Curriculum Vitae

h-index: 21

Google Scholar Website: http://scholar.google.com/citations?user=KvOkV30AAAAJ&hl=en
U of Utah Website: https://faculty.utah.edu/u0034547-DAVID_J_WARREN/research/index.hml
Biomedical Engineering Website: http://www.bioen.utah.edu/directory/profile.php?userID=198

Present Position

Research Associate Professor
University of Utah
20 S. 2030 E., Rm. 506E
Salt Lake City, UT 84112-9458 USA
+1 801-585-2697
+1 801-585-5151 FAX

Positions and Employment

2016-present	Research Associate Professor, Department of Biomedical Engineering, University of Utah, Salt Lake City, UT
2017-present	Research Associate Professor, Department of Electrical and Computer Engineering, University of Utah, Salt Lake City, UT
2016-2017	Research Assistant Professor, Department of Electrical and Computer Engineering, University of Utah, Salt Lake City, UT
2011-2016	Research Assistant Professor, Department of Bioengineering, University of Utah, Salt Lake City, UT
2010-2011	Research Associate, University of Utah, Salt Lake City, UT
2009	Co-Instructor for Undergraduate Level Biophysics, University of Utah, Salt Lake City, UT
2006-present	Instructor for Undergraduate Level Physiology, University of Utah, Salt Lake City, UT
2006-2010	Postdoctoral Fellow, University of Utah, Salt Lake City, UT
2003-2004	Instructor for Undergraduate Level Bioinstrumentation, University of Utah, Salt Lake City, UT
1994-2006	Research Assistant and/or Teaching Assistant, University of Utah, Salt Lake City, UT
1978-1996	Control Systems Research Staff, The Boeing Company, Seattle. WA

Educational Experience

Doctor of Philosophy 2006

Department of Bioengineering
University of Utah
Salt Lake City, UT, USA

Master of Science 1982

Department of Electrical Engineering
University of Washington
Seattle, WA, USA

Bachelor of Science 1979

Department of Electrical Engineering
Washington State University
Pullman, WA, USA

Teaching Experience

University of Utah

Co-Instructor and Lab Instructor for junior-level Physiology for Engineers course, 2006 to present. This course instructs a quantitative understanding of cell-level and system-level physiology. Principal responsibilities are to lecture, direct performance of lab experiences, act as mentor to teaching assistants, grade exams and laboratory reports, and submit final grades.

Co-Instructor for graduate level Electrophysiology and Bioelectricity of Tissues course, 2019 to present. This course provides an intermediate level overview of electrophysiology and bioelectricity at the tissue level to graduate students with special interest in cardiology and neurosciences. Principal responsibilities are to lecture on the nervous system.

Lab Co-instructor for junior-level Biophysics course 2010. This course instructs a quantitative understanding of biophysical processes in natural and engineered molecules, membranes, tissues, and organs. Principal responsibilities were to direct performance of lab experiences, grade laboratory reports, and submit final grades.

Lab Instructor for mixed Graduate & Undergraduate Level Bioinstrumentation 2004, 2003. This course instructs a quantitative understanding of biological signals, sensors related to the measurement of biological signals, analog signal conditioning (amplification, frequency-band filtering, basic circuit elements), and digital signal processing (data conversion, data encoding, digital filters, spectral methods). Principal responsibilities were to lecture, direct performance of lab experiences, act as mentor to teaching assistants, grade exams and laboratory reports, and submit final grades.

Teaching Assistant for junior-level Physiology 2004. This course instructs a quantitative understanding of cell-level and system-level physiology. Principal responsibilities were to assist in performance of lab experiences and grade exams and laboratory reports.

Co-instructor for mixed Graduate & Undergraduate Level Bioinstrumentation 2002. This course instructs a quantitative understanding of biological signals, sensors related to the measurement of biological signals, analog signal conditioning (amplification, frequency-band filtering, basic circuit elements), and digital signal processing (data conversion, data encoding, digital filters, spectral methods). Principal responsibilities were to lecture, direct performance of lab experiences, act as mentor to teaching assistants, grade exams and laboratory reports, and submit final grades.

Teaching Assistant for Graduate Level Neural Interfaces Laboratory 2001, 2000, 1999. This lab-based course introduced advanced graduate students to methods of recording and stimulating neuronal tissue and analytical methods to interpret the results. Principal responsibilities were to assist in performance of lab experiences and grade exams and laboratory reports.

Teaching Assistant for freshman-level Level Fundamentals of Bioengineering 1999-2000. This course teaches fundamental engineering skills via examination of basic physical laws (e.g., Ohm's Law). Principal responsibilities were to assist in performance of lab experiences and grade exams and laboratory reports.

Teaching Assistant for Graduate Level Bioinstrumentation 1997, 1996, 1995. This course instructs a quantitative understanding of biological signals, sensors related to the measurement of biological signals, analog signal conditioning (amplification, frequency-band filtering, basic circuit elements), and digital signal processing (data conversion, data encoding, digital filters, spectral methods). Principal responsibilities were to assist in performance of lab experiences and grade exams and laboratory reports.

University of Washington

Teaching Assistant for junior-level Level Linear System Course 1979-1980. This course instructs an understanding of basic linear system theory and analysis. Principal responsibilities were to perform weekly review sessions and grade homework.

Industrial Experience

Boeing Defense and Space Group 1978 to 1995

Chief Test Engineer for precision pointing experiments with Advanced Space Structure Technology Research Experiment (ASTREX) air bearing test bed at Edwards Air Base. This system simulated an Earth orbit satellite that could precisely control its focus point by actively damping mechanical vibrations of its structure. As Chief Test Engineer and in concert with Air Force personal, I designed, performed, and evaluated tests of the system's ability to change and precisely hold its focus position.

Design and installation of all electronics and software for ASTREX air bearing test bed at Edwards Air Base. Principal responsibilities were the specification, procurement, integration, and installation of all electronics systems associated with ASTREX system and specification, procurement, and software development of a real-time control system.

Laboratory Manager for Dynamics and Controls Laboratory. Principal responsibilities were the performance of unique controls experiment proposed by the control system design and analysis central staff and maintenance of controls hardware, computers, and software in the lab.

Member of control system design and analysis central staff. This group was the controls research group for Boeing Defense and Space Group and provided troubleshooting support to ongoing programs. My specialty in the group was hardware interfaces and computer interfacing.

Lead Engineer of control system design and analysis group for Wind Energy program. This program designed and installed a wind turbine on the north shore of Oahu, HI. Principal responsibilities were to performance and analysis of all tests of the turbine's control systems, both on the bench and in the field.

