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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:

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

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

Research Interests:

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

Research & Scholarly Activities:**Publications: 326**

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: 136**Physiological Research: 66**

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- Duysens, J., Loeb, G.E. and Weston, B.J. Crossed flexor reflex responses and their reversal in freely walking cats. *Brain Res.* 197:538-542, 1980.
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- Loeb, G.E., Hoffer, J.A. and Pratt, C.A. Activity of spindle afferents from cat anterior thigh muscles. I. Identification and patterns during normal locomotion. *J. Neurophysiol.* 54:549-564, 1985.
- Loeb, G.E. and Hoffer, J.A. The activity of spindle afferents from cat anterior thigh muscles. II. Effects of fusimotor blockade. *J. Neurophysiol.* 54:565-577, 1985.
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- International Neuromodulation Society, Orlando, Florida, "Micromodular implants for functional and therapeutic electrical stimulation", 3/96.
- 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, Mt. Sterling, Ohio, "The Appropriate Use of Models", 6/96.
- Alberta Motor Control XIX: Present Perspectives and Future Directions, "Proprioceptive Generalizations About the Limbs", 9/96.
- University of Montreal, Ctr Recherche Sci. Neurologique, "Grace Under Fire - The Real Goal of Motor Control", 11/96.
- Caltech, Pasadena, CA, "Grace Under Fire - The Real Goal of Motor Control", 11/96.
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State of the Science Workshop on Functional Restoration for the Stroke Survivor, “Practice”, keynote speaker, La Jolla, CA, March 7, 2006.

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

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

US-China Workshop on Neural Interface Technologies, Kunming, China, “Injectable Muscle Stimulators and Sensors for Motor Function,” July 9-11, 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.
- Alberta Motor Control, Kananaskis, Canada, "Mathematical Models of Proprioceptors," "Prosthetic Proprioception," Sept. 23-24, 2006
- Simon Fraser University, Vancouver, Canada, "Reanimating Limb = Technology + Neurophysiology," Sept. 25, 2006.
- Global Digital Healthcare, Cambridge Healthtech Institute, Baltimore, MD, "Neural Prostheses: Crossing the Last Meter in Personal Telecommunications," Oct. 10-11, 2006.
- International Symposium on Biomedical Engineering, Taipei, Taiwan, "BION Injectable Neuromuscular Interfaces to Reanimate Paralyzed Limbs" (keynote), Dec. 15, 2006
- 35th Annual Conference of Indian Association for Physical Medicine and Rehabilitation, Patna, India, "BION Injectable Neuromuscular Stimulators: Technology and Clinical Applications," Jan. 20, 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.
- Neurorehabilitation Grand Rounds, Rancho Los Amigos National Rehabilitation Center, Downey, CA, "BIONic Interfaces for Neuromuscular rehabilitation," Oct. 25, 2007.
- 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 Challenges for the Use of Neuromuscular Electrical Stimulation in Rehabilitation Medicine" (keynote), "BIONic Interfaces to Reanimate Paralyzed Limbs," April 26-27, 2008.
- Erasmus University, Rotterdam, Netherlands, "Making the Deaf Hear, the Blind See and the Lame Walk," May 5, 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.
- Fourth China International Life Science Summit, Hangzhou, China, "Trends and Opportunities in Medical Devices," Sept. 22, 2008.
- Engineering Neuroscience & Health, USC, "The Spinal Cord Makes Sensorimotor Control Easy to Do but Difficult to Understand," Sept. 29, 2008.
- University of Utah, Salt Lake City, UT, "Making the Deaf Hear and the Blind See – Some Challenges Along the Way," Nov. 10, 2008.
- 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.
- 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.
- Human Nature and Self Design, Tuebingen, Germany, "Neuroimplants and Beyond," Aug. 1, 2009.
- NSF-CMMI Workshop on Neuromechanical Engineering, Arlington, VA, "Exploiting Neural and Muscular Trophisms for Rehabilitation," Sept. 14, 2009.
- Workshop on Multi-Scale Muscle Mechanics, Woods Hole, MA, "Things that bother a mammalian neurophysiologist about muscle," Sept. 19, 2009.
- XXXIX Neurohike Meeting, Jasper, Canada, "Taking care of business," Sept. 26, 2009.
- First International Academic Conference of Acupuncture and Moxibustion Instrumentation, Shanghai, China, "The Art and Science of Neural Stimulation," Dec. 11, 2009.
- ISSCC 2010, San Francisco, evening session on Bionic Systems, "System design challenges in a very complex system indeed," Feb. 9, 2010.
- Neural Control of Movement Annual Conference, Naples, FL, "Biomimetic Tactile Sensors" and "Spinal-Like Regulators", April 20-25, 2010.

