JIT MUTHUSWAMY

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EDUCATION

May 1996 **Ph.D**. in Biomedical Engineering, (Thesis advisor: Dr. Rob J. Roy)
Rensselaer Polytechnic Institute, Troy, NY

May 1996 **MS** in Electrical, Computer, and Systems Engineering,
Rensselaer Polytechnic Institute, Troy, NY

May 1993 **MS** in Biomedical Engineering, (Thesis advisor: Dr. Rob J. Roy)
Rensselaer Polytechnic Institute, Troy, NY

May 1991 **B.Tech. (Hons.)** Electronics and Electrical Communication Engineering
Indian Institute of Technology, Kharagpur, India

POSITIONS

2006 to present **Associate Professor (tenured)**, Bioengineering, **Arizona State University**, Tempe, AZ
Affiliate Faculty in Electrical Engineering, **Arizona State University**, Tempe, AZ
Graduate Faculty (endorsed to Chair PhD dissertations) in (a) Bioengineering (b) Electrical Engineering (c) Engineering Science (d) Neuroscience (e) Media Arts and Sciences at **Arizona State University**, Tempe, AZ

2000 to 2006 **Assistant Professor**, Bioengineering, **Arizona State University**, Tempe, AZ 85287

1996 to 2000 **Post-doctoral fellow,** Biomedical Engineering**, Johns Hopkins University,** Baltimore, MD (Mentor: Dr. Nitish V. Thakor)

1991 to 1996 **Research assistant**, Biological Signal Processing and Control Laboratory **Rensselaer Polytechnic Institute**, Troy, NY

AWARDS AND HONORS

- **Excellence in Neural Engineering award** (sponsored by the NSF) was awarded at the Joint Annual meeting of the IEEE Engineering in Medicine and Biology Society (EMBS) and the Biomedical Engineering Society (BMES) in Houston, in 2002.
- **Outstanding paper** award (co-authored by mentored student, Nathan Jackson) at the 41st Annual International Microelectronics and Packaging Society (IMAPS) symposium, Providence, RI, Nov. 2-6, 2008.
- **Senior Member**, Institute of Electrical and Electronics Engineers (IEEE)
- **Associate Editor -** IEEE Transactions on Neural Systems and Rehabilitation Engineering (2006-2007)

INTERNATIONAL NEWS FEATURES

Research featured in *Chemical Biology* (2007)- "Bio-chip for spatially controlled transfection of nucleic acid payloads into cells in a culture," authored by T Jain (mentored doctoral student) and J Muthuswamy, published in the journal *Lab on a Chip* was featured in *Chemical Biology* as a news item. Both *Chemical Biology* and *Lab on a Chip* are published by the *Royal Society of Chemistry*.

Research featured in *IEEE Spectrum* (2008) – "Microelectrode array (MEA) platform for targeted neuronal transfection and recording" authored by T Jain (mentored doctoral student) and J Muthuswamy published in *IEEE Transactions on Biomedical Engineering Letters* was featured as a news article in February 2008 issue of *IEEE Spectrum* (monthly magazine of IEEE with a circulation of over 390,000 worldwide).

SPONSORED RESEARCH

External grants funded (as Principal investigator, no co-PIs)

- *Title*: "Cyber-Biomedical Systems"
  Funding agency – Intel Embedded Curriculum Development award
  Award and Duration - $30,000 (direct costs), 12/01/13-11/30/14

- *Title*: "Autonomous MEMS probes for intracellular recording"
  Funding agency – R21NS084492-01, NINDS/NIH
  Award and Duration - $386,097 (total costs), 10/01/13-09/30/14

- *Title*: "Single neuronal recordings using movable microprobes"
  Funding agency – R01 NS055312 –S1, NIH (Competitive Revision)
  Award and Duration - $619,000 (total costs), 10/01/09-09/30/11

- *Title:* " Single neuronal recordings using movable microprobes"
  Funding agency – R01 NS055312, National Institutes of Health
  Award and Duration - $1,060,054 (total costs), 03/01/07-02/27/2011

- *Title:* " Microactuated microelectrodes to assess cortical role in memory deficits"
  Funding agency - Arizona Biomedical Research Commission
  Award and Duration - $450,000 (total costs), 09/01/05-08/31/08

- *Title:* **"**Deep Brain Stimulation Using Microactuated Microprobes"
  Funding agency - R21 NS051773-01, NIH/NINDS
  Award and Duration - $338,597 (total costs), 04/01/2005-03/31/2007

- *Title:* "Microactuated microelectrode arrays for chronic single neuronal monitoring"
  Funding agency - The Whitaker Foundation, Transition award
  Award and Duration - $80,000 (total costs), 11/01/2004-10/31/2005

- *Title:* Microfabricated electrode positioners to study somatosensory deficits after global ischemia
  Funding agency: Whitaker Foundation, Rosslyn, VA.
  Award & Duration: $240,000 (total costs), 05/01/2001-04/31/2004.

- *Title:* Steerable Microfabricated microelectrode drive
  Funding agency: R21 from National Institutes of health, NINDS
  Award & duration: $150,000 (direct costs), 09/01/2000-08/31/2003

- *Title*: A microelectromechanical system for precision drug delivery
  Funding agency: SBIR Phase I from NIDA, National Institutes of Health
  Award & Duration: $100,000, 09/30/1999-08/31/2000, transferred to Dr. Ananth Natarajan (CEO, Infinite Biomedical Technologies, 3600 Clipper Mill Road, #410, Baltimore, MD 21211)

External grants funded (as Co-Principal investigator)

- *Title*: Whitaker Foundation Program Development Award: Neural Molecular Cell Tissue Bioengineering: A Theme for the New Department of Bioengineering At ASU
  Funding agency: Whitaker Foundation
  Award and duration: $2M, 7/1/2000-12/31/2014

- *Title*: Antibody encapsulated electrochemical biosensor for GABA
  Funding agency: SBIR Phase I from NIH, (**PI: Anhong Zhou**, Inframat Inc., Framington, CT)
  Award and Duration: $59,999, 06/01/2003-08/31/2004.

External grants funded (as Co-investigator)

- *Title*: Advanced Neural Implants and control (**PI: Jiping He)**
  Funding agency – DARPA
  Award & duration - $6,000,000 over 3 years; ending May 2004.

Internal Grants funded (as Principal Investigator)

- *Title*: Real-time monitoring of neurite growth and inhibition using acoustic sensors
  Funding agency: Bioengineering Seed Funding Program, Arizona State Univ., Tempe, AZ
  Award & duration: $20,000, June 2003-May 2004.

Internal grants funded (as Co-Principal investigator)

- *Title:* Engineering a novel GABA sensor to study the role of $GABA_A$ receptor abnormalities in absence epilepsy
  Funding agency: Bioengineering Seed Funding Program, Arizona State Univ., Tempe, AZ
  Award & duration: $20,000 Feb. 2002-May 2003.

PUBLICATIONS (in chronological order; '*' - indicates mentored students)

1. **J Muthuswamy**, RJ Roy and A Sharma, "A study of electroencephalographic descriptors and end-tidal concentration in estimating depth of anesthesia," *J Clin. Monit*, 12(5): 353, 1996.

2. **J Muthuswamy** and RJ Roy, "The use of fuzzy integrals and bispectral parameters of Electroencephalograms to predict movement under isoflurane anesthesia," *IEEE Trans. Biomed. Eng*., 46(3): 291-299, 1999.

3. **J Muthuswamy**, D Sherman and NV Thakor, "Higher order spectral analysis of EEG burst patterns during asphyxic injury," *IEEE Trans. Biomed. Eng*, 46(1): 92-99, 1999.

4. **J Muthuswamy** and NV Thakor, "Spectral analysis methods for neurological signals," *J Neurosci. Meth.*, 83(1):1-14, 1998.

5. **J Muthuswamy**, P Tran, R Rangarajan, FA Lenz, DF Hanley and NV Thakor, "Somatosensory stimulus entrains spindle oscillations in the thalamic VPL nuclei in barbiturate anesthetized rats," *Neurosci. Lett.,* 262(3): 191-194, 1999.

6. RG Geocadin, **J Muthuswamy**, NV Thakor and DF Hanley, "Early electrophysiological and histological changes after global cerebral ischemia in rats," *Movement Disorders*, 15S. 1:14-21, 2000.

7. P George, **J Muthuswamy**, J Currie, NV Thakor and M Paranjape, "Fabrication of Screen-Printed Carbon Electrode Arrays for Sensing Neuronal Messengers," *Biomedical Microdevices*, 3:307-313, 2001.

8. **J Muthuswamy**, T Kimura, RG Geocadin, NV Thakor, and DF Hanley, "Vulnerability of the thalamic somatosensory pathway after prolonged global hypoxic-ischemic injury," *Neuroscience,* 115(3):917-929, 2002.

9. A Zhou* and **J Muthuswamy**, "Acoustic biosensor for monitoring antibody immobilization and neurotransmitter GABA in real-time" *Sensors & Actuators B:Chemical.,* 101:1-2:8-19, 2004.

10. **J Muthuswamy**, M Okandan, and N Jackson*, "Surface Micro-Machined Polysilicon Probes for Neurophysiology," *J. Neurosci. Meth.*, 142(1):45-54, 2005.