Lead Engineer and member of technical staff of control system design and analysis group for Automated Transit Systems program. This program designed an automated, small-group people mover on a dedicated track, and it was an outgrowth of the Morgantown Personal Rapid Transit system that connects the three Morgantown campuses of West Virginia University. Principal responsibilities were to design and analyze the performance of vehicle velocity control systems.

Control System Analyst for numerous other projects and proposals.

Honors

University of Utah Graduate Research Supplemental Travel Award for 2005 Society for Neuroscience Annual Meeting

University of Utah Graduate Research Supplemental Travel Award for 2001 Society for Neuroscience Annual Meeting

University of Utah Department of Bioengineering Whitaker Fellowship 1994-1995, 1995-1996

Publications

Theses and Dissertations

Warren, D. J. (2006). Examination of the Organization and Plasticity of Primary Visual Cortex with Multielectrode Arrays. Bioengineering. Salt Lake City, UT, University of Utah. **Doctor of Philosophy:** 187.

Warren, D. J. (1982). A Model of a Pressurized Water Nuclear Reactor Pressurizer for Use with an Instrumentation Failure Detection System. Electrical Engineering. Seattle, WA, University of Washington. **Master of Science, Electrical Engineering:** 236.

Patents

[1] D. T. Kluger, D. J. Warren, G. A. Clark, and K. N. Bachus, "Osseointegrated mount for prosthetic limb and peripheral nerve interface," US Patent 9,308,103, 2016.

[2] G. A. Clark, D. J. Warren, and N. M. Ledbetter, "System and method for electrically shielding a microelectrode array in a physiological pathway from electrical noise," US Patent 8,855,737, 2014. [Online]. Available: http://www.google.com/patents/US20140114164

[3] G. A. Clark, D. J. Warren, N. M. Ledbetter, M. Lloyd, and R. A. Normann, "Microelectrode Array System With Integrated Reference Microelectrodes To Reduce Detected Electrical Noise And Improve Selectivity Of Activation," US Patent 8,359,083, 2009. [Online]. Available: http://www.google.com/patents/US20090283425

Book Chapters

[1] D. J. Warren and R. A. Normann, "Visual Prosthesis," in *Handbook of Neuroprosthetic Methods*, W. E. Finn and P. G. LoPresti Eds., (Biomedical Engineering Series, no. 7), M. Neuman, Ed. Boca Raton, FL: CRC Press, 2019, ch. 11, p. 456.

[2] D. J. Warren, R. A. Normann, and A. Koulakov, "Imaging of Two Dimensional Neural Activity Patterns in Cat Visual Cortex using a

Multielectrode Array," in *Toward Replacement Parts for the Brain*, T. W. Berger and D. L. Glanzman Eds. Cambridge, MA: MIT Press, 2005, ch. 3, p. 480.

Peer Reviewed Articles

[1] H. Dantas, T. C. Hansen, D. J. Warren, and V. J. Mathews, "Interpreting Volitional Movement Intent From Biological Signals: A Review," (in English), *Ieee Signal Proc Mag,* vol. 38, no. 4, pp. 23-33, Jul 2021, doi: 10.1109/msp.2021.3074778.

[2] H. Dantas, T. C. Hansen, D. J. Warren, and V. J. Mathews, "Shared Prosthetic Control Based on Multiple Movement Intent Decoders," (in eng), *IEEE transactions on bio-medical engineering,* Research Support, U.S. Gov't, Non-P.H.S. vol. 68, no. 5, pp. 1547-1556, May 2021, doi: 10.1109/TBME.2020.3045351.

[3] P. Kosta, J. Mize, D. J. Warren, and G. Lazzi, "Simulation-Based Optimization of Figure-of-Eight Coil Designs and Orientations for Magnetic Stimulation of Peripheral Nerve," *IEEE Transactions on Neural Systems and Rehabilitation Engineering,* vol. 28, no. 12, pp. 2901-2913, 2020, doi: 10.1109/TNSRE.2020.3038406.

[4] J. Nieveen, M. Brinton, D. J. Warren, and V. J. Mathews, "A Nonlinear Latching Filter to Remove Jitter From Movement Estimates for Prostheses," (in eng), *IEEE transactions on neural systems and rehabilitation engineering,* Research Support, U.S. Gov't, Non-P.H.S. vol. 28, no. 12, pp. 2849-2858, Dec 2020, doi: 10.1109/TNSRE.2020.3038706.

[5] H. Dantas, D. J. Warren, S. M. Wendelken, T. S. Davis, G. A. Clark, and V. J. Mathews, "Deep Learning Movement Intent Decoders Trained With Dataset Aggregation for Prosthetic Limb Control," *IEEE Trans Biomed Eng,* vol. 66, no. 11, pp. 3192-3203, Nov 2019, doi: 10.1109/TBME.2019.2901882.

[6] C. C. Duncan *et al.*, "Selective Decrease in Allodynia With High-Frequency Neuromodulation via High-Electrode-Count Intrafascicular Peripheral Nerve Interface After Brachial Plexus Injury," (in eng), *Neuromodulation,* vol. 22, no. 5, pp. 597-606, Jul 2019, doi: 10.1111/ner.12802.

[7] Z. B. Kagan, J. T. Mize, P. Kosta, G. Lazzi, R. A. Normann, and D. J. Warren, "Reduced Heat Generation During Magnetic Stimulation of Rat Sciatic Nerve Using Current Waveform Truncation," *IEEE Trans Neural Syst Rehabil Eng,* vol. 27, no. 5, pp. 937-946, May 2019, doi: 10.1109/TNSRE.2019.2911054.

[8] P. Kosta, D. J. Warren, and G. Lazzi, "Selective stimulation of rat sciatic nerve using an array of mm-size magnetic coils: a simulation study,"

Healthc Technol Lett, vol. 6, no. 3, pp. 70-75, Jun 2019, doi: 10.1049/htl.2018.5020.

[9] A. T. Gardner, H. J. Strathman, D. J. Warren, and R. M. Walker, "Impedance and Noise Characterizations of Utah and Microwire Electrode Arrays," *IEEE Journal of Electromagnetics, RF and Microwaves in Medicine and Biology,* vol. 2, no. 4, pp. 234-241, 2018, doi: 10.1109/jerm.2018.2862417.

[10] M. Sharma, A. T. Gardner, H. J. Strathman, D. J. Warren, J. Silver, and R. M. Walker, "Acquisition of Neural Action Potentials Using Rapid Multiplexing Directly at the Electrodes," (in eng), *Micromachines (Basel),* vol. 9, no. 10, p. 477, Sep 20 2018, doi: 10.3390/mi9100477.

