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Shawn K. Kelly
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Education

- **Massachusetts Institute of Technology**, Cambridge, MA
 - Ph.D., Electrical Engineering, October, 2003
 - “A System for Efficient Neural Stimulation with Energy Recovery”
 - Supervisor: John L. Wyatt
- **Massachusetts Institute of Technology**, Cambridge, MA
 - M.Eng., Electrical Engineering, June 1998
 - “A System for Electrical Retinal Stimulation for Human Trials”
 - Supervisor: John L. Wyatt
- **Massachusetts Institute of Technology**, Cambridge, MA
 - S.B., Electrical Engineering, June 1996
 - Minor in Biology; Minor in Biomedical Engineering
 - “A Marking and Identification System for Locating Faulty Assembly Line Parts”
 - Supervisor: Steven Leeb

Primary Interests

- Analog and mixed signal VLSI circuit design
- Retinal prostheses, implantable microelectronic medical devices
- Electrical tissue stimulation, neuromodulation, current source stimulation circuitry, stimulating electrode materials
- Power/data telemetry, power management, micro-power power management circuits

Current Position, 2003 – Present

Boston VA Medical Center, Center for Innovative Visual Rehabilitation
– **Electrical Engineering Project Manager, Analog VLSI Circuit Designer**
Massachusetts Institute of Technology
– **Visiting Scientist**

I am developing and testing a prototype hermetic, chronically-implantable retinal prosthesis for the blind with the Boston Retinal Implant Project, a joint effort of the VA, MIT, and Massachusetts Eye and Ear Infirmary. I lead the electrical design and test group, consisting of 3 other engineers and a technician. I have developed a testing laboratory in conjunction with Professor John Wyatt at MIT, where I have designed and built test circuits and mechanical clamps and fixtures. I design all of the inductively coupled power and data telemetry systems for the prosthesis, I am the lead electrical system designer and IC designer for the next generation implant, and I coordinate implant component assembly by outside vendors. Our group has successfully built two different generations of wirelessly-powered prostheses and implanted both chronically in animals.

Previous Experience

- **MIT Graduate Research Assistant – Ph.D.**, Spring 1999 – October 2003
Designed, laid out, and had fabricated a VLSI chip and power coupling system for low-power neural stimulation, which used 66% less power than the most efficient stimulator in use (US Patent #7,295,872).

- **MIT Graduate Research Assistant – M.Eng.**, Spring 1997 – Spring 1999
Designed battery-powered retinal stimulator, used in 6 human surgical trials.
- **M/A-Com Microwave Test Engineer**, Summer 1996
Designed 50 GHz test system; used skeleton system to test p-i-n diode parameters.
- **MIT Advanced Undergraduate Project**, Spring 1996
Designed simple mechanical ink ejection system to mark faulty assembly line parts.
- **MIT Undergraduate Research**, Fall 1992 – Spring 1995
Determined cartilage mechanical properties under static and dynamic compression.
- **University of Pittsburgh Summer Research**, Summer 1995
Developed circuitry to measure resistivity of brain tissue and cerebrospinal fluid; wrote Matlab models of current distributions near multiple resistivity boundaries.
- **University of Pittsburgh Summer Research**, Summer 1994
Developed experimental hardware/software system for hydrostatic cartilage testing.

Teaching Experience

- MIT Teaching Assistant, 6.111 – Digital Electronics Laboratory. Fall 1996
- MIT Educational Studies Program, Physics Advisor for Mesh summer program. Summer 1996, 1997
- MIT Laboratory Assistant, 6.111 – Digital Electronics Laboratory. Spring 1996
- MIT Experimental Studies Group, taught section of 5.11 – Chemistry. Fall 1995
- MIT Computer Laboratory Assistant, 6.001 – Structure and Interpretation of Computer Programs. Spring 1994

Student Advising

- Thesis Reader for a Ph.D. student, University of New South Wales, Graduate School of Biomedical Engineering, 2008.
- Thesis Committee member for an M.S. student, Tufts University, Department of Electrical and Computer Engineering, 2008.
- Science advisor for an MIT Sloan Business School student developing a retinal implant executive summary for a Neurotechnology Ventures class, 2008.
- Science advisor for an MIT Sloan Business School student team developing a retinal implant business plan for a New Enterprises class, 2007.
- Design Review Committee for a Ph.D. thesis student, Tufts University, Department of Electrical and Computer Engineering, 2006.
- Science Advisor for Boston College business students writing a retinal implant business plan for a class competition, 2005, 2006. My team won in 2006.
- Industry Advisor for a student at the Rhode Island School of Design (RISD) designing a mockup retinal implant eyewear, processor, and telemetry unit, 2005.
- Science Advisor for a group of MIT Sloan business school students writing a retinal implant business plan for the MIT 50K design competition, 2004.

