Work Address
1205 Hamburg Hall, CMU
5000 Forbes Ave., Pittsburgh, PA 15213
412-268-1841

Shawn K. Kelly

skkelly@alum.mit.edu
http://alum.mit.edu/www/skkelly
(updated 10/04/2011)

Home Address
4613 Baptist Road
Pittsburgh, PA 15227
617-875-5163

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

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

Current Position, 2003 – Present

VA Boston Healthcare System, Center for Innovative Visual Rehabilitation
Visiting Scientist at MIT

I am developing and testing a prototype 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. Our group has successfully built three different generations of wirelessly-powered prostheses and implanted all three chronically in animals in preparation for clinical trials.

2006 – Present Electrical Engineering Project Manager

I lead the electrical design and test group, consisting of 4 other engineers and a technician. I am the lead electrical system designer and IC designer for the next generation implant, I design all of the inductively coupled power and data telemetry systems for the prosthesis, and I coordinate current generation implant component assembly by outside vendors.

2003 – 2006 Research Biomedical Engineer, Analog VLSI Circuit Designer

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 have developed telemetry systems and circuits for early generations of the retinal prosthesis.

Previous Experience

- **Rhythmia Medical – Consultant**, November 2006 – March 2007
  Designed test circuits. Consulted on test setup and product development.
- **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 – Programming class. Spring 1994

Student Advising

- Ph.D. Thesis Co-supervisor, Carnegie Mellon University, Department of Electrical and Computer Engineering, 2011.
- Ph.D. Thesis Reader, University of New South Wales, Graduate School of Biomedical Engineering, 2008.
- M.S. Thesis Committee member, 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.
- Ph.D. Thesis Design Review Committee member, 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

- Advisory Board, Science for the Public. 2010 – present
- Alumni Advisory Board (Co-chair), MIT Tech Catholic Community. 2005 – 2011
- 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

- Best Paper Award, IEEE ISABEL conference. 2009
- VA Career Development Award. 2008 – 2011
- Catalyst Foundation Fellowship. 1998 – 2003
- Richard P. Simmons '53 Scholarship. 1992 – 1996
- Bell of Pennsylvania Scholarship. 1992 – 1996
- United States Presidential Scholar. 1992

Memberships

- Medical Development Group Member. 2009 – present
- IEEE Member. 2003 – present
- Sigma Xi Scientific Research Society. 2002 – present
- Association for Research in Vision and Ophthalmology Member. 2001 – present

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 Trans. on Biomed. Circ. and Sys.
IEEE Int'l Symposium on Circ. and Sys.
Investigative Ophth. and Vis. Sci.
IEEE Eng. in Med. and Bio. Conf.
IEEE Biomed. Circ. and Sys. Conf.
IEEE Asian Solid-State Circ. Conf.
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.

Selected Publications

S.K. Kelly, D.B. Shire, J. Chen, P. Doyle, M.D. Gingerich, S.F. Cogan, W. Drohan, S. Behan, L. Theogarajan, J.L. Wyatt, J.F. Rizzo. "A Hermetic Wireless Subretinal Neurostimulator for Vision Prostheses." IEEE Trans. on Biomedical Eng., in press, 2011.

S.K. Kelly, D.B. Shire, J. Chen, P. Doyle, M.D. Gingerich, S.F. Cogan, W. Drohan, L. Theogarajan, J.L. Wyatt, J.F. Rizzo. "Communication and Control System for a 15-Channel Hermetic Retinal Prosthesis." Biomed. Sig. Proc. and Control, Vol. 6, No. 4, pp. 356-363, 2011.

D.K. Freeman, J.S. Jeng, S.K. Kelly, E. Hartveit, S.I.Fried. "Calcium Channel Dynamics Limit Synaptic Release in Resonse to Prosthetic Stimulation with Sinusoidal Waveforms." Journal of Neural Engineering, Vol 8, pp. 046005-1 – 046005-19, 2011.

S.K. Kelly, J.L. Wyatt. "A Power-Efficient Neural Tissue Stimulator with Energy Recovery." IEEE Trans. on Biomedical Circuits and Systems, Vol. 5, No. 1, pp. 20-29, 2011.

J.F. Rizzo, D. Shire, S. Kelly, P. Troyk, M. Gingerich, B. McKee, A. Priplata, J. Chen, W. Drohan, P. Doyle, O. Mendoza, L. Theogarajan, S. Cogan, J. Wyatt. "Development of the Boston Retinal Prosthesis." Proc. IEE Eng. in Medicine and Biology Conf., pp. 3135-3138, 2011.

S.K. Kelly, P. Doyle, A. Priplata, O. Mendoza, J.L. Wyatt. "Optimal Primary Coil Size for Wireless Power Telemetry to Medical Implants." IEEE ISABEL conference, invited paper, 2010.

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. "The Boston Retinal Prosthesis: A 15-Channel Hermetic Wireless Neural Stimulator." IEEE ISABEL conference, invited paper, 2009. Best Paper Award.

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 Eng. in Medicine and Biology Conf., pp. 200-203, 2009.

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 Trans. on Biomedical Eng., 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, W.F. Ellersick, P. Doyle, A.A. Priplata, D.B. Shire, J.L. Wyatt, J.F. Rizzo. "Current Driver Circuits and Safety Features for a Retinal Prosthesis." Invest. Ophthalmol. Vis. Sci. 2011 Vol. 52: 4941

J. Chen, P. Doyle, J. Dumser, A. Marvasti, O. Mendoza, S.K. Kelly, D.B. Shire, J.F. Rizzo. "Surgical Implantation of Newly Designed Subretinal Implant in Minipig Eyes." Invest. Ophthalmol. Vis. Sci. 2011 Vol. 52: 4929.

S.K. Kelly, W.F. Ellersick, P. Doyle, S.F. Cogan, W.A. Drohan, D.B. Shire, J.L. Wyatt, J.F. Rizzo. "Electrical System and Circuit Considerations for a Chronic Retinal Prosthesis." Invest. Ophthalmol. Vis. Sci. 2010 Vol. 51: 3025.

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." Invest. Ophthalmol. Vis. Sci. 2009 Vol. 50: 4578.

W.A. Drohan, S.K. Kelly, J.F. Rizzo, III, J.L. Wyatt. "Electrode and Axon Models." Invest. Ophthalmol. Vis. Sci. 2009 Vol. 50: 4574.

G. Swider, W. Drohan, S.J. Kim, J.F. Rizzo, S.K. Kelly, J.L. Wyatt. "Development of a Wireless Neural Recording System." Invest. Ophthalmol. Vis. Sci. 2008 Vol. 49: 1772.

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." Invest. Ophthalmol. Vis. Sci. 2007 Vol. 48: 674.

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." Invest. Ophthalmol. Vis. Sci. 2006 Vol. 47: 3168.

S.K. Kelly, J.L. Wyatt. "Low-Power Neural Stimulator for a Retinal Prosthesis." Invest. Ophthalmol. Vis. Sci. 2004 Vol. 45: 4174.

S.K. Kelly, J.L. Wyatt. "Low-Power Techniques for a Retinal Prosthesis." Invest. Ophthalmol. Vis. Sci. 2003 Vol. 44: 5064.

Invited Seminar Lectures

S.K. Kelly. "Being Bionic: The New Prosthetics." Science for the Public, community television program, 2011.

S.K. Kelly. "Development of a Retinal Prosthesis for the Blind." Carnegie Mellon University Institute for Complex Engineered Systems Seminar Series, October 15, 2010.

S.K. Kelly. "The Electric Eye: A Visual Prosthesis for the Blind." Science for the Public, community television program, 2010.

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.