[11] M. Leber *et al.*, "Long term performance of porous platinum coated neural electrodes," *Biomed Microdevices,* vol. 19, no. 3, p. 62, Sep 2017, doi: 10.1007/s10544-017-0201-4.

[12] M. M. H. Shandhi, M. Leber, A. Hogan, D. J. Warren, R. Bhandari, and S. Negi, "Reusable High Aspect Ratio 3-D Nickel Shadow Mask," *J Microelectromech Syst,* vol. 26, no. 2, pp. 376-384, Apr 2017, doi: 10.1109/JMEMS.2017.2654126.

[13] S. Wendelken *et al.*, "Restoration of motor control and proprioceptive and cutaneous sensation in humans with prior upper-limb amputation via multiple Utah Slanted Electrode Arrays (USEAs) implanted in residual peripheral arm nerves," *J Neuroeng Rehabil,* vol. 14, no. 1, pp. 121-137, Nov 25 2017, doi: 10.1186/s12984-017-0320-4.

[14] T. S. Davis *et al.*, "Restoring motor control and sensory feedback in people with upper extremity amputations using arrays of 96 microelectrodes implanted in the median and ulnar nerves," (in eng), *Journal of neural engineering,* vol. 13, no. 3, p. 036001, Jun 2016, doi: 10.1088/1741-2560/13/3/036001.

[15] Z. B. Kagan, A. K. RamRakhyani, G. Lazzi, R. A. Normann, and D. J. Warren, "In Vivo Magnetic Stimulation of Rat Sciatic Nerve With Centimeter- and Millimeter-Scale Solenoid Coils," *IEEE Transactions on Neural Systems and Rehabilitation Engineering,* vol. 24, no. 11, pp. 1138-1147, 2016, doi: 10.1109/TNSRE.2016.2544247.

[16] D. J. Warren *et al.*, "Recording and Decoding for Neural Prostheses," *Proceedings of the IEEE,* vol. 104, no. 2, pp. 374-391, 2016, doi: 10.1109/JPROC.2015.2507180.

[17] A. K. RamRakhyani, Z. B. Kagan, D. J. Warren, R. A. Normann, and G. Lazzi, "A um-Scale Computational Model of Magnetic Neural Stimulation in Multifascicular Peripheral Nerves," *Biomedical Engineering, IEEE Transactions on,* vol. 62, no. 12, pp. 2837-2849, 2015, doi: 10.1109/TBME.2015.2446761.

[18] M. B. Christensen, S. M. Pearce, N. M. Ledbetter, D. J. Warren, G. A. Clark, and P. A. Tresco, "The foreign body response to the Utah Slant Electrode Array in the cat sciatic nerve," (in eng), *Acta biomaterialia,* Research Support, U.S. Gov't, Non-P.H.S. vol. 10, no. 11, pp. 4650-60, Nov 2014, doi: 10.1016/j.actbio.2014.07.010.

[19] Z. B. Kagan, A. K. Ramrakhyani, F. Khan, G. Lazzi, R. A. Normann, and D. J. Warren, "Magnetic stimulation of mammalian peripheral nervesin vivo: Reducing power for muscle activation," *Neuromodulation,* vol. 17, no. 5, p. e126, 2014.

[20] K. S. Mathews *et al.*, "Acute monitoring of genitourinary function using intrafascicular electrodes: selective pudendal nerve activity corresponding to bladder filling, bladder fullness, and genital stimulation," (in eng), *Urology,* vol. 84, no. 3, pp. 722-9, Sep 2014, doi: 10.1016/j.urology.2014.05.021 S0090-4295(14)00503-2 [pii].

[21] A. K. Ramrakhyani, Z. B. Kagan, F. Khan, D. J. Warren, R. A. Normann, and G. Lazzi, "Numerical modeling of transverse electric field magnetic neural stimulation," *Neuromodulation,* vol. 17, no. 5, p. e126, 2014.

[22] R. A. Normann *et al.*, "Coordinated, multi-joint, fatigue-resistant feline stance produced with intrafascicular hind limb nerve stimulation," (in eng), *Journal of neural engineering,* vol. 9, no. 2, p. 026019, Apr 2012, doi: 10.1088/1741-2560/9/2/026019.

[23] K. Torab, T. S. Davis, D. J. Warren, P. A. House, R. A. Normann, and B. Greger, "Multiple factors may influence the performance of a visual prosthesis based on intracortical microstimulation: nonhuman primate behavioural experimentation," (in eng), *Journal of neural engineering,* Research Support, N.I.H., Extramural Research Support, Non-U.S. Gov't vol. 8, no. 3, p. 035001, Jun 2011, doi: 10.1088/1741-2560/8/3/035001.

[24] K. Gunalan, D. J. Warren, J. D. Perry, R. A. Normann, and G. A. Clark, "An automated system for measuring tip impedance and among-electrode shunting in high-electrode count microelectrode arrays," (in eng), *J Neurosci Methods,* vol. 178, no. 2, pp. 263-9, Apr 15 2009, doi: S0165-0270(08)00710-3 [pii] 10.1016/j.jneumeth.2008.12.020.

[25] B. K. Thurgood, D. J. Warren, N. M. Ledbetter, G. A. Clark, and R. R. Harrison, "A Wireless Integrated Circuit for 100-Channel Charge-Balanced Neural Stimulation," *Biomedical Circuits and Systems, IEEE Transactions on,* vol. 3, no. 6, pp. 405-414, 2009, doi: 10.1109/tbcas.2009.2032268.

[26] D. Berger, D. Warren, R. Normann, A. Arieli, and S. Grün, "Spatially organized spike correlation in cat visual cortex," *Neurocomputing,* vol. 70, no. 10-12, pp. 2112-2116, 2007, doi: 10.1016/j.neucom.2006.10.141.

[27] S.-J. Kim, S. C. Manyam, D. J. Warren, and R. A. Normann, "Electrophysiological Mapping of Cat Primary Auditory Cortex with

Multielectrode Arrays," *Annals of Biomedical Engineering,* vol. 34, no. 2, pp. 300-309, 2006, doi: 10.1007/s10439-005-9037-9.

[28] D. Warren and R. Normann, "Functional reorganization of primary visual cortex induced by electrical stimulation in the cat," *Vision Research,* vol. 45, no. 5, pp. 551-565, 2005, doi: 10.1016/j.visres.2004.09.021.