11. **J Muthuswamy**, M Okandan, T Jain*, and A Gilletti*, "Electrostatic microactuators for precise positioning of Neural microelectrodes," *IEEE Trans Biomed Eng*, 52:1748-1755, 2005.
(First to successfully demonstrate an integrated micromachining technology to *move* implantable microelectrodes in the brain)

12. M Khraiche*, A Zhou* and **J Muthuswamy**, "Acoustic sensor for monitoring adhesion of Neuro-2A cells in real-time," *J Neurosci. Meth.,* 144(1):1-10, 2005.

13. **J Muthuswamy**, M Okandan, A Gilletti*, M Baker, and T Jain*, "An array of microactuated microelectrodes for monitoring single neuronal activity in rodents," *IEEE Trans Biomed Eng*, 52:1470-1477, 2005.
(First to successfully demonstrate an integrated micromachining technology to *move* an array of chronically implantable microelectrodes in the brain)

14. T Wang*, G Ehteshami, S Massia, and **J Muthuswamy**, "Immobilization and characterization of γ-aminobutyric acid (GABA) on gold surface," *J Biomed Mater Res A*, 79A(1):201-209, 2006.

15. A Gilletti* and **J Muthuswamy**, "Brain micromotion around implants in the rodent somatosensory cortex," *J Neural Eng*, 3:189-195, 2006.
(http://www.iop.org/Select/abstract/-group=subject/-groupval=400/1741-2552/3/3/001; article chosen to be part of "IOP select" by the editors for novelty, significance and potential impact).

16. R Saha* and **J Muthuswamy**, "Structure-property relationships in the optimization of polysilicon thin films for electrical recording/stimulation of single neurons," *Biomedical Microdevices*, 9(3):345-360, 2007 (DOI - 10.1007/s10544-006-9039-x).

17. T Jain* and **J Muthuswamy**, "Microsystem for transfection of exogenous molecules with spatio-temporal control into adherent cells," *Biosensors and Bioelectronics*, 22:863-870, 2007.

18. P Stice*, A Gilletti*, A Panitch and **J Muthuswamy**, "Thin microelectrodes reduce GFAP expression in the implant site in rodent somatosensory cortex," *J Neural Eng*, 4:42-53, 2007.

19. T Jain* and **J Muthuswamy**, "Bio-chip for spatially controlled transfection of nucleic acid payloads into cells in a culture," *Lab on a Chip* , 7:1004-1011, 2007.
(Article featured in *Chemical Biology*, a *Royal Society of Chemistry* publication)

20. T Jain* and **J Muthuswamy**, "Microelectrode array (MEA) platform for targeted neuronal transfection and recording," *IEEE Trans Biomed Eng Lett,* 55(2):827-832, 2008.
(Article featured in February 2008 issue of *IEEE Spectrum*, with a circulation of over 390,000 worldwide)

21. N Jackson* and **J Muthuswamy**, "Artificial dural sealant that allows multiple penetrations of long-term implantable brain probes," *J Neurosci Meth,* 171(1):147-152, 2008.

22. A Sridharan*, **J Muthuswamy**, J LaBelle and V Pizziconi, "Immobilization of Functional Light Antenna Structures Derived From The Filamentous Green Bacterium Chloroflexus aurantiacus," *Langmuir*, 24(15): 8078-8089, 2008.

23. T Wang* and **J Muthuswamy**, "Immunosensor for inhibitor neurotransmitter GABA using quartz crystal microbalance," *Anal Chem*, 80 (22), pp 8576–8582, 2008.

24. N Jackson* and **J Muthuswamy**, "Flexible Chip Scale Package and Interconnect for Implantable MEMS Movable Microelectrodes for the Brain," *IEEE/ASME J Microelectromech Syst*, 18(2):396-404, 2009.

25. A Sridharan*, **J Muthuswamy** and V Pizziconi, "Optoelectronic energy transfer at novel biohybrid interfaces using light harvesting complexes from Chloroflexus aurantiacus," *Langmuir*, 25 (11), pp 6508–6516, 2009.

26. P Stice* and **J Muthuswamy**, "Assessment of gliosis around moveable implants in the brain," *J Neural Eng*, 6, 046004, 2009.

27. N Jackson*, S Anand*, M Okandan and **J Muthuswamy**, "Non-hermetic Encapsulation Materials for MEMS Based Moveable Microelectrodes for Long-Term Implantation in the Brain," *IEEE/ASME J Microelectromech Syst*, 18(6):1234-1245, 2009.

28. A Sridharan*, **J Muthuswamy**, V Pizziconi. " Biohybrid Photoelectrochemical Nanoengineered Interfaces," in *Materials and Strategies for Lab-on-a-Chip — Biological Analysis, Cell-Material Interfaces and Fluidic Assembly of Nanostructures*, edited by S. Murthy, H. Zeringue, S. Khan, V. Ugaz 1191-OO03-19, Mater. Res. Soc. Symp. Proc. Volume 1191, Warrendale, PA, 2009.

29. R Saha*, N Jackson*, C Patel* and **J Muthuswamy**, "Highly doped polycrystalline silicon microelectrodes reduce noise in neuronal recordings in vivo," *IEEE Trans Neural Sys Rehab Eng*, 18(5): 489-497, 2010 (chosen as **cover page** article).

30. N Jackson*, A Sridharan*, S Anand*, M Baker, M Okandan and **J Muthuswamy**, "Long-term neural recordings using MEMS based moveable microelectrodes in the brain," *Frontiers in Neuroengineering* vol.3, article 10, 1-13, 2010. (abstract and full-text)

31. **J Muthuswamy**, S Anand, J Sutanto, M Baker and M Okandan, "Implantable microtechnologies for the brain: Challenges and strategies for reliable operation," Proceedings of IEEE International Reliability Physics Symposium (IRPS), 3B.2.1 - 3B.2.4, 10-14 April, 2011 (abstract).

32. J Sutanto*, S Anand*, C Patel* and **J Muthuswamy**, "Novel first-level interconnect techniques for flip-chip on MEMS," *IEEE/ASME J Microelectromech Syst*, 21(1):132-144, 2011 (abstract).

33. J Sutanto*, S Anand*, A Sridharan*, R Korb*, L Zhou*, M Baker, M Okandan and **J Muthuswamy**, "Packaging and Non-Hermetic Encapsulation Technology for Flip-chip on Implantable MEMS Devices," *IEEE/ASME J Microelectromech Syst*, 21(4):882-896, 2012. (DOI: 10.1109/JMEMS.2012.2190712).

34. S Anand*, J Sutanto*, M Baker, M Okandan, and **J Muthuswamy**, "Electrothermal microactuators with peg drive improve performance for MEMS brain implant applications" *IEEE/ASME J Microelectromech Syst*, vol. 21(5):1172-1186, 2012. (DOI: 10.1109/JMEMS.2012.2203789)

35. **J Muthuswamy**, S Anand*, A Sridharan*, "Adaptive movable neural interfaces for monitoring single neurons in the brain," *Frontiers in Neuroscience*, vol. 5, article 94, 2011 **(invited review)** (abstract and full-text)

36. C Patel* and **J Muthuswamy**, High efficiency, Site-specific Transfection of Adherent Cells with siRNA Using Microelectrode Arrays (MEA). *J. Vis. Exp.* (67), e4415, doi:10.3791/4415 (2012). (http://www.jove.com/video/4415)

37. A. Sridharan* and **J Muthuswamy**, "BACE1 silencing using siRNA shows rapid, functional changes in cultured primary hippocampal neurons," *J Neurosci and Neuroengineering,* vol. 2(6):491-503, 2013.

38. ML Khraiche* and **J Muthuswamy**, "Multi-modal biochip for simultaneous, real-time measurement of adhesion and electrical activity of neurons in culture," *Lab on Chip*, **12**, 2930-2941, 2012, DOI: 10.1039/c2lc40190h.

39. A Sridharan*, C Patel* and **J Muthuswamy**, "Voltage preconditioning allows modulated gene expression in neurons using PEI complexed siRNA," *Molecular Therapy – Nucleic acids*, **2**, e82; doi:10.1038/mtna.2013.102013 (a **Nature** group publication).

40. A Sridharan,* S Rajan and **J Muthuswamy**, "Long-term changes in the material properties of brain-tissue at the implant-tissue interface," *J Neural Eng*, **10,** 066001 doi:10.1088/1741-2560/10/6/066001 2013.

41. A Sridharan*, J Nguyen, J Capadona, **J Muthuswamy**, "Compliant Intracortical Implants Reduce Strains and Strain Rates in Brain Tissue *In Vivo*", *J Neural Eng*. 12, doi:10.1088/1741-2560/12/3/036002 2015.

42. M Khraiche*, W Phillips*, N Jackson*, **J Muthuswamy**, "Sustained Elevation of Neural Activity of Developing Cultures in Response to Ultrasound Exposure," (under review) *Ultrasound in Medicine and Biology*, 2014.

43. S Anand*, S Sampath Kumar*, **J Muthuswamy**, "Autonomous control for mechanically stable navigation of microscale implants in brain tissue to record neural activity," (under review) *Biomedical Microdevices*, 2015.

PATENTS AND INVENTION DISCLOSURES

Jit Muthuswamy and Anhong Zhou - "Acoustic immunosensor for detecting neurotransmitter GABA," US-2005-0173267-A1, filing date 8/11/2005.

