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Education:

1965-1969 - B.A. The Johns Hopkins U. (Human Biology Major)
1968-1972 - M.D. The Johns Hopkins U. School of Medicine

Professional History:

2012-present Chief Scientist (consulting), General stim Inc. (injectable neuromuscular stimulators)
2008-present Adj. Professor of Pharmacy, University of Southern California
2008-present CEO, SynTouch LLC (biomimetic tactile sensors)
2007-present President, Biomed Concepts Inc. (consulting and prototyping in biomedical engineering)
2006-present Adj. Professor of Neurology, University of Southern California
1999-present Professor of Biomedical Engineering and Director of the Medical Device Development Facility, University of Southern California
2013-2015 Distinguished Scientist of the Strategic Advisory Committee, Chongqing Institute for Green and Intelligent Technology, Chinese Academy of Science
2003-2009 Deputy Director, NSF Engineering Research Center on Biomimetic MicroElectronic Systems
1999-2008 Director of Medical Device Development, Alfred E. Mann Institute for Biomedical Engineering at the University of Southern California
1994-1999 Chief Scientist (consulting), Advanced Bionics Corp., Sylmar, California
1991-1999 Director of Bio-Medical Engineering Unit and Professor of Physiology, Queen's University
1990-1999 Member, Medical Research Council Group in Sensory-Motor Neuroscience, Queen's University
1988-1991 Director of Special Projects, Biomedical Engineering Unit, and Professor of Physiology, Queen's University, Kingston, Ontario
1987-1988 Special Expert, Lab. of Neural Control, IRP, NINCDS, NIH
1986-1987 Chief, Neurokinesiology Section, Lab. of Neural Control, IRP, NINCDS, NIH (Sr. Surgeon, U.S. Public Health Service)
1985-1987 Adjunct Associate Professor of Bioengineering, U. Utah
1981-1990 President, Biomed Concepts, Inc. (consulting and prototyping in biomedical engineering)
1980-1981 Partner in Bak Electronics, Inc.(electrophysiological research instrumentation)
1979-1986 Permanent Sr. Investigator, Lab. of Neural Control, IRP, NINCDS, NIH
1979-1981 Guest Researcher, Depts. Otolaryngology and Physiology, UCSF School of Medicine
1974-1979 Medical Officer, Lab. of Neural Control, IRP, NINCDS, NIH
1973-1974 Research Associate, Lab. of Neural Control, IRP, NINCDS, NIH
1972-1973 Internship, Department of Surgery, Univ. of Arizona
1971-1972 Independent R&D of real-time scientific programming language for minicomputers
1971 Guest Research Associate, Univ. of Utah Artificial Eye Project
1967-1972 Research Assist. to Dr. William B. Marks, Dept of Biophysics, Johns Hopkins Univ.
1966-1967 Training in thin film microelectronics, Johns Hopkins Univ. Applied Physics Lab.

Awards and Honors:

Seeing Eye, Inc. Fellowship, 1969-72
Commendation Medal - U.S. Public Health Service
International Exchange Fellowship to Bulgaria - National Academy of Sciences
Queen's National Scholar - Queen's University
Fellow of the American Institute for Medical and Biological Engineering (AIMBE)
Medical Device & Diagnostic Industry Magazine's 100 Notable People in the Medical Device Industry
Breakthrough Innovator Award 2013 – Popular Mechanics
Technology Pioneer 2014 – World Economic Forum

Research Interests:

Neuroprosthetics and neural control techniques
Sensorimotor control in mammals
Implantable medical devices
Haptics for robots

Research & Scholarly Activities:

Publications: 386 (excluding abstracts)

Electronic reprints available through http://bme.usc.edu/gloeb

Books: 1

Loeb, G.E. and Gans, C. *Electromyography for Experimentalists.* Univ. Chicago Press, 1986. (373 pp., 140 figs.)

Full-Length Reports in Refereed Journals: 164

Biomedical Engineering and Methodology: 109

Huang, X., Zheng, K., Kohan, S., Denprasert, P.M., Liao, L., Loeb, G.E. Neurostimulation strategy for stress urinary incontinence, (submitted).

Jalaleddini, K., Niu, C., Chakravarthi Raja, S., Sohn, W.J., Loeb, G.E., Sanger, T., Valero-Cuevas, F. Neuromorphic Meets Neuromechanics, Part II: The Role of Fusimotor Drive, *J. Neural Engineering* (in press).

Zhou, L., Bar-Cohen, Y., Peck, R.A., Chirikian, G.V., Harwin, B., Chmait, R.H., Pruetz, J.D., Silka, M.J. and Loeb, G.E. Analytical modeling for computing lead stress in a novel epicardial micropacemaker, *Cardiovascular Engineering & Technology* (in press).

Vest, A.N., Zhou, L., Huang, X., Norekyan, V., Bar-Cohen, Y., Chmait, R.H. and Loeb, G.E. Design and testing of a transcutaneous RF recharging system for a fetal micropacemaker, *IEEE Trans. Biomed. Circuits and Systems* (in press).

Vest, A.N., Zhou, L., Bar-Cohen, Y. and Loeb, G.E. A novel method to estimate safety factor of capture by a fetal micropacemaker, *Physiological Measurement* (in press), 2016.

Zhou, L., Vest, A.N., Peck, R.A., Sredal, J., Huang, X., Bar-Cohen, Y., Silka, M.J., Pruetz, J.D., Chmait, R. and Loeb, G.E. Minimally invasive implantable fetal micropacemaker: mechanical testing and technical refinements, *Med. & Biol. Engng. & Comput.* DOI: 10.1007/s11517-016-1470-4, 2016.

Bar-Cohen, Y., Loeb, G.E., Pruetz, J., Silka, M.J., Guerra, C., Vest, A.N., Zhou, L. and Chmait, R.H. Preclinical Testing and Optimization of a Novel Fetal Micropacemaker, *Heart Rhythm* 12:1683-1690, 2015, doi: 10.1016/j.hrthm.2015.03.022

Loeb, G.E. and Fishel, J.A. Bayesian Action&Perception: Representing the World in the Brain, *Frontiers in Neuroscience* **8:**341, doi: 10.3389/fnins.2014.00341, 2014, http://journal.frontiersin.org/Journal/10.3389/fnins.2014.00341/abstract.

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Sinha, U.K., Villegas, B., Kuo, C., Richmond, F.J., Masood, R., Nelson, N.I. and Loeb, G.E. Safety of microstimulator during radiation therapy – a preliminary study on head and neck cancer patients. *Journal of Nuclear Medicine & Radiation Therapy,* 5:197, 2014, doi: 10.4172/2155-9619.1000197.

Kaliki, R.R., Davoodi R. and Loeb, G.E. Evaluation of a noninvasive command scheme for upper-limb prostheses in a virtual reality reach and grasp task. *IEEE Trans. BME* 60:792-802, 2013.

De Rugy, A., Loeb, G.E., Carroll, T.J. Are muscle synergies useful for neural control? *Frontiers in Computational Neuroscience,* 7: 10.3389/fncom.2013.00019, 2013.

Loeb, G.E., Zhou, L., Zheng, K., Nicholson, A., Peck, R.A., Krishnan, A., Silka, M., Pruetz, J., Chmait, R. and Bar-Cohen, Y. Design and testing of a percutaneously implantable fetal pacemaker. *Annals Biomed. Engng.*, 41:17-27, DOI: 10.1007/s10439-012-0631-3, 2013.

Roy, D., Wettels, N. and Loeb, G.E. Elastomeric skin selection for a fluid-filled artificial fingertip. *J. Applied Polymer Sci.,* 127.6:4624-4633, 2013.

Li, Yao, Smith, L.H., Hargrove, L.J., Weber, D.J. and Loeb, G.E. Sparse optimal motor estimation (SOME) for extracting commands for prosthetic limbs. *IEEE Trans. Neural Systems and Rehabilitation Engineering,* 10.1109TNSRE.2012.2218286, 2012.

