to DBS, TMS, tCS, FUS, optogenetics, engineering methods for neuromodulation such as modeling, electrode designs and imaging, as well as neuroscience mechanisms of neuromodulation. Original contributions in any area of neuromodulation are invited. All submissions will be peer reviewed, and those receiving the highest scores will be selected for the plenary Highlight Talks session. Students/postdocs are eligible for Poster Competition. Up to 10 Travel Awards will be provided to domestic ($750) or international ($1250) students/postdocs.

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Plenary Speakers

Mark Hallett, MD
Chief, Human Motor Control Section
National Institute of Neurological Disorders and Stroke (NINDS)
National Institutes of Health (NIH)
President, International Federation of Clinical Neurophysiology

Helen Mayberg, MD
Professor of Psychiatry, Neurology and Radiology
Dorothy Fuqua Chair in Psychiatric Neuroimaging and Therapeutics
Member, National Academy of Medicine
Emory University

Walter Paulus, MD, PhD
Director of the Department of Clinical Neurophysiology
University Medical Center Gottingen

William Tyler, PhD
Assistant Professor of Neurobiology and Bioimaging
Arizona State University

Jerrold Vitek, MD, PhD
McKnight Professor and Chair
Department of Neurology
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