[29] D. J. Warren, A. Koulakov, and R. A. Normann, "Spatiotemporal encoding of a bar's direction of motion by neural ensembles in cat primary visual cortex," *Ann Biomed Eng,* vol. 32, no. 9, pp. 1265-75, Sep 2004. [Online]. Available: http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=15493513

[30] R. A. Normann, D. J. Warren, J. Ammermuller, E. Fernandez, and S. Guillory, "High-resolution spatio-temporal mapping of visual pathways using multi-electrode arrays," *Vision Res,* vol. 41, no. 10-11, pp. 1261-75, 2001. [Online]. Available: http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=11322971.

[31] D. J. Warren, E. Fernandez, and R. A. Normann, "High-resolution two-dimensional spatial mapping of cat striate cortex using a 100-microelectrode array," *Neuroscience,* vol. 105, no. 1, pp. 19-31, 2001. [Online]. Available: http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=11483297.

[32] R. A. Normann, E. M. Maynard, P. J. Rousche, and D. J. Warren, "A neural interface for a cortical vision prosthesis," *Vision Res,* vol. 39, no. 15, pp. 2577-87, Jul 1999. [Online]. Available: http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=10396626.

[33] D. Warren, E. Maynard, and R. Normann, "Background cortical activity: Correlated firing of vi neurons in the absence of stimulation," *Investigative Ophthalmology and Visual Science,* vol. 38, no. 4, 1997.

[34] R. A. Normann, E. M. Maynard, K. S. Guillory, and D. J. Warren, "Cortical Implants for the blind," *IEEE Spectrum,* vol. 33, no. 5, pp. 54-59, 1996.

[35] J. E. Sanders, L. M. Smith, F. A. Spelman, and D. J. Warren, "Portable measurement system for prosthetic triaxial force transducers," *IEEE Trans Rehabil Eng,* vol. 3, no. 4, pp. 366-372, 1995.

Abstracts and Proceedings (Peer-reviewed)

[1] T. C. Hansen, M. A. Trout, J. L. Segil, D. J. Warren, and J. A. George, "A Bionic Hand for Semi-Autonomous Fragile Object Manipulation via Proximity and Pressure Sensors," presented at the 2021 43rd Annual

International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC), Virual, Oct 31 - Nov 4 2021, 2021.

[2] H. Dantas, V. J. Mathews, and D. Warren, "Semi-Supervised Adaptive Learning for Decoding Movement Intent from Electromyograms," presented at the 2019 27th European Signal Processing Conference (EUSIPCO), 2-6 Sept. 2019, 2019. [Online]. Available: https://ieeexplore.ieee.org/document/8902698/.

[3] H. Dantas *et al.*, "Shared Human-Machine Control for Self-Aware Prostheses," presented at the 2018 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Calgary, Alberta, Canada, 17 April 2018, 2018.

[4] A. T. Gardner, R. M. Walker, H. J. Strathman, and D. J. Warren, "Signal and Noise Sources from Microwire Arrays Implanted in Rodent Cortex," presented at the 2018 IEEE Life Sciences Conference (LSC), 28-30 Oct. 2018, 2018.

[5] H. Dantas, V. J. Mathews, S. Wendelken, T. S. Davis, G. A. Clark, and D. J. Warren, "Neural decoding systems using Markov Decision Processes," presented at the 2017 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), New Orleans, 08-Mar-2017, 2017.

[6] A. T. Gardner, J. Mize, D. J. Warren, and R. M. Walker, "Comparative characterization of in vivo and in vitro noise of the SIROF Utah electrode array," presented at the 2017 IEEE SENSORS, Oct. 29 2017-Nov. 1 2017, 2017.

[7] J. G. Nieveen *et al.*, "Polynomial Kalman Filter for Myoelectric Prosthetics Using Efficient Kernel Ridge Regression," presented at the 2017 8th International IEEE/EMBS Conference on Neural Engineering (NER), Shanghai, China, 25-28 May 2017, 2017.

[8] M. G. Street, R. Caldwell, D. J. Warren, L. Rieth, and P. A. Takmakov, "Automated and High-Throughput Reactive Accelerated Aging System to Evaluate Performance of Neural Implants," presented at the The Electrochemical Society Meeting Abstracts, National Harbor, Maryland, October 4, 2017, 2017. [Online]. Available: http://ma.ecsdl.org/content/MA2017-02/55/2320.abstract.

[9] Y. Zhang *et al.*, "Individual hand movement detection and classification using peripheral nerve signals," presented at the IEEE EMBS Conference on Neural Engineering, Shanghai, China, 25-28 May 2017, 2017.

[10] Z. B. Kagan *et al.*, "Linear methods for reducing EMG contamination in peripheral nerve motor decodes," presented at the 2016 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), 18 Aug. 2016, 2016.

[11] G. A. Clark *et al.*, "Using Multiple High-Count Electrode Arrays in Human Median and Ulnar Nerves to Restore Sensorimotor Function after Previous Transradial Amputation of the Hand," presented at the EMBC 2014, Chicago, IL, Aug 28 2014, 2014.

[12] Z. B. Kagan, A. K. RamRakhyani, F. Khan, G. Lazzi, R. A. Normann, and D. J. Warren, "Magnetic stimulation of mammalian peripheral nerves in vivo: An alternative to functional electrical stimulation," presented at the Engineering in Medicine and Biology Society (EMBC), 2014 36th Annual International Conference of the IEEE, 2014.

[13] A. K. RamRakhyani, Z. B. Kagan, F. Khan, D. J. Warren, R. A. Normann, and G. Lazzi, "A µm-resolution heterogeneous tissue model for the magnetic stimulation of multifascicular sciatic nerve," presented at the Engineering in Medicine and Biology Society (EMBC), 2014 36th Annual International Conference of the IEEE, 2014.

[14] A. K. RamRakhyani, Z. B. Kagan, F. Khan, D. J. Warren, R. A. Normann, and G. Lazzi, "Effect of Surrounding Conditions on In-Vitro Magnetic Neural Stimulation," presented at the IEEE Neural Engineering Conference, San Diego, CA, 2013.

[15] G. A. Clark, N. M. Ledbetter, D. J. Warren, and R. R. Harrison, "Recording Sensory and Motor Information from Peripheral Nerves with Utah Slanted Electrode Arrays," presented at the 33rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), Boston, MA, 2011.

[16] R. R. Harrison *et al.*, "A wireless neural interface for chronic recording," presented at the Biomedical Circuits and Systems Conference, 2008. BioCAS 2008. IEEE, 2008. [Online]. Available: 10.1109/BIOCAS.2008.4696890.

[17] B. K. Thurgood, N. M. Ledbetter, D. J. Warren, G. A. Clark, and R. R. Harrison, "Wireless integrated circuit for 100-channel neural stimulation," presented at the Biomedical Circuits and Systems Conference, 2008. BioCAS 2008. IEEE, 2008. [Online]. Available: 10.1109/BIOCAS.2008.4696891.