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Hauschild, M., Mulliken, G.H., Fineman, I., Loeb, G.E. and Andersen, R.A. Cognitive signals for brain-machine-interfaces in posterior parietal cortex. *Proc. National Acad. Sci.*109.42:17075-17090, 2012.

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Tsianos, G.A., Rustin, C. and Loeb G.E. Mammalian muscle model for predicting force and energetics during physiological behaviors. *IEEE Trans. Neural Systems & Rehab. Engng.* 20:117-133, 2012.

Davoodi, R. and Loeb G.E., Real-time animation software for customized training to use motor prosthetic systems, *IEEE Trans. Neural Systems and Rehabilitation Engineering*, 20:134-143, 2012.

Davoodi, R. and Loeb, G.E., Development of a physics-based target shooting game to train amputee users of multijoint upper limb prostheses, *Presence: Teleoperators and Virtual Environments,* 21:85-95, 2012.

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Su, Zhe, Fishel, J.A., Yamamoto, T. and Loeb, G.E. Use of tactile feedback to control exploratory movements to characterize object compliance. *Frontiers in Neurorobotics*, 6:7, 2012 (doi: 10.3389/fnbot.2012.00007).

Yamamoto, T., Wettels, N., Fishel, J.A., Lin, C.H., Loeb, G.E., "BioTac –生体模倣型触覚センサ–", 日本ロボット学会誌 (Journal of the Robotics Society of Japan), 30(5):496-498, 2012.

Kaplan, H.M. and Loeb, G.E. Preventing ischial pressure ulcers: I. Review of neuromuscular electrical stimulation. *Applied Bionics & Biomechanics* 8:323-331, 2011.

Kaplan, H.M., Baker, L.L., Davoodi, R., Wong, N.T. and Loeb, G.E. Preventing ischial pressure ulcers: II. Biomechanics. *Applied Bionics & Biomechanics* 8:333-343, 2011.

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Song, D., Raphael, G., Lan, N. and Loeb, G.E. Computationally efficient models of neuromuscular recruitment and mechanics. *J. Neural Eng.* 5:175-184, 2008.

Kaliki, R.R., Davoodi, R. and Loeb, G.E. Prediction of distal arm posture in 3-D Space from shoulder movements for control of upper limb prostheses. *Proceedings of the IEEE*, 96(7):1217-1225, 2008.

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Weber D.J., Stein R.B., Chan K.M., Loeb G.E., Richmond F.J., Rolf R., James K., Chong S.L., Thompson A.K., and Misiaszek J. Functional electrical stimulation using microstimulators to correct foot drop: a case study. *Canadian Journal of Physiology & Pharmacology.* **82**:784-92, 2004.

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Loeb, G.E. and Richmond, F.J.R. Making Design Controls Useful for Research and Development. *Medical Device and Diagnostic Industry* **25(4)**:63-68, April, 2003. http://www.devicelink.com/mddi/archive/03/04/004.html

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Abstracts (previous five years only):

Loeb, G.E. and Fishel, J.A., "Decision support for cost-effective diagnosis and treatment by inverting Bayesian probability," AIMed 2016, Dec. 14, 2016, Dana Point, CA.

Huang, X-C., Zheng, K.-H., Kohan, S., Denprasert, P.M., Liao, L-M., Loeb, G.E., "Development and testing of NuStim system for stress urinary incontinence treatment," Society for Neuroscience, Nov. 15, 2016.

Barradas, V.R., Niu, C.M., Sanger, T.D., Loeb, G.E. and Valero-Cuevas, F.J. "Adjustment of gamma motor neuron firing rates in neuromorphic hardware elicits physiological behavior while controlling a cadaveric human finger under kinematic constraints," Neural Control of Movement, April 20-24, 2015, Charleston, SC.

Sunwoo, J., Goodner, J.R. and Loeb, G.E. "Dimensionality reduction of the spinal-like regulator model improves motor learning," Society for Neuroscience, Nov. 11, 2013, San Diego, CA.

Li, Y., Loeb, G.E., Sunwoo, J. and Cerne, T. "Are high dimensional spinal neural circuits configured to facilitate rapid learning?" SIAM, July 9, 2013, San Diego, CA.

Tsianos, G.A., Loeb, G.E. and Goodner, J. "A realistic model of spinal circuitry facilitates control of center-out reaching movements". Abst. 275.03, Society for Neuroscience, Oct. 14, 2012, New Orleans.

Goodner, J., Tsianos, G.E., Lie, Y. and Loeb, G.E. "BioSearch: A physiologically plausible learning model for the sensorimotor system". Abst. 275.22, Society for Neuroscience, Oct. 14, 2012, New Orleans.

Davoodi R. and Loeb, G.E. "MSMS Software for VR Simulations of Neural Prostheses and Patient Training and Rehabilitation," Medicine Meets Virtual Reality Conference, February 2011, Newport Beach, California.

Tsianos, G.E., Goodner, J.R., Li, Y. and Loeb, G.E. "Biologically inspired learning algorithm for controlling biologically plausible neuromusculoskeletal systems". 21st Annual Conference of Society for the Neural Control of Movement. San Juan, Puerto Rico. April 26 - May 1, 2011.

Y. Li, D. Weber, and G.E. Loeb, "Estimating motor drive from sparse recordings of single motor units". Annual conference of Society of Neuroscience, Washington DC, November 12-16, 2011.

Goodner, A., Tsianos, G., Li, Y. and Loeb, G.E. A physiologically plausible learning model for the sensorimotor system. Society for Neuroscience, 387.. Washington, DC, 2011.

Gerald E. Loeb and Rahman Davoodi, "New Tools for Modeling Everything Below the Foramen Magnum" NEST Forum, San Diego, November 2010.

George A. Tsianos, Giby Raphael, and Gerald E. Loeb, "Investigating the Role of Cocontraction and Energetics in Voluntary Arm Movement" NEST Forum, San Diego, November 2010.

George A. Tsianos, Cedric Rustin, Gerald E. Loeb, "Mammalian muscle energetics model for predicting neural control strategies underlying movement" NEST Forum, San Diego, November 2010.

Tsianos, G.A., Raphael, G. and Loeb, G.E. Neural Circuit Models to Study the Role of the Spinal Cord in Control of Arm Movement. Society of Neuroscience, 863:12. Chicago, Illinois, October 22, 2009.

Tsianos, G.A., Raphael, G. and Loeb, G.E. Neural Circuit Models to Study the Role of the Spinal Cord in Control of Arm Movement. Joint Symposium on Neural Computation, Los Angeles, California. May 16, 2009.

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Tan, W., Sachs, N., Guo, R., Zou, Q., Singh, J., and Loeb, G.E. Multimodal Injectable Sensors for Neural Prosthetic Proprioception. Proc. of First International Conf. on Neural Interface and control (Wuhan, China), May 26-28, 2005.

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Davoodi, R., Hauschild, M., Lee, J., Montazemi, P., Loeb, G.E. Biomimetic Control of FES Reaching. Proc. of First International Conf. on Neural Interface and control (Wuhan, China), May 26-28, 2005.

Weber, D.J., Stein, R.B., Chan, K.M., Rolf, R., Chong, S.L., James, K, Loeb, G.E., and Richmond, F.J.R. Bionic correction of foot drop. Canadian Physiologic Society Winter Meeting, Vernon, BC, 2004.

Guest Lectures (previous 20 years only):

Bearg Lecture in Brain Science, Carnegie Mellon University, "Understanding Human Haptics by Building Robotic Systems," March 8, 2017

China Pharmaceutical University, Nanjing, "Using Electrons as a Locally Delivered Excitatory Neuromodulator," Nov. 24, 2016.

IEEE Humanoids 2016 Workshop on Tactile Sensing for Manipulation, Cancun, "Machine Touch for Dexterous Robotic and Prosthetic Hands," Nov. 15, 2016.