Leadership/Activities

- Alumni Advisory Board (Co-chair), MIT Tech Catholic Community. 2005 – present
- Volunteer math and science tutor for ESL adult education program. 2003 – 2008
- Strategic Advisory Committee to the Chancellor. 1999 – 2000
- Dormitory President, member of the MIT Dormitory Council. 1995 – 1996

Awards/Honors/Memberships

- VA Career Development Award. 2008 – present
- IEEE Member. 2003 – present
- Sigma Xi Scientific Research Society. 2002 – present
- Association for Research in Vision and Ophthalmology Member. 2001 – present
- Catalyst Foundation Fellowship. 1998 – 2003
- Richard P. Simmons '53 Scholarship. 1992 – 1996
- Bell of Pennsylvania Scholarship. 1992 – 1996
- United States Presidential Scholar. 1992

Research Funding

NIH ARRA \$2,279,562; 2009-2011

Co-Investigator

“Advanced Engineering Development of a Chronic Retinal Implant”

VA Rehabilitation R&D \$473,675; 2008 – 2011

Principal Investigator

Career Development Award

“Improved Power and Data Telemetry System for Implanted Medical Devices”

Department of Defense \$2,156,000; 2007 – 2009

Principal Investigator for BVARI sub-contract

“Optimization of Microelectronic Methods to Produce an Implantable Retinal Prosthesis to Treat Blindness”

VA Rehabilitation R&D \$3,750,000; 2001 – 2006; \$3,400,000; 2006 – 2010

Co-Investigator

“Center for Innovative Visual Rehabilitation”

Catalyst Foundation \$218,582; 1998 – 2003

Ph.D. Student Fellow

“Retinal Implant Chip for the Blind”

Journal and Conference Reviewing

IEEE Trans. on Biomed. Eng.

IEEE Eng. in Med. and Bio. Conf.

IEEE Trans. on Biomed. Circ. and Sys.

IEEE Biomed. Circ. and Sys. Conf.

IEEE Int'l Symposium on Circ. and Sys.

IEEE Asian Solid-State Circ. Conf.

Investigative Ophth. and Vis. Sci.

J. Neural Eng.

IEEE Int'l Symposium on Applied Sciences in Biomed. and Comm. Technologies

US Patents

S.K. Kelly, J.L. Wyatt, J.F. Rizzo. “System for and Method of Power Efficient Electrical Tissue Stimulation.” United States Patent #7,295,872, November 2007.

D.B. Shire, S.K. Kelly, W.A. Drohan, J.F. Rizzo, J.L. Wyatt. “Reconfigurable and Modular Neural Prosthetic System.” Patent Pending.

Selected Publications

- S.K. Kelly, D.B. Shire, J. Chen, P. Doyle, M.D. Gingerich, W.A. Drohan, L.S. Theogarajan, S.F. Cogan, J.L. Wyatt, J.F. Rizzo. "Realization of a 15-Channel, Hermetically-Encased Wireless Subretinal Prosthesis for the Blind." Proc. IEEE Engineering in Medicine and Biology Conference, 2009, pp. 200-203.
- D.B. Shire, S.K. Kelly, J. Chen, P. Doyle, M.D. Gingerich, S.F. Cogan, W. Drohan, O. Mendoza, L. Theogarajan, J.L. Wyatt, J.F. Rizzo. "Development and Implantation of a Minimally-Invasive, Wireless Sub-Retinal Neurostimulator." IEEE Transactions on Biomedical Engineering, Vol. 56, No. 10, Oct. 2009, pp. 2502-2511.
- L. Theogarajan, J. Wyatt, J. Rizzo, B. Drohan, M. Markova, S. Kelly, G. Swider, M. Raj, D. Shire, M. Gingerich, J. Loewenstein, B. Yomtov. "Minimally Invasive Retinal Prosthesis." IEEE Int'l Solid-State Circuits Conf., paper 2.5, pp. 99-108, 2006.
- S.K. Kelly, J. Wyatt. "A Power-Efficient Voltage-Based Neural Tissue Stimulator with Energy Recovery." IEEE Int'l Solid-State Circuits Conf., paper 12.6, pp. 228-524, Vol. 1, 2004.
- J.F. Rizzo, J.L. Wyatt, J. Loewenstein, S.K. Kelly, D.B. Shire. "Methods and Perceptual Thresholds for Short-Term Electrical Stimulation of Human Retina with Microelectrode Arrays." Invest. Ophth. and Vis. Sci., 2003, Vol. 44, No. 12, pp. 5355-5361.
- J.F. Rizzo, J.L. Wyatt, J. Loewenstein, S.K. Kelly, D.B. Shire. "Perceptual Efficacy of Electrical Stimulation of Human Retina with a Microelectrode Array During Short-Term Surgical Trials." Invest. Ophth. and Vis. Sci., 2003, Vol. 44, No. 12, pp. 5362-5369.
- S.B. Baumann, D.R. Wozny, S.K. Kelly, F.M. Meno. "The Electrical Conductivity of Human Cerebrospinal Fluid at Body Temperature." IEEE Trans. on Biomedical Engineering, Vol. 44, Issue 3, March 1997, pp. 220-223.