Jemmy Sutanto and **Jit Muthuswamy**, "Method for Creating and Packaging 3-Dimensional Stacks of Biochips Containing Microelectro-Mechanical Systems" **US patent #** 8653642 issued Feb. 18, 2014.

Jemmy Sutanto and **Jit Muthuswamy**, "Systems and methods for high aspect ratio flip-chip interconnects," **US patent #9067272** issued June 30, 2015.

Arati Sridharan and **Jit Muthuswamy**, "Methods and compositions for high efficiency transfection of siRNA," #61/713,310 provisional patent application filed on 10/12/2012.

Chetan Patel and **Jit Muthuswamy**, "Scalable, High efficiency Gene Delivery Systems and Methods," #61/758,678, provisional patent application filed on 1/30/2013.

Swathy Sampath Kumar and **Jit Muthuswamy**, "Autonomous MEMS probes for intracellular recording," invention disclosure filed on 8/20/2013.

Joseph Smith, Barry O'Brien, Yong-Kyun Lee, Edward Bawolek, Jennifer Blain Christen, Michael Goryll, **Jit Muthuswamy**, George Kunnen, and David Allee, "Integrated High-resolution Flexible Dual-mode OLED Pixel and Microelectrode Array for Simultaneous Chronic *In Vivo* Electro-Optical Stimulation and Recording of Neural Tissue," invention disclosure filed on 10/12/2013.

Jit Muthuswamy and Sivakumar Palaniswamy, "Tunable, robotic microelectrodes to interface, stimulate and record from precisely targeted neurons in nerve fibers," invention disclosure filed on 12/4/2014.

Arati Sridharan and **Jit Muthuswamy**, "Brain-like, Soft Bioactive Coatings for Neural Interfaces," invention disclosure filed on 11/25/2014.

Joseph Smith, Michael Goryll, Dixie Kullman, **Jit Muthuswamy**, Jennifer Blain-Christen, "Non-Invasive Transcutaneous Vagus Nerve Optogenetic Stimulato," invention disclosure filed on 2/2/2015.

BOOK CHAPTERS

J Muthuswamy, "Biomedical Signal processing: An overview," in *Standard Handbook of Biomedical Engineering and Design*, Ed. by Myer Kutz, chapter 18, pp. 18.1-18.30, *McGraw-Hill Publishers*, New York, NY, 2003.

A Sridharan* and **J Muthuswamy**, "Gene Injection & Manipulation Using CMOS based Technologies," (in press) in *CMOS Bio-microsystems*, Ed. Kris Iniewski, *Wiley Publishers Inc*., 2011.

J Muthuswamy and M Okandan, "MEMS Neural Probes," *Encyclopedia of Nanotechnology*, Ed by Bharat Bhushan, *Springer*, 2012.

BOOK PROJECTS (currently underway)

J Muthuswamy, "*Implantable microtechnologies for the brain: interconnects and packaging*," (approx. 200 pages) scheduled for completion on April 2012 with **Springer**. (ISBN: 978-1-4419-8519-4).

INVITED PRESENTATIONS

- J Muthuswamy (speaker), P Tran, R Rangarajan, DF Hanley and NV Thakor, "Resonant oscillations in the somatosensory pathway," Neuro-Critical Care Unit, Department of Neurology, **Johns Hopkins University**, Baltimore, MD, June 16, 1998.
- J Muthuswamy, "Resonant oscillations in the thalamo-cortical pathway," **Huntington Medical Research Institute**, Pasadena, CA, Dec. 98.
- J Muthuswamy (speaker), T Kimura, DF Hanley and NV Thakor, "Effect of ischemia on the somatosensory pathway," Neuro-Critical Care Unit, Department of Neurology, **Johns Hopkins University**, Baltimore, MD, Feb. 2, 1999.
- J Muthuswamy, "Electrophysiology of hypoxic-ischemic brain injury," Department of Biomedical Engineering, **Virginia Commonwealth University**, Richmond, VA, May, 1999.
- J. Muthuswamy, "Neurophysiology and microsystems engineering for thalamo-cortical studies," Dept. of Chem., Bio and Materials Engineering, **Arizona State University**, Tempe, AZ, April 2000.
- J Muthuswamy, "Neurophysiology and Microsystems engineering for thalamo-cortical studies," Department of Biomedical Engineering, **Louisiana Tech. Univ.**, Ruston, LA, April 20, 2000.

- J Muthuswamy, "Bio-MEMS in Neurophysiology," Department of Bioengineering, **Univ. of Florida, Gainesville**, FL, Nov. 19, 2003.
- J. Muthuswamy, ***Invited expert panelist*** to participate in a panel (total of 4-members) discussion on "*Technological Trends & Challenges in the Development of BioMEMS & Biosensor Applications,"* at the ***Sensors Expo and Conference***, May 20-23, 2002, San Jose, CA.
- J. Muthuswamy, "Deep Brain Stimulation Using Microactuated Microprobes," ***invited speaker for the plenary session*** titled "Novel Interface Technologies for Stimulation and Control" in the Neural Interfaces Workshop, Sept. 7-9, 2005, ***National Institute of Neurological Disorders & Stroke***, Bethesda, MD.
- J. Muthuswamy, "Micro actuated microelectrodes to assess cortical role in memory deficits," at the 6th **Annual Biosciences Leadership Symposium**, organized by the Arizona Biomedical Research Commission and the Flinn Foundation, Phoenix, AZ, June 12-13, 2006.
- J. Muthuswamy, "Neural Microsystems," Department of Bioengineering, **Louisiana Tech University,** Ruston, LA, Aug. 10, 2006.
- J. Muthuswamy, "Microelectrode arrays and Microdrives for Neural Sensing," at the pre-conference **workshop on "Innovative Neural Prostheses**," during the Annual International conference of the **IEEE Engineering in Medicine and Biology society**, New York, NY, Aug. 29, 2006.
- J. Muthuswamy, "Microsystems in Neural Engineering," Department of Electrical & Computer Engineering, **Texas Tech University**, Lubbock, TX, September 15, 2006.
- J. Muthuswamy, "Novel Microsystems for communication with single neurons," Biomedical Engineering seminar series, **University of Michigan**, Ann Arbor, Nov. 15, 2006.
- J. Muthuswamy, "Novel Microsystems for communication with the Brain," Biomedical Engineering Seminar series, **Purdue University**, West Lafayette, IN, Jan. 31, 2007.
- J. Muthuswamy, "Advanced technologies for clinical Neurology and Neuroscience," Neuroscience conference, Department of Neurology, **Mayo Clinic**, Scottsdale, Arizona simulcast to Mayo Clinic Hospital, August 29, 2007.
- J. Muthuswamy, ***invited panelist*** to participate in a panel discussion on "Digital health," at the International conference on MEMS packaging ***Interpack*** 2007, July 8-12, 2007, Vancouver, BC. Other participating panelists – Dr. Lei Mercado (Medtronic), Anthony Primavera (Boston Scientific), Rashid Bashir (Purdue).
- J. Muthuswamy, "Next generation devices for communication with the brain," in a session on "Novel Bioengineering devices," during Biozona 2008, held in Tuscon, AZ on April 8, 2008.
- J. Muthuswamy, "Novel microtechnologies for neuronal communication," Neural Engineering seminar at **Case Western Reserve University**, Cleveland, OH, March 21, 2008.
- J. Muthuswamy, "Novel microtechnologies for neuronal communication," Biomedical Engineering seminar, **University of California, Irvine**, CA, April 3, 2008.
- J. Muthuswamy, "CMOS assisted gene injection," in a session on "Nanotechnology" at the ***2008 CMOS Emerging Technologies Workshop*** in Vancouver, BC, Canada on Aug. 6th, 2008.
- J. Muthuswamy, invited to speak on "Bringing neurons and devices together in vivo using mechanical depth control of implanted microprobes," invited presentation in a focus session on "Focus Session: Intracortical Probes: How to get Probes and Neurons Together," at the **World Congress on Medical Physics and Biomedical Engineering**, Munich, Sept. 7-12, 2009.
- J Muthuswamy, "Packaging and Interconnects for Implantable MEMS devices," invited speaker at the 2010 **CMOS Emerging Technologies Workshop** in Whistler, BC, Canada on May 19-21, 2010.
- J Muthuswamy, invited to speak at the session on "Micromotion and its Effects on Long-Term Viability of Brain-Machine Interfaces," in the **Neural Interfaces conference**, June 20-23, 2010, Long Beach, CA.
- J Muthuswamy, "Engineering Adaptive Neural Interfaces," invited speaker at the seminar series in Biomedical Engineering, **University of Arizona**, Tucson, AZ on Sept. 13, 2010.
- J Muthuswamy, "Implantables for the brain," invited speaker at the Annual **MEPTEC/SMTA Medical Electronics Symposium**, held at Arizona State University, Tempe, AZ on Sept. 22-23, 2010.
- J Muthuswamy, "Adaptive Interfaces for Long-term Communication with Neurons in the Brain," **National Nanotechnology Infrastructure Network** (NNIN) Symposium in *Organic/Inorganic*

Interfaces and Health Science Applications, at the Biodesign Institute, Arizona State University, Tempe, AZ on January 13th -14th, 2011.