Barrels XXIX, Los Angeles, CA, "Understanding human haptics by building robotic systems," Nov. 10, 2016.

Motor Control 2016 – Bridging Motor Control and Biomechanics, Wisla, Poland, "Useful properties of spinal circuits for learning and performing sensorimotor tasks," Sept. 14, 2016.

ISEK XXI Pre-Congress Workshop, Chicago, IL, "Insight into neural mechanisms of afferent pathways learned from neural recordings, mathematical modeling and real-time neuromorphic simulations," July 5, 2016.

Biomechanics & Neural Control of Movement, Engineering Foundation Conference, Deer Creek, Ohio, "20 Years from Now," June 17, 2016.

Automotive Interiors Expo, Stuttgart, Germany, "Quantifying human touch and feel – without humans," June 1, 2016.

University of Lund, Sweden, "Representing the World in the Brain: Reverse Biomimetic Design from Haptic Robots," Sept. 7, 2015.

Rehabilitation Institute of Chicago, "Machine Touch for Dexterous Robotic and Prosthetic Hands," May 8, 2015.

Google DeepMind, London, U.K., "Representing the World in the Brain: Reverse Biomimetic Design from Haptic Robots," April 13, 2015.

National Science Foundation Workshop on Robotic Locomotion and Manipulation, Arlington, VA, "Machine Touch for Dexterous Robotic and Prosthetic Hands," April 2, 2015.

McGill University, Montreal, Canada, "Representing the World in the Brain: Reverse Biomimetic Design from Haptic Robots," Mar. 18, 2015.

Annual Sensorimotor Control Conference, University of Queensland, Brisbane, Australia, Keynote Address, "Representing the World in the Brain: Reverse Biomimetic Design from Haptic Robots," Feb. 21, 2015.

University of California at Riverside Distinguished Speaker, "Machine Touch for Dexterous Robotic and Prosthetic Hands," Oct. 29, 2014.

RoboBusiness Conference, Boston, MA, "The Future of Machine Touch," Oct. 16, 2014.

American Society of Mechanical Engineers, Los Angeles Chapter, "Machine Touch for Dexterous Robotic and Prosthetic Hands," April 17, 2014.

Aquitaine Institute for Cognitive and Integrative Neuroscience, Bordeaux, France, "Understanding Haptics by Building Computational and Physical Models," April 1, 2014.

CNRS-AIST Joint Robotics Laboratory, Montpellier, France, "Machine Touch for Dexterous Robotic and Prosthetic Hands," March 31, 2014.

University of Paris Marie Curie, "Biomimetic Strategies for Machine Touch," March 27, 2014.

L'Oreal, Paris, "Biomimetic Strategies for Machine Touch," March 26, 2014.

DARPA Sensorimotor Prosthetics Workshop, Scottsdale, AZ, "Biomimetic Strategies for Dexterity," February 13, 2014.

Chongqing Institute for Green and Intelligent Technology (CIGIT), Chongqing, China, "Biomimetic Design for Robotic Systems," Sept. 26, 2013.

Peking University, Beijing, China, "Innovative Device Development in China: An American's Perspectives," Sept. 21, 2013.

Korean Advanced Institute for Science and Technology (KAIST), Seoul, "Biomimetic Technology for Haptically Enabled Robots," Dec. 3, 2012.

Medtronic Korea, Seoul, "New Opportunities in Neural Prosthetic Technologies," Dec. 4, 2012.

Medical Scientist Training Program, University of California at Irvine, keynote speaker, "Feeding the Medical-Industrial Complex," Oct. 6, 2012.

ITRI, Taiwan, "Understanding Haptics by Evolving Mechatronic Systems," Feb. 14, 2012.

International Workshop on Bio-Inspired Systems and Prosthetic Devices (BioPro 2012), Taichung, Taiwan, "Biomimetic Tactile Sensors for Prosthetic Hands and Personal Assistive Robots," Feb. 13, 2012.

Drexel University, Philadelphia, "Understanding Haptics by Evolving Mechatronic Systems," June 22, 2012.

Chongqing Institute of Green and Intelligent Technology (CIGIT), Chinese Academy of Sciences, Chungqing, China, "Biomimetic Technology for Haptically Enabled Robots," June 19, 2012.

Adept Technology, Pleasanton, CA, "Understanding Haptics by Evolving Mechatronic Systems," Feb. 8, 2012.

3rd Military Medical School, Chongqing, China, "Clinical Applications of BION Injectable Neuromuscular Stimulators," June 18, 2012.

West China Hospital, Chengdu, China, "Challenges and Opportunities in Neural Prosthetic Interfaces," Nov. 30, 2011.

Suzhou Institute of Biomedical Engineering (SIBET), Chinese Academy of Sciences, Suzhou, China, "Challenges and Opportunities in Neural Prosthetic Interfaces," Sept. 22, 2011.

Summer School on Impedance, STIFF EC Project, Frauenchiemsee, Germany, "What Roboticists Need to Know About NeuroMusculoSkeletal Systems," July 25, 2011.

Shanghai Medical College of Fudan University, Shanghai, China, "Challenges and Opportunities in Neural Prosthetic Interfaces," Dec. 1, 2011.

Shaanxi Qinming, Xian, China, "BION Injectable Neuromuscular Stimulators: Technology and Clinical Applications," Sept. 23, 2011.

Multimodal & Sensorimotor Bionics Workshop, Munich, Germany, "Biomimetic Strategies for Dexterous Robots and Prosthetic Limbs," July 27, 2011.

Life Science Park, Shanghai, China, "Regulation and Management of Medical Device Design," Sept. 19, 2011.

IEEE-EMBS Distinguished Lecturer Event, San Fernando Valley, CA, "Biomimetic Strategies for Dexterous Robots and Prosthetic Limbs," May 17, 2011.

HRL Laboratories, Malibu, CA, "Practical, Multi-modal Tactile Sensing," Nov. 10, 2011.

Computational Motor Control Workshop, Beer Sheva, Israel, "Understanding Haptics by Evolving Mechatronic Systems," June 15, 2011.

Chongqing Institute of Green and Intelligent Technology (CIGIT), Chinese Academy of Sciences, Chongqing, China, "Tactile Sensing for Dexterous Robots and Prosthetic Limbs," Dec. 6, 2011.

Chinese Pharmaceutical University, Nanjing, China, "Regulation and Management of Medical Device Design," Dec. 4, 2011.

Ben Gurion University, President's Distinguished Guest, Beer Sheva, Israel, "Spinal Circuitry Makes Motor Control Easy to Do but Hard to Understand," June 13, 2011.

University of Southern California, Los Angeles, CA, "Biomimetic Tactile Sensing for Prosthetic and Robotic Hands","Nov. 8, 2010.

Transformational Technologies Conference, Rancho Los Amigos National Rehabilitation Center, Downey, CA, "Multimodal Biomimetic Tactile Sensors for Prosthetic Limbs", Sept. 2, 2010.

Telluride Neuromorphic Cognition Engineering Workshop, Telluride, CO, "Brain Machine Interfaces", June 28-30, 2010.

Neural Control of Movement Annual Conference, Naples, FL, "Biomimetic Tactile Sensors" and "Spinal-Like Regulators", April 20-25, 2010.

ISSCC 2010, San Francisco, evening session on Bionic Systems, "System design challenges in a very complex system indeed," Feb. 9, 2010.

IEEE-EMBS, Thousand Oaks, CA, "Biomimetic Strategies for Dexterous Robots and Prosthetic Limbs", Sept. 29, 2010.

EPFL, Lausanne, Switzerland, ""Biomimetic Haptics for Robots", Aug. 30, 2010.

Computational Motor Control Workshop, Beer Sheva, Israel, "Spinal-like regulator simplifies control of multiple degree-of-freedom limbs," June 16, 2010.

Caltech, Pasadena, CA, "What Does the Brain Control", Oct. 18, 2010.

Brain Machine Interfaces, Ystad Saltsjobad, Sweden, "What Does the Brain Control?", Aug. 28, 2010.