[18] R. A. Normann, D. Warren, and A. Koulakov, "Representations and dynamics of representations of simple visual stimuli by ensembles of neurons in cat visual cortex studied with a microelectrode array," presented at the Neural Engineering, 2003. Conference Proceedings. First International IEEE EMBS Conference on, 20-22 March 2003, 2003. [Online]. Available: http://ieeexplore.ieee.org/ielx5/8511/26900/01196763.pdf?tp=&arnumber=1196763&isnumber=26900.

[19] R. P. Lang and D. J. Warren, "Microprocessor based speed and position measurement system," presented at the Vehicular Technology Conference, 1983. 33rd IEEE, 25-27 May 1983, 1983. [Online]. Available:

http://ieeexplore.ieee.org/ielx5/10802/34065/01623129.pdf?tp=&arnumber=1623129&isnumber=34065.

Abstracts and Proceedings (not Google Scholar listed)

[1] M. Leber *et al.*, "Technology development towards a novel auditory nerve implant (ANI)," in *Society for Neuroscience Annual Meeting*, virtual, Nov 8-11, 2021 2021.

[2] L. W. Rieth *et al.*, "Long-term stability of Utah Slanted Electrodes Arrays as bidirectional peripheral nerves interfaces in human subjects," in *Society for Neuroscience Annual Meeting*, virtual, Nov 8-11, 2021 2021.

[3] I. Sondh *et al.*, "Characterization of electrically-evoked auditory brainstem responses in rhesus monkey, cat, and guinea pig produced by stimulation via a novel auditory nerve implant using the Blackrock Utah array," in *Society for Neuroscience Annual Meeting*, virtual, Nov 8-11, 2021 2021.

[4] W. M. Thomas, L. M. Cavalcanti, V. J. Mathews, and D. J. Warren, "An Adaptive Model Predictive Control System for Functional Neuromuscular Stimulation Torque Control," in *SfN Global Connnections*, virtual, 06 Jan 2021 2021, 2021.

[5] S. Zuniga *et al.*, "Development of a New Surgical Approach for Implantation of a High-Density Penetrating Electrode Array in the Feline Auditory Nerve," in *Mid-winter Meeting, Association of Research Otolaryngologists*, Virtual, Feb. 20-24, 2021 2021.

[6] H. H. Lim *et al.*, "Development and Translation of an Intracranial Auditory Nerve Implant," in *Mid-winter Meeting, Association of Research Otolaryngologists*, San Jose, CA, Jan 25-29, 2020 2020.

[7] T. C. Hansen, H. Dantas, J. A. George, G. A. Clark, D. J. Warren, and V. J. Mathews, "Shared controllers improve control and performance of upper-limb prostheses," in *Society for Neuroscience Annual Meeting*, Chicago, IL, 2019.

[8] D. Hilgart, D. J. Warren, S. J. Barrus, and G. A. Clark, "Performance of wireless Utah slanted electrode arrays in cat: The SARA-USEA," in *Society for Neuroscience Annual Meeting*, Chicago, IL, 23 Oct 2019 2019.

[9] D. Kluger, C. Duncan, T. Davis, D. J. Warren, D. Hutchinson, and G. Clark, "Abstract #35: Using High-Electrode-Count Intrafascicular Peripheral Nerve Interfaces for Selective Mitigation of Chronic Pain," in *Brain Stimulation: Basic, Translational, and Clinical Research in Neuromodulation*, 2019, vol. 12, no. 2: Elsevier, p. e13, doi: 10.1016/j.brs.2018.12.042. [Online]. Available: https://doi.org/10.1016/j.brs.2018.12.042

[10] L. Rieth *et al.*, "Improvement and quantitative analysis of tip metal stability for Utah slanted arrays in long-term clinical studies with a sensorimotor prosthesis," in *Society for Neuroscience Annual Conference*, Chicago, IL, 23 Oct 2019 2019.

[11] L. M. Cavalcanti, W. M. Thomas, H. Dantas, D. J. Warren, and V. J. Mathews, "Nonlinear model-predictive control for functional neuromuscular stimulation," in *Neural Interface Conference*, Minneapolis, MN, 25-27 June 2018 2018.

[12] H. Dantas, S. Wendelken, T. S. Davis, G. A. Clark, D. J. Warren, and V. J. Mathews, "Long-term Performance of EMG Movement Decoders Trained Using Dataset Aggregation," in *Society for Neuroscience Annual Meeting*, San Diego, CA, 3-7 Nov 2018 2018.

[13] A. T. Gardner, H. J. Strathman, M. Sharma, D. J. Warren, and R. M. Walker, "Rapid Electrode Multiplexing for Scalable Neural Recording," in *NIC*, Minneapolis, MN, 25-27 June 2018 2018.

[14] T. C. Hansen *et al.*, "Advances in Shared Human-Machine Control for Upper Limb Prostheses," in *BMES*, Atlanta, GA, 17-20 Oct 2018 2018. [Online]. Available: http://submissions.mirasmart.com/SecureView/BMESArchive/radngni40gd.pdf. [Online]. Available: http://submissions.mirasmart.com/SecureView/BMESArchive/radngni40gd.pdf

[15] W. M. Thomas, L. M. Cavalcanti, H. Dantas, D. J. Warren, and V. J. Mathews, "Simulating Functional Neural Stimulation on OpenSim Biomechanical Models with Nonlinear Model Predictive Control," in *BMES*, Atlanta, GA, 17-20 Oct 2018 2018. [Online]. Available: http://submissions.mirasmart.com/SecureView/BMESArchive/radloox11jm.pdf. [Online]. Available: http://submissions.mirasmart.com/SecureView/BMESArchive/radloox11jm.pdf

[16] R. Caldwell, P. Takmakov, M. Street, D. Warren, and L. Rieth, "Evaluation of Reactive Accelerated Aging to Assess the Lifetime of Utah Electrode Arrays," in *North American Neuromodulation Society 2017*, Los Vegas, NV, 19-22 Jan 2017 2017.

[17] D. T. Kluger *et al.*, "Performance of tasks with closed-loop control of sensorized prosthetic hands by a transradial amputee with peripheral nerve and intramuscular implants," in *Society for Neuroscience Annual Meeting*, Washington DC, 15 Nov 2017 2017.

[18] J. G. Nieveen *et al.*, "Channel Selection of Neural and Electromyographic Signals for Decoding of Motor Intent," in *Myoelectric Control Symposium*, Fredericton, New Brunswick, 08-15-2017 2017.