- J Muthuswamy, "Adaptive Neural Interfaces: Challenges and opportunities," **Biomedical Engineering Seminar**, **University of Houston**, Houston, TX, March 14, 2011.
- J Muthuswamy, "Implantable Microtechnologies for the brain – challenges and strategies for reliable operation," **IEEE International Reliability Physics Symposium**, April 12-14, 2011, Monterey, CA.
- J Muthuswamy, "Adaptive Neural Interfaces," **Department of Defense research planning workshop** on Human Performance Augmentation, hosted by Security and Defense Systems Initiative (SDSI), Arizona State University, Tempe, AZ, March 1-2, 2012.
- J Muthuswamy, "Neural interfaces for next generation prostheses," at the Division of Plastic Surgery, Beth Israel Deaconess Hospital, **Harvard Medical school and Massachusetts Institute of Technology** (MIT), Boston, MA, May 15, 2012.
- J Muthuswamy, "Robotic neural interfaces," at **BAE Systems**, Boston, MA, May 16, 2012.
- J Muthuswamy, "Robotic implants for the brain," at the **CMOS Emerging Technologies** meeting, Vancouver, BC, Canada, July 18-21, 2012.
- J Muthuswamy, "Microscale Robots for Stable Neural Interfaces," at the ***Symposium on Grand Challenges in Neural Technology 2013" in Singapore*** on Dec. 4, 2013.
- Jit Muthuswamy, "Balanced life – finding time to do what is important," ***Winds of Change conference*** organized by Faculty Bridges, Feb. 22, 2014.
- J Muthuswamy, "Packaging and Interconnect Challenges with MEMS for Chronic Brain Implants," at the 36th Annual International conference of the ***IEEE Engineering in Medicine and Biology Society***, Chicago, IL, Aug. 29, 2014.
- J Muthuswamy, "Robotic, optical and wireless neural interface technologies for recording and stimulation of single neurons," **DARPA ElectRx proposer's day meeting**, Washington DC, Dec. 16, 2014.

CONFERENCE ABSTRACTS & PRESENTATIONS (in reverse chronological order; *- mentored students)

1. A Sridharan* and J Muthuswamy, "Soft, brain-like neural interfaces yield stable electrical impedances in long-term experiments," IEEE EMBS BRAIN Grand Challenges conference, Washington DC, Nov. 13-14, 2014. (Won a **honorable mention in the Young Investigator award** competition)
2. S Palaniswamy* and J Muthuswamy, "Mechanical interconnects to enable autonomous movable microelectrodes to record and stimulate single neurons in deep brain structures," IEEE EMBS BRAIN Grand Challenges conference, Washington DC, Nov. 13-14, 2014.
3. A Shah*, J Smith, J Blain-Christen and J Muthuswamy, "Optogenetic Stimulation of Primary Neurons using Novel OLEDs," IEEE EMBS BRAIN Grand Challenges conference, Washington DC, Nov. 13-14, 2014.
4. A Sridharan*, A Karpur* and J Muthuswamy, "Dynamics of Neuromodulation by Gene Silencing in Neuronal Networks In Vitro," IEEE EMBS BRAIN Grand Challenges conference, Washington DC, Nov. 13-14, 2014.
5. S Sampath Kumar* and J Muthuswamy, "Autonomous, movable interfaces for intracellular recording," IEEE EMBS BRAIN Grand Challenges conference, Washington DC, Nov. 13-14, 2014.
6. J Muthuswamy, "Packaging and Interconnect Challenges with MEMS for Chronic Brain Implants," 36th Annual International Conference of the IEEE EMBS, Chicago, August 26-30, 2014.
7. J Muthuswamy, M Okandan, B Towe, J Smith and J Blain-Christen, "Robotic, optical and wireless neural interface technologies for recording and stimulation of single neurons," DARPA ElectRx proposer's day meeting, Washington DC, Dec. 16, 2014.
8. S Anand, S Sampath Kumar and J Muthuswamy, "Closed-loop control for microscale robotic neural interfaces," 6th International IEEE EMBS Conference on Neural Engineering, San Diego, CA, Nov. 6-8, 2013.

9. A Sridharan, R Murty and J Muthuswamy, "Gel-based Mimics for Tissue-Electrode Interfaces in the Brain Under Chronic Conditions," 6th International IEEE EMBS Conference on Neural Engineering, San Diego, CA, Nov. 6-8, 2013.
10. A Sridharan and J Muthuswamy, "Electromodulated Delivery of BACE1 siRNA to Primary Neurons in Culture Restores Electrical Function in Alzheimer's Disease Models," 6th International IEEE EMBS Conference on Neural Engineering, San Diego, CA, Nov. 6-8, 2013.
11. S Anand, S Sampath Kumar and J Muthuswamy, "Biomechanical issues in autonomous positioning of microelectrodes in brain tissue," Annual meeting of the Society for Neuroscience, San Diego, CA, Nov. 9-13, 2013.
12. A Sridharan* and J Muthuswamy, "Tunable gene expression in neurons using voltage preconditioning," Annual meeting of the Society of Neuroscience, New Orleans, LA, Oct. 13-17, 2012.
13. M Khraiche* and J Muthuswamy, "Multifunctional biochip for simultaneous, real-time measurement of adhesion and electrical activity of neurons in culture," Annual meeting of the Society of Neuroscience, New Orleans, LA, Oct. 13-17, 2012.
14. M Khraiche* and J Muthuswamy, "Monitoring integrin-mediated adhesion and electrical activity of neurons simultaneously using a multi-modal biochip in neuronal cultures," Annual meeting of the Biomedical Engineering Society, Atlanta, GA, Oct. 24-27, 2012.
15. A Sridharan*, C Patel and J Muthuswamy, "Controllable siRNA Loading in neurons using voltage preconditioning," Annual meeting of the Biomedical Engineering Society, Atlanta, GA, Oct. 24-27, 2012.
16. C Patel* and J Muthuswamy, "High-throughput transfection of precisely targeted primary neurons using microscale electroporation," Annual meeting of the Biomedical Engineering Society, Atlanta, GA, Oct. 24-27, 2012.
17. S Anand, S Sampath Kumar and J Muthuswamy, "Impact of brain hyper-elasticity and viscoelasticity on microelectrode navigation for tracking targeted neurons," Neural Interfaces Conference, Salt Lake city, UT, June 18-20, 2012.
18. J Sutanto*, S Anand*, A Sridharan*, R Korb*, L Zhou*, M Baker, M Okandan, and J Muthuswamy, "Flip-chip based packaging for linear ratcheting microactuators enables 3D stacks of movable microelectrodes for the brain," Hilton Head Solid-state sensors, actuators and microsystems workshop, Hilton Head, SC, June 3-7, 2012.
19. C Patel*, A Sridharan* and J Muthuswamy, "Targeted delivery of siRNA molecules in primary neuronal culture using an optically transparent MEA based biochip," Annual meeting of the Society for Neuroscience, Washington DC, Nov. 12-16, 2011.
20. S Anand*, K Seyedmadani*, J Sutanto*, A Sridharan* and J Muthuswamy, "Stability of neural signal recordings from movable microelectrode arrays," Annual meeting of the Society for Neuroscience, Washington DC, Nov. 12-16, 2011.
21. J Muthuswamy, A Sridharan* and Y Na*, "Understanding the Brain Tissue-Microelectrode Interface for Neural Implants Under Long-Term Conditions," Annual meeting of the Society for Neuroscience, Washington DC, Nov. 12-16, 2011.
22. A Sridharan*, C Patel* and J Muthuswamy, "Development of a Rapid, Dose-Dependent, Therapeutic Assessment Platform for Neurons," Annual meeting of the Society for Neuroscience, Washington DC, Nov. 12-16, 2011.
23. J Sutanto*, R Korb*, M Baker, M Okandan and J Muthuswamy, "Novel 3D Stacking Approach for MEMS Microelectrodes to Create High Density Neural Interfaces," Annual meeting of the Biomedical Engineering Society, Hartford, CT, Oct. 12-15, 2011.
24. A Sridharan* and J Muthuswamy, "Mechanics of the Brain Tissue-Microelectrode Interface in Neural Prostheses," Annual meeting of the Biomedical Engineering Society, Hartford, CT, Oct. 12-15, 2011.
25. A Sridharan*, N Jackson*, S Anand*, M Baker, M Okandan, and J Muthuswamy, "Assessment of long-term neural recordings from rodents using MEMS based moveable microelectrodes," Annual meeting of the Society for Neuroscience, San Diego, CA, Nov. 13-17, 2010.