17th Joint Symposium on Neural Computation, Los Angeles, CA, "What Does the Brain Control?", May 22, 2010.

XXXIX Neurohike Meeting, Jasper, Canada, "Taking care of business," Sept. 26, 2009.

Workshop on Multi-Scale Muscle Mechanics, Woods Hole, MA, "Things that bother a mammalian neurophysiologist about muscle," Sept. 19, 2009.

Robotics Science and Systems, Workshop on Understanding the Human Hand for Advancing Robotic Manipulation, Seattle, "Robust Biomimetic Tactile Sensing and Grip Control," June 28, 2009.

NSF-CMMI Workshop on Neuromechanical Engineering, Arlington, VA, "Exploiting Neural and Muscular Trophisms for Rehabilitation," Sept. 14, 2009.

Neurosurgery Grand Rounds, USC, "Opportunities & Challenges for Prosthetic Sensorimotor Interfaces," May 4, 2009.

International Workshop on Neuromorphic Systems and Neural Prostheses, Taiwan, "Bio-Inspired Strategies for Dexterous Robots and Prosthetic Limbs," May 21, 2009.

Human Nature and Self Design, Tuebingen, Germany, "Neuroimplants and Beyond," Aug. 1, 2009.

First International Academic Conference of Acupuncture and Moxibustion Instrumentation, Shanghai, China, "The Art and Science of Neural Stimulation," Dec. 11, 2009.

University of Utah, Salt Lake City, UT, "Making the Deaf Hear and the Blind See – Some Challenges Along the Way," Nov. 10, 2008.

Korean Institute for Science and Technology, Seoul, Korea, "Prosthetic Interfaces with the Nervous System," April 25, 2008.

International Symposium on Functional Electrical Stimulation, Taipei, Taiwan, "Opportunities and Chalenges for the Use of Neuromuscular Electrical Stimulation in Rehabilitation Medicine" (keynote), "BIONic Interfaces to Reanimate Paralyzed Limbs," April 26-27, 2008.

Fourth China International Life Science Summit, Hangzhou, China, "Trends and Opportunities in Medical Devices," Sept. 22, 2008.

Erasmus University, Rotterdam, Netherlands, "Making the Deaf Hear, the Blind See and the Lame Walk," May 5, 2008.

Engineering Neuroscience & Health, USC, "The Spinal Cord Makes Sensorimotor Control Easy to Do but Difficult to Understand," Sept. 29, 2008.

DLR Inst. Robotics and Mechatronics, Wessling, Germany, "Biomimetic Interfaces for Mechatronic Limbs," May 7, 2008.

Advanced Neural Microsystems, ISCAS-2008, Seattle, WA, "General Purpose Technology for a General Purpose Nervous System," May 19, 2008.

Neurorehabilitation Grand Rounds, Rancho Los Amigos National Rehabilitation Center, Downey, CA, "BIONic Interfaces for Neuromuscular rehabilitation," Oct. 25, 2007.

IEEE International Solid-State Circuits Conference, San Francisco, CA, "BIONic Neuromuscular Interfaces," Feb. 13, 2007.

4th World Congress of the International Society of Physical and Rehabilitation Medicine, Seoul, Korea, "The Many Interfaces Required for Functional Reanimation of Limbs," June 12, 2007.

35th Annual Conference of Indian Association for Physical Medicine and Rehabilitation, Patna, India, "BION Injectable Neuromuscular Stimulators: Technology and Clinical Applications," Jan. 20, 2007.

US-China Workshop on Neural Interface Technologies, Kunming, China, "Injectable Muscle Stimulators and Sensors for Motor Function," July 9-11, 2006.

University of California at Irvine Engineering Symposium on Prosperity thru Technology, May 15, 2006.

Simon Fraser University, Vancouver, Canada, "Reanimating Limb = Technology + Neurophysiology," Sept. 25, 2006.

Second Computational Motor Control Workshop, Ben-Gurion University of the Negev, Beer-Sheva, Israel, "Biomimetic Integration of Sensorimotor Neural Prostheses", June 7, 2006.

Sate of the Science Workshop on Functional Restoration for the Stroke Survivor, "Practice", keynote speaker, La Jolla, CA, March 7, 2006.

Neural Interfaces Workshop, National Institutes of Health, Bethesda, MD, "BIONic Neuromuscular Interfaces," Aug. 21-23, 2006.

Johns Hopkins University Center for Hearing and Balance, Baltimore, MD, "Reanimating Limbs = Technology + Neurophysiology," Aug. 23, 2006.

International Symposium on Biomedical Engineering, Taipei, Taiwan, "BION Injectable Neuromuscular Interfaces to Reanimate Paralyzed Limbs" (keynote), Dec. 15, 2006

Global Digital Healthcare, Cambridge Healthtech Institute, Baltimore, MD, "Neural Prostheses: Crossing the Last Meter in Personal Telecommunications," Oct. 10-11, 2006.

Alberta Motor Control, Kananaskis, Canada, "Mathematical Models of Proprioceptors," "Prosthetic Proprioception," Sept. 23-24, 2006

University of Southern California, Los Angeles, CA, "Design and Fabrication of Disposable, Percutaneous Chemical Sensors", Jan. 31, 2005

SoCalBio Investor Conference, Los Angeles, CA, "The Sencil™: Indwelling Percutaneous Optical Fibers with Nanoengineered Chemical Sensors", Mar. 23, 2005.

Rutgers University, New Brunswick, NJ, "Biomimetic Reanimation of Paralyzed Limbs", Nov. 21, 2005.
First International Conference on Neural Interface and Control, Wuhan, China, "FES and BION™ Development", May 27, 2005.
Biotechnology Club, University of Southern California, "The Development of Medical Devices: Research, Construction and Distribution", Mar. 30, 2005.
Design of Medical Devices Conference, University of Minnesota, Minneapolis, "Modular Injectable Interfaces with the Body", April 13, 2005.
University of California at Santa Cruz, "Making the Deaf Hear, the Blind See and the Lame Walk", June 8, 2004.
Univ. of Indonesia, Jakarta, "Treatment of Hearing Loss: Technology Meets Economics", Dec. 15, 2004
SoCalBio Medical Technology Showcase, Los Angeles, "Implantable Glucose Sensor", June 16, 2004.
Rehabilitation Institute of Chicago, IL, "Making the Deaf Hear, the Blind See and the Lame Walk", Mar. 10, 2004.
Nano and Microtechnology Symposium, California Institute for Quantitative Biomedical Research, "BIONic Reanimation of Paralyzed Limbs", April 17, 2004
Multidisciplinary Research Colloquium in Gerontology, USC, "Making the Deaf Hear, the Blind See and the Lame Walk", Jan. 22, 2004.
Humanoids 2004, Santa Monica, CA, "Biomimetic Sensorimotor Control for Paralyzed Patients and Robots", Nov. 12, 2004.
Dept. Aerospace & Mechanical Engineering, University of Southern California, "Neural Prosthetic Reanimation of Paralyzed Limbs," Sept. 29, 2004.
Cornell University, Ithaca, NY, "Neural Prosthetic Reanimation of Paralyzed Limbs", Nov. 23, 2004.
Canadian Physiological Society, British Columbia, Canada, "Biomimetic Prosthetic Proprioception", Jan. 28-Feb. 1, 2004.
Brandeis University, Boston, MA, "Neural Prosthetic Reanimation of Paralyzed Limbs", Nov. 22, 2004.
Bionics and Prosthetics - 2003 Whitney Symposium, GE Global Research, Schenectady, NY, "BIONics", Mar. 8-9, 2004.
BioNEMS Symposium, Los Angeles, CA, "Survival Strategies for Millimeter Scale Injectable Stimulators", May 22, 2004.
Spinal Cord Conference, Keynote Speaker for Ernest Bors Symposium, Long Beach, CA, "BIONic Therapy for Paralyzed Legs", June 5, 2004.
Strategic Partnering Opportunities Conference, Southern California Biomedical Council, "The BION Project", March 12, 2003.
Neurology/Neurosurgery Grand Rounds, University of Southern California, "Strategies for Neuromuscular Stimulation", Feb. 25, 2003.
Biomedical Engineering Seminar, USC, Los Angeles, CA, "Modular Injectable Interfaces with the Body – A New Direction for Medical Devices & Diagnostics?", Sept. 16, 2003.
AARP Workshop, Los Angeles, CA, "The Emerging Reality of Neural Prosthetics", June 16, 2003.
Spinal Cord Conference and Training, Long Beach, CA, "BIONs – History and Potential", June 5, 2003.
Science & Technology Series, Johns Hopkins U. Center for Talented Youth, "Neural Prosthetics – Making the Deaf Hear, the Blind See, and the Lame Walk", Nov. 16, 2003.
USC School of Pharmacy Winter Retreat, Ojai, CA, "Embedded Electronics in our Bodies, our Homes and our Lives", Jan. 19, 2002.
USC School of Engineering, 2002 Technology Equity Conference, San Diego, CA, "Alfred Mann Institute for Biomedical Engineering – An Experiment in Technology Transfer" and "BION Implants to Reanimate Paralyzed Muscles", Sept. 24, 2002.
University of Chicago, IL, "Reanimating Paralyzed Limbs – Coping with Spatially Distributed, Multimodal Systems", Oct. 23, 2002.
UCLA Biomedical Engineering Student Association, Los Angeles, CA, "BIONic Reanimation of Paralyzed Muscles and Limbs", Mar. 8, 2002
Society for Neuroscience Symposium on Computational Motor Control, Orlando, FL, "Model-Based Analysis of Sensorimotor Control Strategies", Nov. 2, 2002.
Llewellyn-Thomas Lecture, Institute of Biomaterials & Biomedical Engineering, Toronto, Canada, "Prosthetic Interfaces with the Nervous System", June 6, 2002.