[19] S. Wendelken *et al.*, "High Degree-of-Freedom Control of Virtual and Robotic Prosthetic Hands Using Surface EMG," in *Myoelectric Control Symposium*, Fredericton, New Brunswick, 08-15-2017 2017.

[20] D. Kluger *et al.*, "Closedloop control of a sensorized virtual prosthetic hand by a human subject after amputation," in *Society for Neurscience*, San Diego, CA, 12-16 Nov 2016 2016.

[21] D. Kluger *et al.*, "Closed-loop control of a virtual prosthetic hand by a human subject after prior amputation," in *Neural Interface Conference*, Baltimore, MD, 25-29 June 2016 2016.

[22] J. M. Mize, M. M. H. Shandhi, S. Negi, R. Bhandari, and D. J. Warren, "Simulation of Neuronal Localization Using the Utah Multisite Electrode Array," in *BMES 2016 Annual Meeting*, Minneapolis, MN, 5-8 Oct 2016 2016.

[23] S. Wendelken *et al.*, "Motor Decoding and Sensory Stimulation for Upper-limb Prostheses Using Implanted Neural and Muscular Electrode Arrays," in *Neural Interface Conference*, Baltimore, MD, 25-29 June 2016 2016.

[24] D. Page *et al.*, "Utah Slanted Electrode Array Recording and Stimulation Restores Movement and Sensation to Human Amputees," in *Biomedical Engineering Society Annual Meeting*, Tampa, FL, Cot 2015 2015.

[25] Z. A. Wach, A. K. RamRakhyani, Z. B. Kagan, G. Lazzi, R. Normann, and D. J. Warren, "Optimization of simulated RLC circuit and solenoid coils used in the magnetic stimulation of rat sciatic nerves," in *Radio Science Meeting (Joint with AP-S Symposium), 2015 USNC-URSI*, 19-24 July 2015 2015, pp. 309-309, doi: 10.1109/USNC-URSI.2015.7303593.

[26] S. Wendelken *et al.*, "Using multiple Utah Slanted Electrode Arrays (USEAs) to control 5-degrees-of-freedom of a virtual prosthetic hand and provide sensations in the phantom hand for a human, transradial amputee," in *Society for Neuroscience Annual Meeting*, Chicago, IL, Oct 2015 2015.

[27] A. K. RamRakhyani, Z. B. Kagan, F. Khan, D. J. Warren, R. Normann, and G. Lazzi, "Effect of membrane capacitance on the induced electric field for the magnetic peripheral nerve stimulation," in *Radio Science Meeting (Joint with AP-S Symposium), 2014 USNC-URSI*, 2014: IEEE, pp. 249-249.

[28] Z. B. Kagan, A. K. RamRakhyani, F. Khan, G. Lazzi, R. A. Normann, and D. J. Warren, "Magnetic Stimulation of feline sciatic nerve with solenoid coils: Evoking motor responses," in *Society for Neuroscience Annual Meeting*, San Diego, CA, 2013.

[29] Z. B. Kagan, A. K. RamRakhyani, F. Khan, G. Lazzi, D. J. Warren, and R. A. Normann, "In vivo and in vitro peripheral nerve stimulation via electromagnetic induction," in *BMES Annual Meeting*, Seattle, WA, 2013.

[30] A. K. RamRakhyani, F. Khan, D. J. Warren, R. Normann, and G. Lazzi, "On the design of efficient magnetic coils for the stimulation of peripheral nerves," in *Radio Science Meeting (Joint with AP-S Symposium), 2013 USNC-URSI*, 2013: IEEE, pp. 221-221.

[31] G. A. Clark *et al.*, "Selective, high-optrode-count, artifact-free stimulation with infrared light via intrafascicular Utah Slanted Optrode Arrays," in *SPIE BiOS*, 2012: International Society for Optics and Photonics, pp. 82075I-82075I-8.

[32] D. J. Warren *et al.*, "Fully-integrated, fully-wireless neuronal recording of peripheral nerve activity and associated real-time control of a virtual prosthetic arm," in *Society for Neuroscience 40th Annual Meeting*, San Diego, CA, 13 Nov 2010 2010.

[33] G. A. Clark *et al.*, "Restoring Motor and Sensory Function with Neuroprostheses," in *International Congress of Physiological Sciences, Kyoto, Japan*, 2009, vol. 31.

[34] D. J. Warren *et al.*, "Real-time wireless control of a virtual prosthetic arm via decodes of peripheral nerve activity," in *Society for Neuroscience*, Chicago, IL, 2009.

[35] G. A. Clark, N. M. Ledbetter, D. J. Warren, S. A. Towns, and R. A. Normann, "Chronic, EMG-free unit recordings from Utah Slanted Electrode Arrays in cat sciatic nerve," in *Society for Neuroscience 2008*, Washington, DC, 2008.

[36] D. J. Warren *et al.*, "Optimal linear filter control of a virtual prosthetic hand via wirelessly recorded myoelectric signals," in *Society for Neuroscience*, Washington, DC, 2008.

[37] G. A. Clark, D. J. Warren, and N. M. Ledbetter, "Stimulation of sciatic nerve via Utah Slanted Electrode Arrays evokes potentials in somatosensory cortex," in *Society for Neuroscience Annual Meeting*, San Diego, CA, 11/06/2007 2007.

[38] N. M. Ledbetter *et al.*, "Use of stimulus-evoked compound action potentials recorded by Utah Slanted Electrode Arrays to assay nerve somatotopy," in *Society for Neuroscience Annual Meeting*, San Diego, CA, 06-Nov-2007 2007.

[39] B. Winslow, H. Kavarana, D. J. Warren, and P. A. Tresco, "Brain tissue reaction surrounding stainless steel electrodes is similar to that observed with planar silicon penetrating microelectrode arrays in the rat cerebral cortex," in *Society for Neuroscience*, Atlanta, GA, 2006.

[40] D. J. Warren, A. Koulakov, and R. A. Normann, "Filling in the Map: Estimating Receptive Field Characteristics at Locatoins Not Sampled by a Multielectrode Array.," in *Society for Neuroscience*, Washington, DC, 2002, p. Program No. 125.5.

[41] D. Warren, R. Normann, and E. Fernandez, "Spatio-temporal dependencies in ganglion cell ensemble responses to moving stimuli," in *INVESTIGATIVE OPHTHALMOLOGY & VISUAL SCIENCE*, 2001, vol. 42, no. 4: ASSOC RESEARCH VISION OPHTHALMOLOGY INC 9650 ROCKVILLE PIKE, BETHESDA, MD 20814-3998 USA, pp. S676-S676.