26. C Patel, A Sridharan and J Muthuswamy, "A novel biochip for the controlled delivery of siRNA molecules to a targeted population of primary neurons in a culture," Annual meeting of the Society for Neuroscience, San Diego, CA, Nov. 13-17, 2010.
27. C Patel, A Sridharan and J Muthuswamy, "A novel biochip for site-specific transfection of cells in a culture," Annual meeting of the Biomedical Engineering Society, Austin, TX, Oct. 6-9, 2010.
28. J Sutanto, S Anand, J Muthuswamy, "The development of a chip scale flip chip packaging with flexible interconnect for implantable MEMS devices in the rat brain," presented at the Neural Interfaces conference, Long Beach, CA, June 20-23, 2010.
29. J Sutanto, S Anand and J Muthuswamy, "Novel packaging and Interconnect Techniques for Implantable MEMS devices for the brain," presented at the Annual meeting of the Biomedical Engineering Society, Austin, TX, Oct. 6-9, 2010.
30. A Sridharan, N Jackson, S Anand, M Baker, M Okandan and J Muthuswamy, "Long-term Neural Recordings Using MEMS based Moveable Microelectrodes," presented at the Neural Interfaces conference, Long Beach, CA, June 20-23, 2010.
31. K Seyedmadani, V Pizziconi, J Muthuswamy and SH Tillery, "The design of cost-efficient prosthetic gripper spring powered rotary (SPR) prosthetics," presented at the Annual meeting of the Biomedical Engineering Society, Austin, TX, Oct. 6-9, 2010.
32. A Sridharan*, J Muthuswamy and V Pizziconi, "Biohybrid Photoelectrochemical Nanoengineered Interfaces," MRS Spring Meeting Symposium OO proceedings, San Francisco, CA, Apr 13-17, 2009.
33. J Muthuswamy, N Jackson* and M Okandan, "Semi-chronic multi-unit recordings using silicon MEMS based movable microelectrodes," presented at the Nanosymposium on Neuroprosthetics II, Annual meeting of the Society of Neuroscience, Chicago, IL, Nov. 15-19, 2009.
34. M Khraiche*, N Jackson* and J Muthuswamy, "Early Onset of Electrical Activity in Developing Neurons Cultured on Carbon Nanotube Immobilized Microelectrodes," presented at the annual meeting of the IEEE Engineering in Medicine and Biology Society (EMBS), Minneapolis, MN, Sept. 2-6, 2009.
35. M Khraiche*, N Jackson*, and J Muthuswamy, "Early Onset of Electrical Activity in Developing Neurons Cultured on Carbon Nanotube Immobilized Microelectrodes," presented at the 10th Annual University of California Systemwide Bioengineering Symposium, held at Merced, CA, June 19-21, 2009.
    (Massoud Khraiche was awarded **first place** for distinguished oral presentation)
36. M. Khraiche*, W. Phillips*, N Jackson*, and J Muthuswamy "Effects of high frequency ultrasound on electrical excitability of developing single neurons," presented at the Annual meeting of the Society of Neuroscience, Washington DC, Nov. 15-19, 2008.
37. P Stice*, J Lawler*, N Jackson* and J Muthuswamy, "Glial scarring in response to movable microimplants in the brain," presented at the Annual meeting of the Society of Neuroscience, Washington DC, Nov. 15-19, 2008.
38. N Jackson* and J Muthuswamy, "Novel Flexible Interconnect and Packaging for MEMS-based Movable Brain Probes", 5th International Conference and Exhibition of the International Microelectronics and Packaging Society (IMAPS) on Device Packaging, Scottsdale, AZ, March 8-9, 2008.
    (**won the 1st place award for the best student research poster**)
39. N Jackson* and J Muthuswamy, "Flexible Interconnect and Packaging for MEMS Moveable Neural Microelectrodes," presented at the 41st Annual International Microelectronics and Packaging Society (IMAPS) Symposium in Providence, RI, Nov. 2-6, 2008.
    (selected as **one of two outstanding papers** of the conference)
40. N Jackson* and J Muthuswamy, "Flexible Interconnect and Packaging for MEMS Moveable Neural Microelectrodes," presented at the Neural Interfaces Conference, Cleveland, OH, June 16-18, 2008.
41. N Jackson*, P Stice*, M Okandan and J Muthuswamy, "Movable MEMS polysilicon microelectrodes for long-term single neuronal recordings," presented at the Neural Interfaces Conference, Cleveland, OH, June 16-18, 2008.
42. M Khraiche*, W Phillips*, N Jackson* and J Muthuswamy, "Ultrasound induced increase in excitability of single neurons," Annual meeting of the IEEE Engineering in Medicine and Biology Society (EMBS), Vancouver, BC, Canada, August 20-24, 2008.

43. A Sridharan*, J Muthuswamy and V Pizziconi, “Energy Transfer Dynamics of F-Chlorosomes in an Electrochemical Cell,” Joint Meeting of the Biophysical Society (52nd Annual Meeting) and 16th International Biophysics Congress (IUPAB), Long Beach, CA, Feb 2-6, 2008.
44. A Sridharan*, J Muthuswamy and V Pizziconi, “Novel Photoelectrochemical Cell Using Bacterial Light Antenna Structures,” Fall meeting of Materials Research Society, Boston, MA, Nov. 26-27, 2007.
45. R Saha* and J Muthuswamy, “Polysilicon thin film based implants for single neuronal recording/stimulation,” Fall meeting of Materials Research Society, Boston, MA, Nov. 26-27, 2007.
46. N Jackson* and J Muthuswamy, “Flexible interconnect and packaging for MEMS based moveable neural probes,” Annual meeting of the Biomedical Engineering Society, Los Angeles, CA, Sept. 26-29, 2007.
47. M Khraiche*, C Pauken and J Muthuswamy, “Monitoring focal contacts and adhesion of neuroblastoma and primary neurons using acoustic sensors," Annual meeting of the Biomedical Engineering Society, Los Angeles, CA, Sept. 26-29, 2007.
48. N Jackson*, P Stice*, M Okandan and J Muthuswamy, “Electro-thermally actuated MEMS probes for long-term single neuronal recordings,” Annual meeting of the Biomedical Engineering Society, Los Angeles, CA, Sept. 26-29, 2007.
49. P Stice*, N Jackson*, M Okandan and J Muthuswamy, “Immunohistological assessment of implant site of movable polysilicon microelectrodes in the brain,” Annual meeting of the Biomedical Engineering Society, Los Angeles, CA, Sept. 26-29, 2007.
50. T Wang*, M Khraiche* and J Muthuswamy, “Design and development of novel microacoustic sensors with optimal electrode dimensions,” Annual meeting of the Biomedical Engineering Society, Los Angeles, CA, Sept. 26-29, 2007.
51. T Wang* and J Muthuswamy, “Acoustic Immunosensor for Direct Measurement of Neurotransmitter GABA,” Annual meeting of the Biomedical Engineering Society, Los Angeles, CA, Sept. 26-29, 2007.
52. A Sridharan*, J Muthuswamy and V Pizziconi, “Photoelectrochemical Characterization of Indium Tin Oxide Electrodes For Biophotonic Applications," Annual meeting of the Biomedical Engineering Society, Los Angeles, CA, Sept. 26-29, 2007.
53. P Stice*, N Jackson*, M. Okandan and J Muthuswamy, “Assessing GFAP expression around MEMS based movable microprobes in the brain,” Annual meeting of the Society for Neuroscience, San Diego, CA, Nov. 3-7, 2007
54. N Jackson*, P Stice*, M Okandan and J Muthuswamy, “Long-term cortical multi-unit recordings using MEMS based movable microelectrodes,” Annual meeting of the Society for Neuroscience, San Diego, CA, Nov. 3-7, 2007.
55. M Khraiche* and J Muthuswamy, “Assessing dynamics of primary cortical neuronal adhesion in culture,” Annual meeting of the Society for Neuroscience, San Diego, CA, Nov. 3-7, 2007.
56. A Sridharan*, J Muthuswamy and V Pizziconi, “Bioelectronic interfacing of nanoscaled F-chlorosomes for a photoelectric sensor,” Nano & Giga Challenges in Electronics and Photonics, Phoenix, AZ, March 12-16, 2007.
57. A Sridharan*, J Muthuswamy, J LaBelle and V Pizziconi, “Characterization of covalently immobilized chlorosomes on indium-tin-oxide conductive glass substrate,” 51st Annual Meeting of Biophysical Society, Baltimore, MD, March 3-7, 2007.
58. T Jain* and J Muthuswamy, “Spatio-temporally controlled transfection of nucleic acid payloads in cell-culture,” 3rd International IEEE EMBS Conference on Neural Engineering of the IEEE Engineering in Medicine and Biology Society, Kohala Coast, Hawaii, USA, May 2-5, 2007.
59. N Jackson*, P Stice*, M Okandan and J Muthuswamy, “Long-term cortical recordings with microactuated microelectrodes,” 3rd International IEEE EMBS Conference on Neural Engineering of the IEEE Engineering in Medicine and Biology Society, Kohala Coast, Hawaii, USA, May 2-5, 2007.
60. A Sridharan*, J Muthuswamy, J LaBelle and V Pizziconi, “A novel hybrid nano-biophotonic device,” Western Biomedical Engineering Conference, Nov. 10,2006, Phoenix, AZ.
61. R Saha* and J Muthuswamy, “Optimal polysilicon films for single neuronal recording and stimulation,” Annual conference of the BMES, Oct. 11-14, 2006, Chicago, IL.
62. M Khraiche* and J Muthuswamy, “Acoustic resonators to monitor changes in focal adhesion points in neuronal adhesion,” Annual conference of the BMES, Oct. 11-14, 2006, Chicago, IL.