Christopher Reeve Paralysis Foundation, Research Consortium Associates Meeting, Irvine, CA, "Learning From the Spinal Cord," May 18, 2002.

Catholic University of America, Washington, DC, "We Made the Deaf Hear….Now What?", October 8, 2002.

Association of Pacific Rim Universities, Los Angeles, CA, "AMI-USC: An Experiment in Biomedical Technology Transfer", May 30, 2002.

VA/NIH Prosthetics Roundtable, Bethesda, MD, "BIONic Interfaces for Rehabilitation and Repair," June 25, 2001.

University of Minnesota, Minneapolis, MN, "Neural Prosthetic Interfaces Between Electronics and Neurons: Making the Deaf Hear, the Blind See and the Lame Walk", Nov. 26, 2001.

Neurosurgical Grand Rounds, Massachusetts General Hospital, Boston, MA, "Making the Deaf Hear, the Blind See and the Lame Walk", June 21, 2001.

Neural Prosthesis Workshop, NIH, Bethesda, MD, "Clinical Experience with Microstimulators," Oct. 19, 2001.

Neural Information and Coding Workshop 2001, Big Sky, Montana, "Useful Effects from Lousy Signals: How to Build a Clinically Successful Neural Prosthesis", March 20, 2001.

MIT Leg Lab, Cambridge, MA, "BIONic Implants for Distributed Neural Prosthetic Interfaces", June 20, 2001.

Long Beach VA Medical Center and UC Irvine, CA, "BION Injectable Muscle Stimulators: Current Clinical Trials and Potential Application to Sleep Apnea", Sept. 26, 2001.

Jet Propulsion Lab, Pasadena, CA, "BIONic Implants for Distributed Neural Prosthetic Interfaces", June 28, 2001.

International Symposium on Movement and Sensation, Cairns, Australia, principal speaker, "The Importance of Biomechanics," Sept. 6, 2001.

Industrial Technology Research Institute (ITRI), Taipei, Taiwan, "The Field of Neural Prosthetics" and "BION Technology and Biomimetic Control Strategies to Reanimate Paralyzed Limbs", Dec. 17, 2001.

Hospital for Special Care, New Haven, CT, "BIONs – Injectable Electrical Stimulators for Paralyzed Muscles", June 13, 2001.

CI2001, Los Angeles, CA, "Managing Extreme Versatility – CLARION II Implant Architecture", March 3, 2001.

Cal Tech, Visual Research Lab Seminar, "Command and Control: Does our reach exceed our grasp?", Nov. 5, 2001.

Cal Tech, Pasadena, CA, Sloan Seminar, "Making the Deaf Hear, the Blind See and the Lame Walk", Nov. 5, 2001.

5th SIAM Conference on Control and its Applications, San Diego, CA, "Get Real: Biological and Neural Prosthetic Control of Muscles and Limbs", July 12, 2001.

Symposium on Spinal Cord Function and Rehabilitation, sponsored by J. Physiol. In honor of Prof. Jankowska, New Orleans, LA, "Learning *From* the Spinal Cord", 11/2000.

Rehabilitation Medicine Rounds, Veterans Administration Hospital, Los Angeles, "BIONic Implants for Therapeutic Electrical Stimulation," 3/00.

NIPS*2000 Workshop on Algorithms, Technologies and Neural Representations for Neuroprosthetics and Neurorobotics, Breckenridge, CO, "Primitives or Primitive: Forgetting Knowledge about the Spinal Cord", 12/2000.

Marquette University, Milwaukee, WI, "Bionic Man: Myth, Reality and Progress," 3/2000.

IEEE USC Student Chapter, Los Angeles, CA, "Electronic Interfaces with the Brain", 10/2000.

Engineering the Future of Medicine Symposium, A.E. Mann Institute for Biomedical Engineering, University of Southern California, "A Brief History of Neural Prosthetics," 2/2000.

7th Joint Symposium on Neural Computation, Los Angeles, CA, Keynote speaker: "Dialogs with the Nervous System," 5/2000.

1st Annual International IEEE EMBS Special Topic Conference on Microtechnology in Medicine and Biology, Lyon, France, "Design and Fabrication of Hermetic Microelectronic Implants", 10/2000.

National Institute of Mental Health, Neural Prosthetics Conference, Washington, DC, "We Made the Deaf Hear. Now What?" 8/99.

IVth International Symposium on the Head/Neck System, Tokyo, "Is the Neck a Leg?", 8/99.

Institute of Movement Science, University College London, England, "How Might the Brain Represent Muscles, Limbs and Spinal Circuits?" 3/99.

Institute of Electronic Systems, Aalborg University, Aalborg, Denmark, "Bionic Neurons for Electrical Stimulation of Paralyzed Muscles: Technology and Biology," 3/99.

University Southern California, Los Angeles, "Brain - Spinal Cord - Muscle: A Hierarchy of Sensorimotor Control," 1/98.

University of California at Los Angeles, CA, "Neural Prosthetic Interfaces Between Electronic Devices and the Nervous System," 7/98.

University of Arizona, Tucson, AZ, "What Might the Brain Know about Muscles, Limbs and Spinal Circuits:," 11/98.

Neural Control of Movement, Satellite on Computational Modelling, Key West, Florida, "The Importance of Being Muscular," 4/98.

Biomedical Engineering Society, Cleveland, OH, "Muscle as Motor," 10/98.

Arizona State University, Tempe, AZ, "Brain - Spinal Cord - Muscle: A Hierarchy of Sensorimotor Control," 3/98.

University of Washington, Seattle, "Grace Under Fire - The Real Goal of Motor Control," 1/97.

University of Montreal, Ctr Recherche Sci. Neurologique, "Grace Under Fire - The Real Goal of Motor Control", 11/96.

SCIB Symposium on Muscle Properties and Organismal Function: Shifting Paradigms, Albuquerque, NM, 12/96, invited summary.

Queen's University, Psychology Dept., Kingston, Ontario, "Cochlear Prostheses - Speaking Directly to the Brain", 1/96.