Selected Conference Abstracts

- S.K. Kelly. "The Boston Retinal Implant Project: Progress on the Development and Testing of a Hermetic Retinal Prosthesis." German Retina Implant Foundation International Symposium on Artificial Vision, Bonn, September 2009.
- S.K. Kelly, P. Doyle, O. Mendoza, W.A. Drohan, G.W. Swider, D.B. Shire, J.L. Wyatt, J.F. Rizzo, III. "Improved Class A Based Transmitter System for Wireless Retinal Implant Data Telemetry." Conference abstract 4578 for The Association for Research in Vision and Ophthalmology (ARVO), May 2009.
- W.A. Drohan, S.K. Kelly, J.F. Rizzo, III, J.L. Wyatt. "Electrode and Axon Models." Conference abstract 4574 for ARVO, May 2009.
- P. Doyle, S.K. Kelly, O.D. Mendoza, W.A. Drohan, D.B. Shire, J.L. Wyatt, J.F. Rizzo, III. "A System for Developing Feature Extraction Algorithms for Retinal Implant Devices." Conference abstract 4591 for ARVO, May 2009.
- D.B. Shire, S.K. Kelly, M.D. Gingerich, O. Mendoza, W. Drohan, J. Chen, J.F. Rizzo, III, J.L. Wyatt. "Long-Term in vivo Operation of the Wireless Boston Retinal Neuroprosthesis." Conference abstract 4596 for ARVO, May 2009.

D.B. Shire, S.K. Kelly. "Chronic Implantation of a Wireless Subretinal Neurostimulator in Yucatan Minipigs." Poster at the Eye and the Chip World Congress on Artificial Vision, Detroit, MI, June 2008.

G. Swider, W. Drohan, S.J. Kim, J.F. Rizzo, S.K. Kelly, J.L. Wyatt. "Development of a Wireless Neural Recording System." Conference abstract 1772 for ARVO, April 2008.

J.F. Rizzo, J. Chen, D.B. Shire, S.K. Kelly, M.D. Gingerich, G. Swider, W. Drohan, J.L. Wyatt. "Implantation of a Wirelessly Powered Subretinal Prosthesis Using an ab externo Surgical Technique." Conference abstract 3027 for ARVO, April 2008.

D.B. Shire, S.K. Kelly, M.D. Gingerich, O. Mendoza, G. Swider, W. Drohan, J. Chen, J.F. Rizzo, J.L. Wyatt. "Operation of a Wirelessly Powered Subretinal Neurostimulator." Conference abstract 3031 for ARVO, April 2008.

W.A. Drohan, S.K. Kelly, J.F. Rizzo, J.L. Wyatt. "External Field Firing Thresholds for Neurons." Conference abstract 3032 for ARVO, April 2008.

S.K. Kelly, G.W. Swider, W.A. Drohan, J.L. Wyatt, J.F. Rizzo. "Exploration of Optimal Coil Designs for Retinal Implant Power and Data Telemetry." Conference abstract 674 for ARVO, May 2007.

G.W. Swider, W.A. Drohan, O.R. Ziv, S.K. Kelly, J.L. Wyatt, J.F. Rizzo. "Development of Stimulation/Recording System for Evaluation of Retinal Implants." Conference abstract 2563 for ARVO, May 2007.

W.A. Drohan, S.K. Kelly, J.F. Rizzo, J.L. Wyatt, S.I. Fried. "Development of Retinal Ganglion Cell Model to Assess Optimal Stimulation Parameters." Conference abstract 2574 for ARVO, May 2007.

S.K. Kelly, M. Markova, L. Theogarajan, W.A. Drohan, G.W. Swider, B. Yomtov, J.L. Wyatt, J.F. Rizzo. "Development of a Telemetry System for the Boston Retinal Implant." Conference abstract 3168 for ARVO, May 2006.

S.K. Kelly, J.L. Wyatt. "Low-Power Neural Stimulator for a Retinal Prosthesis." Conference abstract 4174 for ARVO, April 2004.

S.K. Kelly, J.L. Wyatt. "Low-Power Techniques for a Retinal Prosthesis." Conference abstract 5064 for ARVO, May 2003.

Invited Seminar Lectures

S.K. Kelly. "Functional Vision for the Blind: The Boston Retinal Implant." Boston Chapter of the IEEE Society on Social Implications of Technology, September 22, 2008.

S.K. Kelly. "The Boston Retinal Implant Project: Overview and Current VLSI Research." Tufts University Department of Electrical and Computer Engineering Seminar Series, March 7, 2006.

S.K. Kelly. "Explanation of the Boston Retinal Implant Project." Classroom lecture for ages 4-13, Portmagee Gaelic School, Portmagee, Co. Kerry, Ireland, October 12, 2006.