63. P Stice* and J Muthuswamy, “Quantitative assessment of gliosis around long-term neural implants,” Annual meeting of the Society for Neuroscience, Oct. 14-18, 2006, Atlanta, GA.
64. R Saha and J Muthuswamy, “Ion implanted LPCVD polysilicon thin films for neuroelectronics devices”, Materials Research Society Spring meeting, San Francisco, CA, April 17 - 21, 2006.
65. R Saha* and J Muthuswamy, "Mechanical stress in the brain tissue due to relative micromotion between implants and the brain," Annual conference of the BMES, Sept. 28-Oct. 1, 2005, Baltimore, MD.
66. T Jain* and J Muthuswamy, "Microsystems for spatiotemporal control over delivery of exogeneous molecules to adherent cells," Annual conference of the BMES, Sept. 28-Oct. 1, 2005, Baltimore, MD.
67. J Muthuswamy, M Okandan, M Baker, and N Jackson*, "Steerable microelectrodes for neuronal communication," Annual conference of the BMES, Sept. 28-Oct. 1, 2005, Baltimore, MD.
68. T. Wang*, G. Ehteshami, S. Massia and J. Muthuswamy, "GABA immobilized surfaces for assessing biofunctionality of GABA," Annual conference of the BMES, Sept. 28-Oct. 1, 2005, Baltimore, MD.
69. J. Muthuswamy, M. Okandan and N. Jackson*, "Neural microelectrodes that move," Annual meeting of the Society for Neuroscience, Nov. 12-16, 2005, Washington DC.
70. T. Wang*, J. Si, and J. Muthuswamy, "An acoustic platform for studying binding kinetics of neurotransmitter γ-aminobutyric acid (GABA)," Annual meeting of the Society for Neuroscience, Nov. 12-16, 2005, Washington DC.
71. J. Muthuswamy, M. Okandan, A. Gilletti*, M. Baker, and N. Jackson* and T. Jain,"Movable microprobes for the brain," 3rd Annual IEEE EMBS Special Topic Conference on Microtechnologies in Medicine and Biology, May 12-15, 2005, Oahu, Hawaii.
72. R. Saha*, A. Gilletti* and J. Muthuswamy, "Tissue Micromotion Induced Stress around Brain Implants," 3rd Annual IEEE EMBS Special Topic Conference on Microtechnologies in Medicine and Biology, May 12-15, 2005, Oahu, Hawaii.
73. J Muthuswamy, A Gilletti*, T Jain* and M Okandan, “Microactuated Neural Probes to Compensate for Brain Micromotion,” Annual International conference of the IEEE EMBS, Sept. 17-21, 2003, Cancun, Mexico.
74. T Wang* and J Muthuswamy, “Acoustic Immunosensor for Real-time Sensing of Neurotransmitter GABA,” Annual International conference of the IEEE EMBS, Sept. 17-21, 2003, Cancun, Mexico.
75. PJ Stice*, A Panitch and J Muthuswamy, “Improved Viability of Chronic Neural Implants Using Thin Microelectrodes,” Annual International conference of the IEEE EMBS, Sept. 17-21, 2003, Cancun, Mexico.
76. M Khraiche*, A Zhou* and J Muthuswamy, “Acoustic Sensors for Monitoring Neuronal Adhesion in Real-Time,” Annual International conference of the IEEE EMBS, Sept. 17-21, 2003, Cancun, Mexico.
77. T Wang* and J Muthuswamy, “Real-time Sensing and Regeneration of GABA Sensor,” Annual meeting of BMES, Oct. 1-4, 2003, Nashville, TN.
78. A Gilletti*, T Jain* and J Muthuswamy, “Physiological Micromotion in the Somatosensory Cortex,” Annual meeting of BMES, Oct. 1-4, 2003, Nashville, TN.
79. M Khraiche* and J Muthuswamy, “Real-time acoustic sensor for Neuronal adhesion,” Annual meeting of BMES, Oct. 1-4, 2003, Nashville, TN.
80. A.C. Gilletti*, T. Jain*, M. Okandan, J. Muthuswamy. “Overcoming brain micromotion in chronic neural implants,” Program No. 429.21. *2003 Abstract Viewer/Itinerary Planner*. Washington, DC: Society for Neuroscience, Nov. 8-12, 2003.
81. A Zhou* and J Muthuswamy, “Molecular recognition of neurotransmitter GABA using acoustic sensors,” Joint Meeting of the IEEE Engineering in Medicine and Biology Society And the *Biomedical Engineering Society*, Oct. 23-26, 2002, Houston, TX.
82. J Muthuswamy, D Salas and M Okandan, “A chronic micropositioning system for Neurophysiology,” Joint Meeting of the IEEE Engineering in Medicine and Biology Society And the *Biomedical Engineering Society*, Oct. 23-26, 2002, Houston, TX.
83. A Hensley* and J Muthuswamy, “Ultrasound induced permeabilization of cell membranes as a therapy for cytotoxic neuronal edema,” Joint Meeting of the IEEE Engineering in Medicine and Biology Society And the *Biomedical Engineering Society*, Oct. 23-26, 2002, Houston, TX.

84. A Zhou*, S Dluzansky and J Muthuswamy, "Novel acoustic immunosensor for detecting GABA," Annual meeting of the *Society for Neuroscience*, Nov. 1-5, 2002, Orlando, FL.
73. J Muthuswamy, D Salas and M Okandan, "MEMS-based micropositioning system for tracking single neurons in behaving animals," Annual meeting of the *Society for Neuroscience*, Nov. 1-5, 2002, Orlando, FL.
74. P Stice*, A Panitch, J He and J Muthswamy, "PGA coated thin neural implants to minimize gliosis," Annual meeting of the Society for Neuroscience, Nov. 1-5, 2002, Orlando, FL.
75. T. Wang* and J. Muthuswamy, "Statistical modeling and Analysis of Thalamic Oscillations," Annual meeting of *Biomedical Engineering Society*, Oct. 4-7, 2001, Durham, NC.
76. A. Hensley*, W. Phillips and J. Muthuswamy, "Ultrasound induced permeabilization of cell membrane as a therapy for cytotoxic neuronal edema," Annual meeting of *Biomedical Engineering Society*, Oct. 4-7, 2001, Durham, NC.
77. J. Muthuswamy, J. Williams, D. Kipke, "Chronic mouse neural recording in mice: methods and applications," Annual meeting of *Biomedical Engineering Society*, Oct. 4-7, 2001, Durham, NC.
78. T. Wang* and J. Muthuswamy, "A non-homogeneous binomial model for Thalamic oscillations," Annual meeting of the IEEE *Engineering in Medicine and Biology society*, Oct. 25-28, 2001, Istanbul, Turkey.
79. P George, J Muthuswamy, J Currie, NV Thakor and M Paranjape, "Sensing nitric oxide neuronal messengers using screen printed carbon micro-electrode arrays," presented at *Transducers 2001*, June 10-14, Munich, Germany.
80. J Muthuswamy, M Okandan, J Jakubczak, P McWhorter, G Moriwaki, DF Hanley and NV Thakor, "Surface micromachined polysilicon probes for Neurophysiology," presented as a Late News poster at the Hilton Head 2000, *Sensor & Actuator Workshop*, June 4-8, 2000 at Hilton Head Island, SC.
81. J Muthuswamy, M Okandan, and NV Thakor, "Surface Micro-Machined Polysilicon Probes for Neurophysiology," abstract submitted for the *World Congress on Med. Physics and Biomed. Eng.*, July 23-28, 2000 at Chicago, IL.
82. M Meyer, P George, A. Bandhyopadhyay, J Muthuswamy and NV Thakor, "A microfabricated drug delivery and electro-chemical sensing device for neural recordings," abstract submitted for the *World Congress on Med. Physics and Biomed. Eng.*, July 23-28, 2000 at Chicago, IL.
83. T Kimura, RG Geocadin, J Muthuswamy, R Gaiki, G Moriwaki, J Chao, NV Thakor, and DF Hanley, "Early neuronal injury in the RT nucleus and SEP recovery after transient global ischaemia in rats," presented at the *52nd Annual meeting of Amer. Acad. of Neurology*, May 2000 at San Diego, CA.
84. J Muthuswamy, M Okandan, J McBrayer, G Moriwaki, DF Hanley, and NV Thakor, "Polysilicon Microprobe for Recording Action Potentials in the Brain," presented at the annual meeting of the *Biomedical Engineering Society*, Oct. 12-14, 2000 at Seattle, WA.
85. J Muthuswamy, D Sherman and NV Thakor, "Message from the Brain." Presented at the *ICMDTP International Conf.*, Dec. 1999 at Chennai, India.
86. NV Thakor, M Meyer, P George, A Bandyopadhyay and J Muthuswamy, "Medical Microsystems." Presented at the *ICMDTP International Conf.*, Dec. 1999 at Chennai, India.
87. DL Sherman, J Muthuswamy, MJ Hinich and NV Thakor, "Detecting low frequency modulations in multi-neuronal action potentials using spectral correlation," *Proc. Of the European Med. & Biol. Eng. Conf.*, vol. 37, suppl. 2, pp.426-427, 1999 at Vienna, Austria.
88. RG Geocadin, J Muthuswamy, NV Thakor and DF Hanley, "Early Electrophysiological and histological changes after global cerebral ischemia in rats." Presented at the *Workshop on post-hypoxic myoclonus*, sponsored by NINDS, NIH, Myoclonus Research foundation and UCB pharma Inc., March, 1999 at Washington DC.
89. J Muthuswamy, T. Kimura, R. Singhal, DF Hanley and NV Thakor, "Thalamo-cortical dissociation after prolonged global hypoxic-ischemic injury." *Soc. for Neurosci. Conf.*, abstract # 876.9, pp. 2195, 1999 at Miami, FL.
90. J Muthuswamy, DF Hanley and NV Thakor, "Monitoring thalamocortical pathways during recovery from brain injury." Presented at the *Analysis of Neural Data Workshop*, Aug. 17th – 29th, 1998 at Woods Hole, MA.