Pediatric Use of Cochlear Implants, Miami, Florida, "Speech Processing Strategies for Children", 2/96.

International Neuromodulation Society, Orlando, Florida, "Micromodular implants for functional and therapeutic electrical stimulation", 3/96.

Caltech, Pasadena, CA, "Grace Under Fire - The Real Goal of Motor Control", 11/96.

Brain Research Association, Newcastle upon Tyne, England, Plenary Lecture: "Grace Under Fire - The Real Goal of Motor Control", 3/96.

Biomechanics & Neural Control of Movement, Engineering Foundation Conference, Deer Creek, Ohio, "The Appropriate Use of Models", 6/96.

Alberta Motor Control XIX: Present Perspectives and Future Directions, "Proprioceptive Generalizations About the Limbs", 9/96.

Administrative

Professional Memberships:

American Institute for Medical and Biological Engineering (AIMBE)
Institute of Electrical and Electronics Engineers (IEEE, senior member)
Society for Neuroscience
Biomedical Engineering Society (BMES)
Phi Beta Kappa

Advisory Posts (previous 20 years only):

Editorial Boards: Associate Editor, *IEEE Trans. Neural Systems and Rehabilitation Engineering* (2002-4); *J. Neurophysiol.* (1987-90); *Exercise & Sports Science Reviews* (1985-1995); *Exp. Brain. Res.* (1992-2008); Honorary Editorial Board of *Applied Bionics and Biomechanics*, (2003-present), Editorial Advisory Panel, *Expert Review of Medical Devices* (2004-present); Advisory Board, *IEEE Transactions on Neural Systems & Rehabilitation Engineering* (2005-present); Editorial Board, *Open Biomedical Engineering Journal* (2007-present)

Frequent Referee: *Nature, J. Neuroscience, J. Neurophysiology, Exp. Brain Res., J. Physiol., IEEE-BME, IEEE-TNRE, J. Neurosci. Methods, Med. & Biol. Engng. & Comput., J. Biomech., Ann. Biomed.Engng., Muscle & Nerve, J. Neural Engng., PLoS Computational Biology*

Ad hoc Study Section member: US NIH, US NSF, MRC Canada, NSERC Canada

Advisory Board, STEM Academy of Hollywood

Advisory Board, Chongqing Institute for Green and Intelligent Technology, Chinese Academy of Science

Academic Committees (USC only)

2016-17: Senate Task Force on Innovation

2014-: Advisory Board for Body Engineering Los Angeles GK-12

2014-: Viterbi Research Committee

2012-15: Ph.D. Admissions Committee, Biomedical Engineering; chair 2014-

2012-2013: Curriculum Committee, Neuroscience Graduate Program

2012-2013: Ph.D. Admissions Committee, Neuroscience Graduate Program

2011-: Space Utilization Committee, Biomedical Engineering Dept.

2011-12: Advisory Committee for Global Initiatives, Viterbi School of Engineering

2010-12: Appointments, Promotions & Tenure Committee, Viterbi School of Engineering

2005-7: University Research Committee for the Academic Senate

2005-: Board of Advisors, Regulatory Science Program

2004-5: Committee on Nanotechnology, Viterbi School of Engineering

2004-10: Faculty Advisory Committee to the Distance Education Network

2004: Task Force on Restructuring of the Independent Health Professions

2004-10: USC Health Faculty Collaborative

2003-4: Provost's Strategic Planning Committee

2002-7: University Committee on Academic Review

2002-3: MS Program Review Committee, School of Engineering

2002: Internal Review Committee, Dept. of Electrical Engineering

2001-3: Board of Advisors, National Network for Technology Education and Commercialization (NSF funded)

2001-2: Research Committee for the School of Engineering

2001-2: Board of Advisors, Technology Commercialization Alliance

2000-3: Research Committee of the Academic Senate; chair 2001-3

2000-2: Appointments, Promotion and Tenure Committee for the School of Engineering

1999-2008: Steering Committee, Institute for Health in an Aging Population

Scientific Meeting Organization:

Organizing Committee, Computational Motor Control Workshop, Beer Sheva, Israel, 6/2010, 6/2011.

Workshop Organizer, Winter Conference on Brain Research, 1/1985, 1/2007.

Track Chairman, Neural Engineering Committee, Biomedical Engineering Society, 1/2007.

Track Chair, Neural Engineering, BioMedical Engineering Society Annual Meeting, 9/2007.

Track Chair, Neural Prosthetics and Rehabilitation, IEEE-EMBS, Shanghai, 9/2005.

Organizer, Symposium Series "Engineering the Future of Medicine", A.E. Mann Institute:

- "Can we make the blind see?" Feb., 19, 2000
- "Putting the brain in command" July 8, 2000
- "Breaching barriers to drug entry" Mar. 31, 2001
- "Electric power in vivo" Feb. 28, 2004

Program Committee, 1st Annual International IEEE EMBS Special Topic Conference on Microtechnology in Medicine and Biology, Lyon, France, 10/2000.

Meeting Organizer, "Musculoskeletal Modeling Workshop", sponsored by A.E. Mann Institute for Biomedical Engineering, Morro Bay, CA, 8/2000

Session Organizer, NCM2000 Satellite on Computational Models, Key West, FL, 4/2000.

Organizing Committee, Conference for Research in Action and Perception, Kingston, ON, 6/98.

Program Committee, Neural Prostheses - Motor Systems V Conference, Burnaby, BC, 8/97.

Focus Group Leader, 1997 Conference on Implantable Auditory Prostheses, Pacific Grove, Ca, 8/97.

Scientific Panel Organizer, Neural Control of Movement Meeting, Cancun, Mexico, 4/97.

Program Committee, Engineering Foundation Conference on Biomechanics & Neural Control of Movement IX, Deer Creek, Ohio, 6/96.

Panel Organizer, "Linking Neural Control to Movement: Insights from Biomechanics," Neural Control of Movement, Marco Island, Florida, 4/93.

Scientific Committee, North Sea Conference - Biomedical Engineering 90, Antwerp, Belgium.

Cochairman, Engineering Foundation Conference on Biomechanics & Control, Henniker, NH, 7/87.

Panel Organizer, "Neural Prosthetic Electrode Arrays: The Perennial Promise of Microelectronics," Materials Research Society, 12/85.

Panel Organizer, 16th Annual Neural Prosthesis Workshop, NINCDS, 11/85.

Steering Committee, Engineering Foundation Conference on Neural Prostheses, Henniker, NH, 8/85.

Steering Committee, Engineering Foundation Conference on Biomechanics & Neural Control of Movement, Henniker, NH, 7/85.

Teaching

Program Development: Founding Director, USC Master of Science in Medical Device and Diagnostic Engineering

Post-doctoral Fellowship Supervision and Funding Source:

K.E. Aktogan (2011- 2012), Government of Turkey
Yao Li (2010- 2013), DARPA
V.J. Santos (2007- 2008), AMI-USC
N. Rodriguez (2005-2007), AMI-USC
A. Inmann (2002-2003), AMI-USC
R. Davoodi (1999-2001), AMI-USC
Wan Jiang (1997-98), MRC Grant
H. Ruddy (1991-1993), Network of Centres of Excellence/NIH Program-Project Grant
R.P. Young (1990-1992), NIH Grant
J. Weytjens (1986-1988), Fulbright Scholar
C.J. Heckman (1986-1988), PHS NRSA
J. Blaszczyk (1985-1987), Fogarty International Fellowship
S.J. Duenas (1984-86), Fogarty International Fellowship
S. Spector (1984-86), PHS NRSA
C.A. Pratt (1979-80), PHS NRSA
J. Duysens (1977-78), Fogarty International Fellowship

Ph.D. Thesis Adviser:

X. Huang (in progress), Dept. of Biomedical Engineering, USC
L. Zhou (2016), Dept. of Biomedical Engineering, USC
A. Nicholson-Vest (2015), Dept. of Biomedical Engineering, USC
G. A. Tsianos (2012), Dept. of Biomedical Engineering, USC