[42] D. J. Warren and R. A. Normann, "High Resolution Study of the Retinotopic Organization of Area 17 in the Cat," in *Society for Neuroscience 30th Annual Meeting*, New Orleans, LA, 2000.

[43] D. J. Warren and D. J. Normann, "Stationarity of Receptive Field Characteristics with Non-Contextual Stimulation," in *ARVO Annual Meeting*, Fort Lauderdale, FL, 1999.

[44] D. J. Warren and R. A. Normann, "Changes in Neural Firing Activity after Kindling in Cat Primary Visual Cortex," in *Society for Neuroscience 29th Annual Meeting*, Miami Beach, FL, 1999.

[45] D. J. Warren, K. S. Guillory, and R. A. Normann, "Kindling Not Observed in Cat Visual Cortex," in *ARVO Annual Meeting*, Fort Lauderdale, FL, 1998.

[46] D. J. Warren and R. A. Normann, "Variability of Neural Activity as a Result of Electrical Stimulation in Cat Primary Visual Cortex," in *Society for Neuroscience 28th Annual Meeting*, Los Angeles, CA, 1998.

[47] D. J. Warren, E. M. Maynard, and R. A. Normann, "Spatiotemporal Patterns of Spontaneous Activityin Cat Area 17," in *Society for Neuroscience 27th Annual Meeting*, New Orleans, LA, 1997.

[48] D. J. Warren, N. D. Hadfield, P. J. Rousche, and R. A. Normann, "Spatiotemporal Correlated Firing of V1 Neurons: Simultaneous Recordings from 16 Electrodes," in *Society for Neuroscience 26th Annual Meeting*, Washington, DC, 1996.

Grants and Other Support

ACTIVE SUPPORT

R01EB029271-01	(PI: Gianluca Lazzi, USC)	08/01/2019 – 07/31/2022
Role: PI for Subaward		
1.0 calendar months		
NIH		$75,814 TDC/yr to Utah.

CRCNS US-SPAIN RESEARCH PROPOSAL: COMPUTATIONAL MODELING FRAMEWORK FOR SAFETY AND EFFICACY ASSESSMENT OF PNS STIMULATION

The major goal of this project is to develop and make available to the scientific community a modular, integrated, multiscale computational modeling framework that will allow the user to design safe and effective peripheral neurostimulators.

NSF ECCS- 1901492 (PI: David Warren) 07/01/2019 – 06/30/2022
Role: PI
1.0 calendar months
NSF ECCS - IntgStrat Undst Neurl&Cogn Sys $111,094 TDC/yr.

CHS: MEDIUM: COLLABORATIVE RESEARCH: COLLABORATIVE ONLINE LEARNING AND CONTROL FOR MOTOR PROSTHESIS

The major goal of this project is to learn human intent from biological signals, extracting higher- level goals using sensors embodied in the patient, and developing controllers for motor manipulation based on estimated motor movement intent and higher-level goals.

NSF CBET-1724345 (PI: Warren) 09/01/2017 – 8/31/2022
Role: PI
2.0 calendar months
NSF $98,736 TDC/yr.

CRCNS RESEARCH PROPOSAL: COLLABORATIVE RESEARCH: DATA-DRIVEN APPROACHES FOR RESTORING NATURALISTIC MOTOR FUNCTIONS USING FUNCTIONAL NEURAL STIMULATION

This project we propose to develop and evaluate the use of machine learning methods, such as the convolution neural network models that were inspired by the organization of primary visual cortex, to control activation of muscles via asynchronous intrafascicular stimulation peripheral nerves. Specifically, the goal of this project is to develop and evaluate methods to restore natural, coordinated, and graceful gait in an animal model of paralysis, an anesthetized feline.

N66001-15-C-4017 (PI: Gregory Clark) 02/09/2015 – 02/08/2022
Role: Co-PI
1.0 to 4.0 calendar months
DARPA $680,774 TDC/yr.

HAPTIX - EMBODIED PROSTHESES

The major goal of this project is to perform series of technological developments and functional investigations to restore dexterous, intuitive motor function and cutaneous and proprioceptive sensory function after hand amputation.

1UG3NS107688-01 (PI: Hubert Lim) 09/30/2018 – 07/31/2022
Role: PI for Subaward
1.0 to 4.0 Calendar months
NIH $82,880 TDC/yr. to Utah

DEVELOPMENT AND TRANSLATION OF AN INTRACRANIAL AUDITORY NERVE IMPLANT.

The proposed project will build and evaluate the safety and design needs of a new type of intracranial auditory prosthesis that targets the auditory nerve between the cochlea and the brainstem (auditory nerve implant, ANI) in order to substantially improve hearing performance over the current standard of care, the cochlear implant (CI).

1R44DC018261-01 (PI: Rajmohan Bhandari) 09/30/2018 – 07/31/2022
Role: Co-PI for Subaward
1.0 Calendar months
NIH $88,361 TDC/yr. to Utah

DEVELOPMENT AND TRANSLATION OF NOVEL SIC ENCAPSULATION THIN FILM FOR CHRONIC AUDITORY NERVE IMPLANT ELECTRODES.

The proposed project will develop and evaluate performance and biocompatibility/safety of a new Silicon Carbide (SiC) based encapsulation designed to extend the long-term stability and implantable lifetime for a high-density Utah Slant Electrode Array (HD-USEA) in line with lifetime expectations for conventional cochlea implant electrodes.

1R03EB029625-01 (PI: Frank Sachse) 06/01/2020 – 03/31/2022
Role: Key Personnel
0.5 Calendar months
NIH $50,000 TDC/yr.

A NEW APPROACH FOR MEASUREMENT OF ELECTRICAL CONDUCTIVITIES OF CARDIAC TISSUES

The proposed project aim is to support the further advancement and clinical translation of computational models of cardiac tissues.

1R44 DC018757-01 (PI: Rajmohan Bhandari) 06/30/2020 – 04/30/2023
Role: Co-PI for Subaward
1.0 Calendar months
NIH $6,007 TDC/yr. to Utah

DEVELOPMENT OF AN AMF ORION/BLACKROCK HD-USEA BASED 60/128 CHANNEL IMPLANTABLE WIRELESS SIMULATOR SYSTEM FOR HUMAN AUDITORY NERVE IMPLANTS

The proposed project aims to develop and translate a novel clinical high (60) channel implantable programmable stimulator (IPS) for use in Cochlear (CI) and auditory nerve (ANI) implants to expand the useable parameter space (electrode count, tonal range, lower stimulation threshold) far beyond current limits.