91. J Muthuswamy, DF Hanley and NV Thakor, "Synchronous oscillations in the thalamic VPL nucleus under low frequency somatosensory stimulation." Presented at the *6th annual Dynamical Neuroscience Satellite Symposium on "Beyond Neurons and Synchrony," at the Soc. for Neurosci. Conf.,* 1998 at Los Angeles, CA.
92. J Muthuswamy, P Tran, M Kim, DF Hanley and NV Thakor, "Stimulus frequency and intensity dependent gating of the somatosensory pathway in barbiturate anesthetized rats." *Soc. for Neurosci. Conf.*, abstract #55.9, pp. 129, 1998 at Los Angeles, CA.
93. J Muthuswamy, D Sherman, MJ Hinich and NV Thakor, "Spectral correlation of action potential firing rates after hyxpoxic-ischemic brain injury." *Proc. of IEEE Eng. in Med. and Biol., 20th Annual Intl. Conf.,* pp. 2020-2022, 1998 at Hong Kong, China.
94. J Muthuswamy, JKT Chao, D Sherman and NV Thakor, "Characteristics of thalamic multi-unit activity and EEG during recovery from asphyxia." Poster presented at the *19th Annual Intl. Conf. of IEEE Eng. in Med. and Biology,* 1997 at Chicago, IL.
95. J Muthuswamy, D Sherman and NV Thakor, "Bispectral analysis of EEG burst patterns from piglets during recovery from asphyxia." *Proc. of IEEE Eng. in Med. and Biology, 18th Annual Intl. Conf.,* pp.853, 1996 at Amsterdam, Netherlands.
96. J Muthuswamy, D Sherman and NV Thakor, "Higher order spectral analysis of burst patterns in EEG during recovery from asphyxia." *Annual meeting of Biomed. Eng. Soc.,* abstract 414, 1996 at State College, PA.
97. J Muthuswamy and RJ Roy, "AR parameters of EEG and anesthetic concentration in multiple neural networks to detect depth of anesthesia." *Proc. Ohio Aerospace Inst. neural networks symposium and workshop,* Aug. 1995, Ohio, USA.
98. RJ Roy and J Muthuswamy, "A neural network analysis of the bispectrum in determining depth of anesthesia in the dog." Anesthesia and Analgesia, vol.80, No.2S, Feb. 1995, S407 (Abstract of poster presented at *International anesthesia research society,* 69th Clinical and Scientific congress, Hawaii, March 1995).
99. J Muthuswamy and RJ Roy, "Predicting depth of anesthesia using Bispectral parameters in a neural network." *Proc. of IEEE Eng. in Med. and Biology, 16th Annual Intl. Conf.,* pp. 1087-1088, 1994 at Baltimore, MD.
100. A Nayak, J Muthuswamy and RJ Roy, "Neural net based prediction of depth of anesthesia." Proc. of *Artificial Neural Networks in Engg Conf.,* vol. 4, pp.663-668, Nov. 1994, St. Louis, Missouri. (Publ. ASME Press)
101. J Muthuswamy and RJ Roy, "Bispectrum analysis of EEG of a dog to determine the depth under halothane anesthesia." Proc. *of 19th IEEE Annual Northeast Bioeng. Conf.,* pp. 5-6, 1993, at Newark, NJ.

CONFERENCES AND TECHNICAL SESSIONS CHAIRED

- Chair of "*Bio-signal processing"* session in the IEEE-EMBS International Conf., Chicago, 1997.
- Co-chair of "*Neuronal Coding"* session in the Joint Annual International Conf. of IEEE-EMBS and BMES at Atlanta, Oct. 1999.
- Co-chair of "*Chronic Neural implants"* session in the Annual Meeting of the Biomedical Engineering Society, at Durham, NC, Oct. 4-7, 2001.
- Co-chair of "Neural sensors" session at the Joint annual meeting of the IEEE Engineering in Medicine and Biology society and Biomedical Engineering Society, Oct. 23-26, 2002, Houston, TX.
- Co-chair of "*Nano- and Micro-neurotechnology*," session at the Annual meeting of the IEEE Engineering in Medicine and Biology Society, Sept. 17-21, 2003, Cancun, Mexico.
- Co-chair of "*Neural recording and stimulation*," session at the Annual meeting of the Biomedical Engineering society, Oct. 1-4, 2003, Nashville, TN.
- Co-chair of "Neural signal and information processing," session at the Annual meeting of the Biomedical Engineering Society, Sept. 28 - Oct. 1, 2005, Baltimore, MD.

- **Program Co-chair** of IEEE/ICME International conference on Complex Medical Engineering, Tempe, AZ, April 9-11, 2009.
- Chair of "Materials and Medicine" session in the International symposium on Integrated functionalities (sponsored by the Materials Research Society), Dallas, TX, July 29-31, 2013**.**

OTHER PROFESSIONAL ACTIVITIES

Associate Editor (Emeritus) - IEEE Transactions on Neural Systems and Rehabilitation Engineering
Honorary Editorial board – Medical devices: Evidence and Research, Dove Press
Honorary Editorial board – Eye and Brain, Dove Press
Review Editor, Frontiers in Neuroengineering

Reviewer for:

- *Funding agencies* - National Science Foundation IGERT panel, NSF BES division review panelist and National Institutes of Health, Neurotechnology (NT) study section, BNVT study section.

- *Journals* - IEEE Transactions on Biomedical Engineering, IEEE Transactions on Neural Systems and Rehabilitation Engineering, Journal of Neural Engineering, Journal of Neurophysiology, Synapse, Annals of Biomedical Engineering, Journal of Clinical Monitoring, Brain Research, Experimental Brain Research, Sensors and Materials, IEE proceedings of nanobiotechnology, Sensors and Materials, Biomaterials, PLoS ONE Computational Biology, Acta Biomaterilia, Journal of Micro/Nanolithography, MEMS, and MOEMS.

DOCTORAL STUDENTS

Graduated

Role - primary mentor and chair of dissertation committee

1. Tingting Wang - "Developing biofunctional platforms for functional assessment of neurotransmitter GABA," graduated with PhD in **Bioengineering** in **May 2007** (currently post-doc in Biomedical Engineering at Univ. of California, Irvine).
2. Tilak Jain - "Microsystems for spatiotemporal control over delivery of exogeneous molecules to adherent cells," graduated with PhD in **Bioengineering** in **May 2007**. (currently Senior Scientist, Illumina Inc., San Diego, CA)
3. Rajarshi Saha - "Optimal polysilicon interfaces for single neuronal stimulation and recording," graduated with PhD in **Electrical Engineering** in **February 2008**. (currently Senior packaging Engineer with Soraa Inc., CA)
4. Paula Stice - "Assessment of the reactive astrocyte responses around fixed and moveable chronic microimplants in the brain," graduated with PhD in **Bioengineering** in **Jan 2009** (currently patent examiner at US Patent and Trademark Office, Washington DC).
5. Nathan Jackson - "Chronic neural recordings in the brain using novel flexible packaged moveable MEMS microelectrode arrays," graduated with PhD in **Bioengineering** in **May 2009**. (currently Research Associate at Tyndall Institute, Ireland)
6. Massoud Louis Khraiche – "Novel biochip for simultaneously monitoring mechanical and electrical properties of neurons in vitro," graduated with PhD in **Bioengineering** in **July 2009**. (currently Project Scientist in Bioengineering at Univ. of California, San Diego, CA).
7. Chetan Patel – "Microscale electroporation for transfection of genetic constructs into adherent secondary cells and primary neurons in culture," graduated with PhD in **Bioengineering** Dec. 2012. (currently with Medtronic Inc., Tempe, AZ)
8. Celeste Fralick – "A Statistical Clinical Decision Support Tool For Determining Thresholds in Remote Monitoring Using Predictive Analytics," graduated with PhD in Bioengineering in **May 2013**. (currently Principal Engineer, Intel).
9. Sindhu Anand – "Closed-loop control for micro-robotic neural interfaces," graduated with PhD in Bioengineering in **December 2013** (currently Technology development engineer with Intel, Portland, OR).

Role - co-mentor and co-chair of dissertation committee

1. William Phillips – "High frequency ultrasound alterations of the electrical activation of neural tissue," (co-advisor – Dr. Bruce Towe), graduated with PhD in **Bioengineering** in **August 2008**.
2. Arati Sridharan – "An Analysis of Chlorosomes—Exploring Structural & Functional Properties of Light Antenna Structures Derived from *Chloroflexus aurantiacus* for Exploitation in Bioelectronic Devices.**"** (co-advisor – Dr. Vincent Pizziconi), graduated with PhD in **Bioengineering** in **April 2009**. (currently post-doc with myself at Arizona State Univ., Tempe, AZ).
3. Steven Bellinger – "Modeling the direct effects of induced electric fields on axon membranes in the brain," graduated with PhD in Bioengineering in **March 2009.**
4. Didem Yamak (co-advisor – Dr. Metin Akay) – "Characterization of Coronary Atherosclerotic Plaques by Dual Energy Computed Tomography," graduated with PhD in Bioengineering in **May 2013**.