J. A. Fishel (2012), Dept. of Biomedical Engineering, USC
N.A. Wettels (2011), Dept. of Biomedical Engineering, USC
M. Hauschild (2010), Dept. of Biomedical Engineering, USC
R. Kaliki (2009), Dept. of Biomedical Engineering, USC
G. Raphael (2009), Dept. of Biomedical Engineering, USC
Dan Song (2008) Dept. of Biomedical Engineering, USC
H. M. Kaplan (2008), Dept. of Biomedical Engineering, USC
K.C. Liao (2006) Dept. of Biomedical Engineering, USC
W. Tan (2006), Dept. of Biomedical Engineering, USC
M. P. Mileusnic (2005), Dept. of Biomedical Engineering, USC
A.C. Dupont (2001), Dept. Physiology, Queen's Univ.
I.E. Brown (1998), Dept. Physiology, Queen's Univ.
T. Cameron (1996), Dept. Physiology, Queen's Univ.
S.H. Scott (1993), Dept. Physiology, Queen's Univ.
A.J. Rindos (1988), Dept. Elect. Engineering, Univ. Maryland
C.M. Chanaud (1988), Dept. Zoology, Univ. Maryland

M.Sc. Thesis Adviser:

J.E. Arguelles-Morales (2013), Dept. of Biomedical Engineering, USC
M. Lai-Chuck-Choo (2012), Dept. of Biomedical Engineering, USC
Zhe Su (2012), Dept. of Biomedical Engineering, USC
C.S. Lin (2011), Dept. of Biomedical Engineering, USC
J. Goodner (2011), Dept. of Biomedical Engineering, USC
N. Sachs (2006), Dept. of Biomedical Engineering, USC
H.C. Fornwalt (2005), Dept. of Biomedical Engineering, USC
M. Rodriguez (2005), Dept. of Biomedical Engineering, USC
D. M. Kleiman (2003), Dept. of Biomedical Engineering, USC
J. Singh (2002), Dept. of Biomedical Engineering, USC
E. Cheng (1999), Dept. Physiology, Queen’s Univ.
I.E. Brown (1995), Dept. Physiology, Queen's Univ.
C. Engstrom (1990), Dept. of Anatomy, Queen's Univ.
A.J. Rindos (1982), Dept. Zoology, Univ. Maryland

Doctoral Thesis Committees:

Anton Spanne (external reviewer, 2015), University of Lund, Sweden
Shanie Liyanagamage (in progress), Dept. of Biomedical Engineering, USC
Zhe Su (in progress), Dept. of Biomedical Engineering, USC
Emily Lawrence (in progress), Dept. of Biomedical Engineering, USC
Joseph Crew (in progress), Dept. of Biomedical Engineering, USC
Alexander Reyes (2015), Dept. of Biomedical Engineering, USC
Cesar Medina (2015), Doctoral Program in Regulatory Science, USC
Kobby Dankwah (2015), Doctoral Program in Regulatory Science, USC
Taranjit Singh (2012), Doctoral Program in Regulatory Science, USC
Tony Chan (2012), Doctoral Program in Regulatory Science, USC
Susan Bains (2012), Doctoral Program in Regulatory Science, USC
Duane Mauzey (2012), Doctoral Program in Regulatory Science, USC
C. Zhou (in progress), Dept. of Biomedical Engineering, USC
Bardia Fallah Behabadi (in progress), Dept. of Biomedical Engineering, USC
Arthi Srinivasan (2012), Dept. of Biomedical Engineering, USC
Navya Davuluri (2011), Dept. of Biomedical Engineering, USC
Michael Jamieson (2011), Doctoral Program in Regulatory Science, USC
Monika Jadi (2010), Dept. of Biomedical Engineering, USC
Alan Horsager (2009), Dept. of Biomedical Engineering, USC
N. Sachs (2007), Dept. of Biomedical Engineering, USC
Joe Fu-Jiou Lo, Ph.D. (2007), Dept. of Biomedical Engineering, USC
J Henry Lin (2007), Dept. of Pathology, USC

J. Y. Hwang (2006), Dept. of Biomedical Engineering, USC
Eric Ortega, Ph.D. (2006), Dept. of Biomedical Engineering, USC
Chunhong Zhou, Ph.D. (2005), Dept. of Biomedical Engineering, USC
Juji Harimoto, Ph.D. (2003), Dept. of Biomedical Engineering, USC
Javier Jo, Ph.D.(2003), Dept. of Biomedical Engineering, USC
Deniz Baskent, Ph.D. (2003), Dept. of Biomedical Engineering, USC

Course Organizer:

Physiological Instrumentation, PHGY 484/884, Queen's Univ.
Applied Electrophysiology, seminar and laboratory, BME 620L, USC
Development and Regulation of Medical Products, BME 416, USC
Advanced Overview of Neuroscience (core course, organizer for Sensorimotor System) NEUR 525, USC

Guest Lecturer, USC courses:

BME 201 Biomedical Engineering Practice
BME 414 Rehabilitation Engineering
BME 501 Advanced Topics in Biomedical Systems
BME 504 Neuromuscular Systems
BAEP 551 Introduction to New Ventures
RSCI 601 Biomedical Commerce
RSCI 604 Regulation in Asia
RSCI 605 Management of Human Resources
RSCI 608 Regulation in Europe and the Americas
MPTX 511 Introduction to Medical Product Regulation
MPTX 515 Quality Systems and Standards
NEUR 532 Systems and Behavioral Neurobiology
NEUR 524 Advanced Overview of Neuroscience

Special Course Faculty:

National Center for Adaptive Neurotechnologies, Summer Course, Albany, NY, 2016-2017
Workshop on Neuromorphic Engineering, Telluride, CO, 2010.
UCLA Dept. of Biomedical Engineering, BME260 Neuroengineering, guest lecturer 2000-2002
USC School of Pharmacy Short Course, Clearing Roadblocks in the New-Product Path, 2000.
Queen's University, PHGY 801 - Beyond Academia: Using Biomedical Science in Business and Government, 1996 - 1999.
Advanced Bionics Corp., Continuing Education in Medical Devices, 1994 - 1999.
Cold Spring Harbor Course on Computational Neurobiology, 1985, 1986, and 1988.

Research Support

Current External Grants and Contracts (academic from US sources only):

5P50FD004896-02 Bar-Cohen (PI), Loeb (co-PI) 09/16/2013-08/31/2018
US Food & Drug Administration
Pediatric Medical Device Consortium
The goal is the creation of a multi-disciplinary network at USC, CHLA and other academic medical centers and businesses to foster development of promising new medical devices specifically for pediatric applications.

1 R01 HD075135-01 Bar-Cohen (PI), Loeb (co-PI) 12/01/2012 – 11/30/2017
National Institutes of Health
Preclinical Development of a Fetal Micropacemaker

Funds the design, fabrication and chronic animal studies of a minimally invasive cardiac pacemaker that can be injected into the chest of a fetus in utero to treat complete heart block with hydrops fetalis.

Recently Completed Grants and Contracts (academic from US sources only):

CBET-0922784 Loeb (PI) 06/01/2009 - 09/30/2013
National Science Foundation
MRI: Development of Tactile Sensing Hand+Arm for Robotic Haptics
This grant funds the purchase of an industrial robot and fitting with our BioTac tactile sensors and control software.

235660 Loeb (subcontract PI) 07/01/2011 – 12/31/2013
National Science Foundation
Development of a Common Platform for Unifying Humanoids Research
This grant fund the development of anthropomorphic robots and their controllers for a consortium of US labs; my group is development the tactile sensors and reflex control loops.

5R01NS069214-02 Sanger (PI), Loeb (Co-PI) 01/01/2011 – 12/31/2013
National Institutes of Health
High-Speed Simulation of Developmental Motor Disorders
The goal of this study is to adapt our existing models of peripheral and spinal sensorimotor components so they can be run at very high speeds to simulate developmental pathologies such as cerebral palsy and dystonia.