- 17th Joint Symposium on Neural Computation, Los Angeles, CA, "What Does the Brain Control?", May 22, 2010.
- Computational Motor Control Workshop, Beer Sheva, Israel, "Spinal-like regulator simplifies control of multiple degree-of-freedom limbs," June 16, 2010.
- Telluride Neuromorphic Cognition Engineering Workshop, Telluride, CO, "Brain Machine Interfaces", June 28-30, 2010.
- Brain Machine Interfaces, Ystad Saltsjobad, Sweden, "What Does the Brain Control?", Aug. 28, 2010.
- EPFL, Lausanne, Switzerland, "'Biomimetic Haptics for Robots", Aug. 30, 2010.
- Transformational Technologies Conference, Rancho Los Amigos National Rehabilitation Center, Downey, CA, "Multimodal Biomimetic Tactile Sensors for Prosthetic Limbs", Sept. 2, 2010.
- IEEE-EMBS, Thousand Oaks, CA, "Biomimetic Strategies for Dexterous Robots and Prosthetic Limbs", Sept. 29, 2010.
- Caltech, Pasadena, CA, "What Does the Brain Control", Oct. 18, 2010.
- University of Southern California, Los Angeles, CA, "Biomimetic Tactile Sensing for Prosthetic and Robotic Hands", Nov. 8, 2010.
- IEEE-EMBS Distinguished Lecturer Event, San Fernando Valley, CA, "Biomimetic Strategies for Dexterous Robots and Prosthetic Limbs," May 17, 2011.
- Ben Gurion University, President's Distinguished Guest, Beer Sheva, Israel, "Biomimetic Strategies for Dexterous Robots and Prosthetic Limbs," June 10, 2011.
- Computational Motor Control Workshop, Beer Sheva, Israel, "Spinal Cord Model," June 12, 2011.
- Summer School on Impedance, STIFF EC Project, Frauenchiemsee, Germany, "What Roboticists Need to Know About NeuroMusculoSkeletal Systems," July 25, 2011.
- Multimodal & Sensorimotor Bionics Workshop, Munich, Germany, "Biomimetic Strategies for Dexterous Robots and Prosthetic Limbs," July 27, 2011.

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 15 years only):

Theme Coordinator, Neuroscience Network of Centres of Excellence (1993-97)

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-present); 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: *J. Neuroscience*, *J. Neurophysiology*, *Exp. Brain Res.*, *J. Physiol.*, *J. Morph.*, *IEEE-BME*, *IEEE-TNRE*, *J. Neurosci. Methods*, *Med. & Biol. Engng. & Comput.*, *J. Biomech.*, *Brain & Behavioral Sciences*, *Ann. Biomed.Engng.*, *Muscle & Nerve*, *J. Neural Engng.*

Ad hoc Study Section member: US NIH, US NSF, MRC Canada, NSERC Canada, Muscular Dystrophy Association Canada, Rick Hansen Fund

Academic Committees (USC only)

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

2000-2: Appointment, Promotion and Tenure Committee for the School of Engineering, representing Dept. of Biomedical Engineering

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

2001-2: Research Committee for the School of Engineering

2001-2: Board of Advisors, Technology Commercialization Alliance

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

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

2002-7: University Committee on Academic Review

2002: Internal Review Committee, Dept. of Electrical Engineering

2003-4: Provost's Strategic Planning Committee

2004- : Faculty Advisory Committee to the Distance Education Network

2004: Task Force on Restructuring of the Independent Health Professions

2004- : USC Health Faculty Collaborative

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

2005-7: University Research Committee for the Academic Senate

2005-: Board of Advisors, Regulatory Science Program

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

Scientific Meeting Organization:

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

Meeting Organizer, "Putting the Brain in Control" Engineering the Future of Medicine Series, A.E. Mann Institute for Biomedical Engineering, Los Angeles, CA, 7/2000.

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

Meeting Organizer, "Can We Make the Blind See?" Engineering the Future of Medicine Series, A.E. Mann Institute for Biomedical Engineering, Los Angeles, CA, 2/2000.

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.

Workshop Organizer, Winter Conference on Brain Research, 1/85, 1/2007.

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

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

Teaching

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

Post-doctoral Fellowship Supervision and Funding Source:

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

Ph.D. Thesis Adviser:

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

M.Sc. Thesis Adviser:

A.J. Rindos (1982), Dept. Zoology, Univ. Maryland
C. Engstrom (1990), Dept. of Anatomy, Queen's Univ.
I.E. Brown (1995), Dept. Physiology, Queen's Univ.
E. Cheng (1999), Dept. Physiology, Queen's Univ.
J. Singh (2002), Dept. of Biomedical Engineering, USC
D. M. Kleiman (2003), Dept. of Biomedical Engineering, USC
M. Rodriguez (2005), Dept. of Biomedical Engineering, USC
H.C. Fornwalt (2005), Dept. of Biomedical Engineering, USC
N. Sachs (2006), Dept. of Biomedical Engineering, USC
J. Goodner (2011), Dept. of Biomedical Engineering, USC

Thesis Committees:

Javier Jo, Ph.D.(2003), Dept. of Biomedical Engineering, USC
 Deniz Baskent, Ph.D. (2003), Dept. of Biomedical Engineering, USC
 Juji Harimoto, Ph.D. (2003), Dept. of Biomedical Engineering, USC
 Chunhong Zhou, Ph.D. (2005), Dept. of Biomedical Engineering, USC
 Eric Ortega, Ph.D. (2006), Dept. of Biomedical Engineering, USC
 J Henry Lin (2007), Dept. of Pathology, USC
 Joe Fu-Jiou Lo, Ph.D. (2007), Dept. of Biomedical Engineering, USC
 N. Sachs (2007), Dept. of Biomedical Engineering, USC
 J. Y. Hwang (2006), Dept. of Biomedical Engineering, USC
 T. Li (in progress), Dept. of Biomedical Engineering, USC
 C. Zhou (in progress), Dept. of Biomedical Engineering, USC
 W.H. Tran (in progress), Dept. of Biomedical Engineering, USC
 Alan Horsager (2009), Dept. of Biomedical Engineering, USC
 Monika Jadi (2010), Dept. of Biomedical Engineering, USC
 Michael Jamieson (2011), Doctoral Program in Regulatory Science, USC
 Bardia Fallah Behabadi (in progress), Dept. of Biomedical Engineering, USC
 Navya Davuluri (in progress), Dept. of Biomedical Engineering, USC
 Taranjit Singh (in progress), Doctoral Program in Regulatory Science, USC
 Susan Bains (in progress), Doctoral Program in Regulatory Science, USC

Course Organizer:

Physiological Instrumentation, PHGY 484/884, Queen's Univ.
 Applied Electrophysiology, seminar and laboratory, BME620, USC
 Development and Regulation of Medical Products, BME416, USC

Special Course Faculty:

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

Research Funding**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.

Recent and Current Research Funding:

National Science Foundation – Major Research Instrumentation Development (2009-2011)

National Academies Keck Futures Initiative (2007)

DARPA – Revolutionizing Prosthetics, contract to Johns Hopkins University Applied Physics Laboratory – subcontract P.I. (2006-2010)

DARPA – REPAIR, contract to Caltech – subcontract P.I. (2010-2014)

National Science Foundation – Biomimetic Microelectronic Systems Engineering Research Center – Deputy Director (2003-2008)

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

National Institutes of Health - Program Project Grant - Project P.I.

National Institutes of Health - R01 Individual Research Grant - P.I. (2000-2003)

National Institutes of Health - Neural Prosthesis Contract - co-P.I.

National Institutes of Health - Small Business Innovative Research Grants – subcontractor

Whitaker Foundation – Special Opportunity Grant – co-P.I. (2000-2003)

Consulting (partial listing)

Rehabilitation Institute of Chicago (2010-present)

Setpoint Medical, Boston, MA (2009-present)

Victhom Human Bionics, Saint-Augustin-de-Desmaures, Canada (2008-2010)

Connolly Bove Lodge & Hutz LLP, Los Angeles (2008-present)

Shanghai Medical Cochlear Corp., Shanghai, China (2007- 2010)

Kardium Corp., Vancouver, Canada (2006-present)

Bioness Inc., Valencia, CA (2006-2008)

Advanced Neuromodulation Systems, Plano, Texas (2001)

A.E. Mann Foundation, Sylmar, California (1987-1999)

Advanced Bionics Corp., Sylmar, California (1993-1999)

PI Medical, Portland, Oregon (1992-1996)

Advanced Surface Technology, Billerica, Massachusetts (1991-1993)

Biophor Corp., Billerica, Massachusetts (1991-1992)

Jet Process Corp., New Haven, Connecticut (1991-1992)

Abiomed Inc., Danvers, Massachusetts (1989-1990)

Ionic Atlanta, Atlanta, Georgia (1988-1990)

Trovan Ltd., Luxembourg (1988-1992)

Mentor Technologies, Inc., Rockville, Maryland (1987-1990)

Taymar Inc., Westminster, Colorado (1987-1988)

Travenol Laboratories, Deerfield, Illinois (1986-1987)

BTS, Inc., Greenbelt, Maryland (1985-1986)

Identification Devices, Inc., Boulder, Colorado (1985-1986)

Collier's Encyclopedia, Macmillan Publishers, New York (1986)

Intermedics, Freeport, Texas (1985-1986)

Gentronix, Inc., Rockville, Maryland (1984-1986)

Storz Instrument Company, St. Louis, Missouri (1983-1985)

University of California, Dept. of Urology, San Francisco, California (1984-1986)

Micro-Probe, Inc., Clarksburg, Maryland (1984-1987)

Biostim, Inc., Princeton, New Jersey (1983-1985)

Parco Scientific Company, Vienna, Ohio (1981-1983)

Bak Electronics, Inc., Rockville, Maryland (1979-1984)

AUTOBIOGRAPHICAL SKETCH

I received both my bachelors and medical degrees at 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. 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. Recently, my students and I formed SynTouch LLC, a start-up company developing BioTac® biomimetic tactile sensors.

I have authored or coauthored over 300 publications (excluding abstracts), including a book on electromyography, 66 full-length physiological research reports in refereed journals, 70 full-length biomedical engineering papers in refereed journals, and 54 issued 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 systems 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 endeavor to obtain working expertise in the various fields of basic research, clinical medicine, applied engineering and industrial relations that must be brought together for such "high-tech" endeavors to succeed.