Current PhD students

Role - primary mentor and chair of dissertation committee

1 Swathy Sampath Kumar – PhD student joined in Fall 2012.
2 Yuri Vozyanov – PhD student joined in Fall 2015.

Role – doctoral thesis committee member

1. Chin Lip Ket (External examiner), Nanyang Technological University, Singapore, 2012
2. Chow Tzu Hao (External examiner), Nanyang Technological University, Singapore, 2011
3. Brent Winslow (External committee member), Univ. of Utah, Salt Lake city, Utah, 2010.
4. John Paderi (stand-in member) – Chair: Dr. Alyssa Panitch
5. John Schneider – Chair: Dr. Tony Garcia
6. Addie Hicks – Chair: Dr. Jim Sweeney
7. David Meller – Chair: Dr. Steven Helms-Tillery
8. Steven Bellinger – Chair: Dr. Peter Steinmetz
9. Aaron Fairchild – Chair: Dr. Metin Akay
10. Rhett Martineau - chair: Dr. Bruce Towe
11. Byron Olson - graduated in Dec. 2005; chair - Dr. Jiping He
12. Ryan Clement (stand-in member) - chair: Dr. Daryl Kipke
13. Kevin Otto - chair: Dr. Daryl Kipke
14. Matthew Holecko (stand-in member) - chair: Dr. Stephen Massia
15. Jing Fan - Chair: Dr. Jiping He
16. Tao Kang - chair: Dr. Jiping He
17. Xinying Cai - chair: Dr. Jiping He
18. Derek Dosdall - chair: Dr. James Sweeney
19. Brian Hillen – Chair: Dr. Ranu Jung
20. Sivakumar Balasubramanian – Chair (Jiping He)
21. Nathan Baldwin – Chair (Steven Helms Tillery)
22. Dan Gulick – Chair (Bruce Towe)
23. Jerry Tian – Chair (Jiping He)
24. Kyung Park – Chair (Metin Akay)
25. Yusuf Tufail – Chair (Jamie Tyler)

MASTERS STUDENTS

Graduated

Role - primary mentor and chair of dissertation committee

1. Aaron Hensley – “Ultrasound induced permeabilization of neurons as a therapy for cytotoxic neuronal edema,” graduated Dec. 12, **2002**.
2. Aaron Gilletti - "Brain micromotion and chronic actuated neural implants," graduated Dec. **2003**.
3. Massoud Khraiche - "Acoustic Sensors For Monitoring Neuronal Adhesion And Spreading In Real-Time," graduated June **2004**.
4. Yeocheon Na – “Developing constitutive models of brain tissue and mechanical interconnects,” graduated May **2006**.
5. Jonathan Rogul – “Modeling and Simulation of acoustic microsensors for biological applications,” graduated in May **2009**.

6. Ze Kai, graduated in August 2012
7. Robert Korb, graduated in May 2012.
8. Li Zhou, graduated in May 2012.
9. Joshua Hope, graduated in December 2011.
10. Chandana Pedapati, graduated in December 2014.

Current Masters students

1. Sivakumar Palaniswamy
2. Ankur shah
3. Shahrzad Talebian
4. Garen Minassians
5. Alec Thimsen
6. Aashish Masih
7. Sindhu Kolluru

Dissertation committee member for the following students

1. Tim Bruns - graduated in December 2001 (chair - Dr. James Sweeney)
2. Simon Marshall - graduated in May 2002 (chair - Dr. Jiping He)
3. He Huang - graduated in May 2002 (chair - Dr. Jiping He)
4. Dominique Gauthier – graduated in December 2007(chair – Dr. Metin Akay)
5. Kinjal Bhavsar – graduated in May 2008 (chair – Dr. Metin Akay)
6. Sarah Salameh – graduated in August 2008 (chair – Dr. Brent Vernon)
7. Chip Carter – Chair (Jiping He)
8. Matt Piccini - chair: Dr. Bruce Towe
9. Amy Hall – Chair: Dr. Bruce Towe
10. Emma Zimmermann – Chair (Metin Akay)

Undergraduate projects supervised

2001

Senior Capstone Design project BME 417&490

Rhett Martineau and Ryan Knight, "Detection and Classification of nerve action potentials for telemetry."

2002

Senior Capstone Design project BME 417&490

Paula J. Stice – "Novel implantable microelectrodes to reduce brain injury"
Massoud Khraiche – "Acoustic sensors to detect neuronal adhesion"
Chris Visser – "Design of chronic multi-channel recording electrodes for clinical neuroscience applications".

2003

Senior Capstone Design project BME 417&490

Ming Xu – "Hydroelectric Bloodstream Power Extractor,"
David Hunn – "Acoustic Device to measure cell adhesion and platelet aggregation"
Adam McCullough – "Neuron Tracker: An array of individually adjustable Neural probes,"
Cylynn Wisniewski – "Design optimization of a Neural Implant,"

BREU student

Lyndrath Martin - "Analysis of sensori-motor deficits after stroke"

2004

Senior Capstone design project EEE 489

Umar Lyles , Zafar Haq, Ray McKee, Mai Cao - "Neural Telemetry channel"

Senior Capstone Design project BME 417&490

Kristen Lechleiter - "Controlled drug delivery system to improve neural implants"
Benjamin Schwartz - "Mincubator - a miniature incubator for cell cultures" (dropped out of Capstone design after one semester)
Chad Nguyen - "Low voltage pulse generator for microelectroporation"
Tammy Delozier - "Therapeutic Scooter"
Jose Quiroga - "Eye-controlled computer mouse for quadriplegics"

2005

FURI (Fulton Undergraduate Research Initiative)

Jesse Martin - "Quantitative assessment of neuroanatomical changes after stroke"

Senior Capstone Design project BME 417&490

Atsuhito Katayama - "Neurofeedback for clinical applications"
Benjamin Schwartz - "Mincubator - a miniature incubator for cell cultures"
Lindsay Oleson - "Wireless neural data transmission using the Berkeley wireless motes"

2006
Undergraduate Honors thesis
Jesse Martin – "Neural response to implanted brain electrodes"
Rachel Aguiar – "Pain management feedback dispensing device"

Senior Capstone Design project BME 417&490
Chetan Patel – "Wireless transmission for Neural Prosthesis"
Soroush Mirtalaei – "EMG based controller of a virtual hand prosthetic"

2007
FURI (Fulton Undergraduate Research Initiative)
Payal Bhavsar – "Quantitative assessment of neuronal plasticity"

Undergraduate research
Masoud Sultani – "Molecular correlates of neuronal plasticity"
Haithem Babiker – "Automated control of microactuators in brain implants"

2008
Senior Capstone Design project BME 417&490
Payal Bhavsar – "Quantitative assessment of neuronal plasticity"
Haithem Babiker – "Wireless control of MEMS devices using MOTE platforms"
Masoud Sultani – "Polyethylene Glycol artificial nucleus pulposus"
Colt Cowdell – "Volumetric sensors for biological fluids"
Ali Alnamani – "Micropolymer channels for feeding cells in culture"

2009
Senior Capstone Design project BME 417&490
Amanda Krstec – Design and development of an eye tracker system
Kimia Seyedmadani – Design and development of a prosthetic arm gripper

2010
Senior Capstone Design project BME 417&490
Ruhani Alam and Erica Pratt – Design and development of a novel hand-held device to measure infant head circumference
Eddie Tobin and Eric Nelson – Design and development of an infant sleep apnea monitor

2011
Senior Capstone Design project BME 417&490
Julian Holbrook and Andrew Benstead – ECG Telemetry Pack
David Beighe – Sleep cycle alarm clock
Undergraduate research
Derrick Buck – Microfluidic wells for culturing neurons on microelectrode arrays
Jennifer Wong – RT-PCR assays for neurons

2012
(**Honors** research) Amanda Moore – Intracellular recording using MEMS probes
(**Honors** thesis) Kyle Donnely – Nanoporation for transfection of genetic constructs

(**FURI** award) Ranil Johsua - Develop and test a novel method for protein expression analysis for small populations of cells cultured on bio-microchips
(**IMSD** – Initiative for Maximizing Student Development award) Victor Orioke – Spotting techniques for high-throughput assays involving primary cell lines

2013
(**FURI** award and **IMSD** award) Aman Aberra – Functional gene silencing in neurons using high throughput microelectrode arrays
(**FURI** award and **NASA** space grant award) Ajay Karpur – Electrophysiological signatures of gene silencing in neurons
(**FURI** award) Amanda Moore – Robotic microelectrodes for intracellular recording
Kyle Ester and Amanda Moore (Honors research thesis) – Intracellular recording from Aplysia ganglion cells
Andrew Dobos, Seung Roh and Jacob York (Capstone project) – Electronic control for shakers in incubators

2014
Reem Gerais – Microfluidic platform for sustaining long-term neuronal cultures
Payton Herrera and Bharathiraja Nagappan (Capstone) – Wearable Ultrasonic Navigation Tool for the Blind and Visually Impaired
Tim Peterson, Omar Karaboulad, , Mohamad Immam, Parminder Chanda (Capstone) - Low Strain Dental Loupes
Raj Ahir, Shayan Azimi, Gevorg Khandanyan, Tuan Phan, Shemal Shukla (Capstone) - Electric Flossing and Brushing Device
Markey Olson, Alyssa Oberman, Robert Valenza (Capstone) - VisiBraille Braille Teaching Device
Salvador Casillas, Nicolas Paredes (Capstone) - Truck Driver Monitoring System
James Kyeh (**Honors** thesis) – Modeling and simulation of opsin function in optogenetic constructs