19GM-1088723 Loeb (subcontract PI) 03/31/2010 – 03/30/2012
DARPA – Caltech
Reorganization and Plasticity to Accelerate Injury Recovery (R.E.P.A.I.R.), Phase 1
The goal is to develop complete models of sensorimotor behavior and dysfunction and to guide the development of prosthetic and rehabilitation strategies; I direct the development of spinal cord and limb models.

N6601-11-C-4171 Loeb (subcontract PI) 07/01/2011 – 06/30/2013
DARPA – University of Pittsburgh
Reliable Spinal Nerve Interfaces for Sensorimotor Neuroprostheses
The goal of this study is to demonstrate clinically viable algorithms and subsystems for reliably decoding motor-control signals from detected peripheral signals.

EFRI-COPN 0836042 Valero-Cuevas (PI), Loeb (Co-Investigator) 11/01/2008 – 10/31/2012
National Science Foundation
Reverse-engineering the human brain's ability to control the hand
The goal of this study is to understand the biomechanics of the hand and its implications for neural control strategies; my role is to consult on muscle and proprioceptor properties and models.

JHU/APL 907959 Harshbarger (PI) 03/07/06 - 03/06/10
DARPA subcontract
Revolutionizing Prosthetics 2009 (Phase 2)

EEC-0310723 Humayan (PI) 09/01/2003 - 08/31/2008
National Science Foundation
Engineering Research Center for Biomimetic Microelectronic Systems

I was Deputy Director and P.I. of the testbed for Neuromuscular Prostheses.

National Academies Keck Futures Initiative (2007)

National Institutes of Health – Bioengineering Research Partnership - P.I. (2002-2007)

Contract Administration:
Project Officer, #N01-NS-7-2366, Stanford Univ., Development of a Multichannel Electrode for an Auditory Prosthesis, 1976-79.

Project Officer, #N01-NS-7-2364, University of California at San Francisco, Development of a Multichannel Electrode for an Auditory Prosthesis, 1976-79

Project Officer, #N01-NS-3-2348, Univ. of Maryland, Kinesiological Modeling of the Cat Hindlimb, 1982-1986 and #N01-NS-6-Z300, 1986-89.

Principal Investigator, NIH Contracts #N01-NS-9-2327, #N01-NS-2-2322, #N01-NS-5-2325 to A.E. Mann Foundation, Micro-stimulator for Functional Neuromuscular Stimulation, 1989-98.

Consulting (partial listing)
General Stim Inc., Los Angeles and Hangzhou, China (2014-present)
MicroNuronix, Los Angeles and Hangzhou, China (2012-2014)
Sheppard Mullin Richter & Hampton LLP (2012-2016)
Nurotron, Hangzhou, China (2011-2013)
Purdue University (2011-2013)
Rehabilitation Institute of Chicago (2010-2013)
Setpoint Medical, Boston, MA (2009-2012)
Kardium Corp., Vancouver, Canada (2006-2008)
Connolly Bove Lodge & Hutz LLP, Los Angeles (2008-2012)
Shanghai Medical Cochlear Corp., Shanghai, China (2007- 2010)
Victhom Human Bionics, Saint-Augustin-de-Desmaures, Canada (2008-2010)
Bioness Inc., Valencia, CA (2006-2008)
Advanced Neuromodulation Systems, Plano, Texas (2001)
Advanced Bionics Corp., Sylmar, California (1993-1999)
A.E. Mann Foundation, Sylmar, California (1987-1999)
PI Medical, Portland, Oregon (1992-1996)
Advanced Surface Technology, Billerica, Massachusetts (1991-1993)
Trovan Ltd., Luxembourg (1988-1992)
Jet Process Corp., New Haven, Connecticut (1991-1992)
Biophor Corp., Billerica, Massachusetts (1991-1992)
Mentor Technologies, Inc., Rockville, Maryland (1987-1990)
Ionic Atlanta, Atlanta, Georgia (1988-1990)
Abiomed Inc., Danvers, Massachusetts (1989-1990)
Taymar Inc., Westminster, Colorado (1987-1988)
Travenol Laboratories, Deerfield, Illinois (1986-1987)
Micro-Probe, Inc., Clarksburg, Maryland (1984-1987)
University of California, Dept. of Urology, San Francisco, California (1984-1986)
Intermedics, Freeport, Texas (1985-1986)
Identification Devices, Inc., Boulder, Colorado (1985-1986)
Gentronix, Inc., Rockville, Maryland (1984-1986)
Collier's Encyclopedia, Macmillan Publishers, New York (1986)
BTS, Inc., Greenbelt, Maryland (1985-1986)
Storz Instrument Company, St. Louis, Missouri (1983-1985)
Biostim, Inc., Princeton, New Jersey (1983-1985)
Bak Electronics, Inc., Rockville, Maryland (1979-1984)
Parco Scientific Company, Vienna, Ohio (1981-1983)

AUTOBIOGRAPHICAL SKETCH

I received both my bachelors and medical degrees from The Johns Hopkins University through their accelerated/combined program 1965-1972. While an undergraduate and medical student, I worked on several projects involving microelectronic fabrication of electrode arrays for neurophysiological research and neural prosthetics, including service as principal investigator on a biomaterials development contract from NIH to Johns Hopkins and as a guest researcher at the University of Utah Artificial Eye Project. I trained for one year as a resident in the Department of Surgery, University of Arizona, and I am a licensed physician in the State of California.

From 1973 to 1987, I was a medical officer in the USPHS in the Laboratory of Neural Control, National Institute of Neurological and Communicative Disorders and Stroke, National Institutes of Health, Bethesda, Maryland. In 1983, I received the Commendation Medal of the U.S. Public Health Service. I was responsible for planning and conducting a wide range of studies concerning the sensorimotor control of locomotion, electrophysiological studies of peripheral nerve conduction, and development of novel research techniques for neurokinesiological studies. In particular, my research group developed a variety of implantable electrodes and transducers that permit detailed study of single neuron and whole muscle activity during natural behavior in intact animals. I directed a collaborative project with the University of Maryland to develop a comprehensive musculoskeletal model of the cat hindlimb.

In addition to pursuing basic research, I have been involved in a variety of biomedical engineering projects in various capacities, including a guest appointment at University of California at San Francisco, adjunct associate professor at University of Utah, and president of Biomed Concepts, Inc., a consulting and prototype development business with several current projects (www.BiomedConceptsGroup.com). During the period 1979-1981, I commuted regularly to UCSF, where I was responsible for recruiting and leading the engineering team that developed the forerunner of the CLARION® cochlear implant, which now provides functional speech perception for thousands of profoundly deaf patients. From 1988-1998 I led an inter-institutional team (Queen's University, Mann Foundation, and Illinois Institute of Technology) that developed a new class of implantable electronic devices (BION®) for a wide range of applications involving therapeutic and functional electrical stimulation of weak and paralyzed muscles. From 1994-1999 I was Chief Scientist for Advanced Bionics Corp. (Sylmar, California), working on commercialization and further development of the CLARION and BION systems. In 2008, my students and I formed SynTouch LLC, a technology company developing BioTac® biomimetic tactile sensors (www.SynTouchLLC.com), which has been designated a Technology Pioneer by the World Economic Forum.

I have authored or coauthored over 380 publications (excluding abstracts), including a book on electromyography (in press since 1986), 55 full-length physiological research reports in refereed journals, 108 full-length biomedical engineering papers in refereed journals, and 65 issued U.S. patents. I have served on the editorial boards of 8 journals and regularly referee for several others.

My research strategy is to understand how the nervous system solves problems in sensorimotor control and perception so that we can apply biomimetic strategies to the design of robotic and prosthetic systems. My students and I strive to combine the basic research, clinical medicine, applied engineering and industrial relations that are required for such "high-tech" endeavors to succeed.