RA 10062320 (PI: David Warren) 09/01/2022 – 11/30/2022
Role: PI
0.5 Calendar months
Blackrock $80,820 TDC/yr. to Utah

EVALUATION OF MECHANICAL STABILITY AND INSERTION PERFORMANCE OF A NOVEL AUDITORY NERVE ELECTRODE ARRAY IN NERVOUS TISSUE

Perform 23 insertions of AN-USEA (Auditory Nerve – Utah Slanted Electrode Array) devices into a peripheral nerve with zero broken tines (shafts) using the newly developed AN-USEA and a modified version of the insertion system as part of a milestone for 1UG3NS107688-01.

PREVIOUS SUPPORT

R21EY027618-01 (PI: Walker) 09/30/2016 – 08/31/2019
Role: Co-PI
2.0 calendar months
NIH NATIONAL EYE INSTITUTE $150,000 TDC/yr.

RAPID ELECTRODE MULTIPLEXING AND SCALABLE NEURAL RECORDING

Our long-term goal is to develop fully implantable devices, for recording and stimulation, with spatial resolution commensurate with cellular density and capable of providing access to signals from 1000's of individual neurons. The overall objective of the proposed research is to develop a prototype of a recording circuit that, when scaled, will be capable of acquiring and processing the electrical activity of 1000+ individual neurons, in a form factor compatible with state-of-the-art neural probes. We hypothesize that rapidly multiplexed neural recording circuits can provide access to orders of magnitude higher channel counts safely, reliably, and with high signal fidelity.

1R01NS085213-01A1 (PI's: Bhandari, Negi, Warren) 05/01/2014 – 01/31/2018
Role: Corresponding PI
3.0 calendar months
NIH/NINDS $310,948 TDC/yr.

DESIGN AND VALIDATION OF THE UTAH MULTISITE ELECTRODE ARRAY (UMEA)

The major goal of this project is to develop and test multiple recording sites per shaft of a standard Utah Electrode Array, which we have called the Utah Multisite Electrode Array (UMEA). To achieve this goal, we will 1) Design, investigate and validate different configurations of high density (56 electrodes/mm^2) UMEA, 2) Perform *in-vitro* testing, and 3) Perform *in-vivo* validation and comparison of recording performance of different configuration of the UMEA.

10036101 (PI: Florian Solzbacher) 07/01/2014 – 06/30/2017
Role: Co-PI
3.0 calendar months
Blackrock Microsystems (sub-award to NIH/NIBIB 1R43EB018200-01A1) $68,369 TDC/yr.

PLASMA-ASSISTED ATOMIC LAYER DEPOSITION OF ALUMINA AND PARYLENE-C BI-LAYER ENCAPSULATION FOR CHRONIC BIOMEDICAL IMPLANTS

The major goal of this project is to develop a novel bi-layer encapsulation scheme that combines Plasma Assisted Atomic Layer Deposited (PA-ALD) alumina layer underneath the Parylene layer. To achieve this goal, we will 1) Optimize an ALD alumina/Parylene bi-layer encapsulation scheme and compare performance with Parylene-only encapsulation on test devices, 2) Develop etch methods to selectively expose active electrode sites on UEAs coated with optimized ALD alumina/Parylene bilayer, 3a) Evaluate charge injection and impedance characteristics of UEAs coated with ALD alumina/Parylene bilayer 3b) In vitro soak tests and device failure analysis, 4) Comparison of in vivo performance of ALD alumina/Parylene bi-layer coated UEAs to Parylene-only coated UEAs.

ECCS-1202235 (PI Gianluca Lazzi) 07/01/2012-06/30/2017
Role: Co-PI
1.0 calendar months
NSF/ECCS $91,880 TDC/yr.

FUNDAMENTAL PROPERTIES OF MICROMAGNETICS FOR PERIPHERAL AND CENTRAL NERVOUS SYSTEM STIMULATION

The major goal of this project is to realize the hardware necessary for magnetic stimulation of peripheral and central nervous system and prove the principle of magnetic stimulation. To achieve this goal, we 1) investigate coil geometries that will allow us to control the magnetic field of the microcoils, increase magnetic flux density levels well beyond those of traditional coils, and 2) alter the orientation of the fields in proximity of the target nerves.

N66001-12-C-4042 (PI: Gregory A. Clark) 03/20/2012-03/19/2015
Role: Co-PI

3.0 calendar months
US DEPARTMENT OF DEFENSE/USAMRAA Up to $2,061,740 TDC/yr.

SELECTIVE, HIGH-CHANNEL-COUNT INTRAFASCICULAR PERIPHERAL NERVE INTERFACES

The major goal of this project is to investigate the reliability of stimulating and recording electrode array-based neural interfaces to the nerves of the lower arm in both non-human primate experiments and in short-term human preclinical trials.

W81XWH-10-1-0931 (PI: Gregory A. Clark) 09/30/2010-10/29/2013
Role: Other Personnel
variable amount
US DEPARTMENT OF DEFENSE/USAMRAA $166,667 TDC/yr.

BRAIN-CONTROLLED INTRAFASCICULAR NERVE STIMULATION WITH HIGH-COUNT ELECTRODE ARRAYS FOR PRODUCING COORDINATED HAND MOVEMENTS IN NONHUMAN PRIMATES

The major goal of this project is to restore volitional, coordinated hand movements during temporary paralysis in monkeys (and ultimately, in humans).

1R01NS064318-01A1 (PI: Florian Solzbacher) 08/01/2009-7/30/2013
Role: Other Personnel
variable amount
NIH/NINDS $953,483 TDC/yr.

NEXT GENERATION WIRELESS NEURAL INTERFACES FOR CHRONIC AND ACUTE APPLICATIONS

The major goal of this project is to lay the foundation to make wireless neural interface technology a turnkey technology that can be disseminated to the neuroscience and clinical research communities.

2RO1NS039677-05A1 (PI: Richard A. Normann) 04/01/2005-3/31/2010
Role: Other Personnel
variable amount
NIH/NINDS $277,851 TDC/yr.

MULTISITE, INTRAFASCICULAR STIMULATION FOR STANCE

The major goal of this project is to use penetrating microelectrode arrays, implanted in the nerves innervating the muscles of the hip, knee, and ankle to provide controlled excitation of these muscle groups.

N66001-06-C-8005 (PI: Gregory A. Clark) 04/01/2006-1/30/2010
Role: Other Personnel
variable amount
DARPA Up to $1,677,850 TDC/yr.

REVOLUTIONIZING PROSTHETICS

The major goal of this project is to develop chronic recording and stimulating capabilities in the severed nerves of upper arm amputees for use in controlling a prosthetic limb.