Full Professor Neuroscience
Texas Instruments Distinguished Chair in Bioengineering
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ROBERT L. RENNAKER II Ph.D

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In my roles as an administrator, researcher, scientists, teacher, and entrepreneur I have dedicated my career to developing affordable and innovative therapies and technologies with the singular goal of improving the quality of life for individuals suffering from injuries and medical disorders. My leadership and training as a United States Marine has allowed me to successfully build and run an academic department, research center, and multiple companies simultaneously. My focus has been on the success of these endeavors not on building my personal curriculum vitae.

As Department Head for Bioengineering at The University of Texas at Dallas (2013-2018):

- Successfully recruited 24 faculty in 5 years.
- The mentorship program resulted in all 8 tenure track faculty recruited receiving NIH R01 awards
- The department grew from its founding in 2012 to being nationally ranked #62 by *US News and World Report*, Best Biomedical Engineering School (graduate) among public Universities in 2019.
- The department grew from 60 students to over 850 students in just 6 years.
- Departmental federal funding rose from $100,000 in 2012 to over $11 million in new awards in 2018.
- Successfully completed the inaugural ABET review in 2015
- Successfully completed the second ABET review in 2017
- Successfully completed the graduate program review 2018

Founding Executive Director of the Texas Biomedical Device Center (2012 – 2018):

- We have published over 150 peer-reviewed publication
- Raised ~$48 Million in external funding from DARPA, NIH, and private foundations.
- Developed 8 new technologies to monitor and help restore function following a neurological injury or disease.
- Developed a Class 3 implantable device for human trials
- Developed a potential therapy for SCI, PTSD, Stroke, Tinnitus and Hearing Loss

As a servant leader, I have dedicated my life to the betterment of the world and those around me. Strategic thinking underlies all aspects of my leadership. I have an innate ability to identify the real problem at hand, garner the resources necessary, and focus my teams on creating solutions that move the needle in a real and tangible direction. Adapt, Overcome, and Improvise are ingrained in me from my days as a US Marine. The leadership training provided by the United States Marine Corps has served me and my teams well. Our success is a result of a people-centric leadership style that focuses on the mission of the entity and supporting its people. Success flows from building an environment that enables individuals to focus on their job so they can do their best work and are acknowledged and rewarded for their hard work not just their success.

EDUCATION/TRAINING

PhD in Bioengineering, Arizona State University, 2002
MS in Bioengineering, Arizona State University, 2001
BSE in Bioengineering, Arizona State University, 1997
AA in Electrical Engineering, University of Central Florida, 1995

POSITIONS

1988-1993	United States Marine	MCAS New River Jacksonville, NC
1998-2002	Whitaker Ph.D. Fellow	Arizona State University Tempe, AZ
2002-2009	Assistant Professor, Aerospace and Mechanical Engineering & Center for Biomedical Engineering	University of Oklahoma Norman, OK
2009	Associate Professor, Aerospace and Mechanical Engineering & Center for Biomedical Engineering	University of Oklahoma Norman, OK
2008-2019	Owner/CEO	Vulintus Inc.
2019-Present	Board Member	Vulintus Inc.
2009-Present	Associate Professor, Brain and Behavioral Sciences; Neuroscience & Erik Johnson School of Engineering, Electrical Engineering	The University of Texas at Dallas Richardson, TX
2012-01/2019	Director, Texas Biomedical Device Center	The University of Texas at Dallas Richardson, TX
2013-10/2018	Department Head, Bioengineering	The University of Texas at Dallas Richardson, TX
2014-Present	Full Professor, Biomedical Engineering, Neuroscience, and Electrical Engineering	The University of Texas at Dallas Richardson, TX
2014-Present	Owner/CEO	Optokinetix LLC
2015-2018	Consultant	Konan Medical USA Irvine CA
2019-Present	Associate Director, Texas Biomedical Device Center	UTD, Richardson, TX
2018-Present	Vice President for Engineering and Innovation	Konan Medical USA, Irvine, CA
2020-Present	Chief Executive Officer for XNerve Medical	Dallas, Texas
2020-Present	Director of IAO Foundation	Richardson, Texas

HONORS

1988-1993	United States Marine Corps Awards: Letter of Accommodation 3 Letters of Appreciation 3 Meritorious Mast Awards Navy and Marine Corps Achievement Medal For Actions During Desert Storm Marine Corps Good Conduct Medal Marine Corps Expeditionary Medal Southwest Asia Service Medal Humanitarian Service Medal 2 Naval Sea Service Medals Kuwait Liberation Medal 2 Navy Unit Commendation National Defense Medal Rifle Expert Marksman Badge
1998	Whitaker Foundation Ph.D. Fellowship
2003	The University of Oklahoma Tom J. Love Outstanding Professor
2007	The University of Oklahoma Alumni Teaching Award
2009	The University of Oklahoma Presidential Associates Presidential Professorship
2013	UT Dallas, Cecil H. and Ida Green Professor in Systems Biology
2014	UT Dallas Texas Instruments Distinguished Chair in Bioengineering

LEADERSHIP

Philosophy: A leader's primary job is to enable the success of those under her or his supervision. In general there are a few things a leader must do to create an environment where success is the focus. The following is a list of general principles I used to build two highly successful academic entities.

1) No jerk policy. Make it clear that all people in the organization are valuable and should be treated with respect.
2) Create an environment where every person feels part of the ownership in the success of the organization.
    a. Use meetings to formulate and discuss policies or to make decisions.
    b. Elicit feedback anonymously so people feel comfortable giving an honest opinion.
3) Set quantifiable expectations for each employee.
4) Reward success publicly.
5) Take a positive approach to dealing with failure to meet expectations in private (training).
6) Set quantifiable goals for the organization.
7) Publish the results of our efforts to meet the organizational goals publicly. Encourage hitting goals when missed.
8) Identify the real problem: Create methods for identifying areas of concern and create solutions for those problems, versus solving a perceived problem that is not defined.
9) Bring in outside experts and companies to provide feedback and advice

While books have been written on leadership, the underlying principle that leads to success is creating an organization filled with highly skilled and talented people who excel at their job, want to be at work, and see want to see the team succeed. This means a leader must create this environment and manage the moral and tone of those under her or his supervision so they love their jobs. A leader must set the example quietly. Everyone knows the leader works harder and more hours and is dedicated to the success of the organization, but a leader knows this never needs to be pointed out. A leader serves the team members while maintaining a professional working relationship.

Leadership Successes in Academia

Bioengineering Department UT Dallas

In June of 2013 I was appointed department head of bioengineering at UT Dallas. The program was two years old, had 7 tenure/tenure track faculty, zero teaching faculty, and one staff member. I quickly assessed the health of the program. I found that there were no course materials developed for the junior year, the faculty were not organized, there were no policies or procedures and the educational programs where not being assessed. In short, the program was poised to fail the students that had placed their trust in the bioengineering program. I informed leadership at UT Dallas of the state of the program and requested resources to immediately fix the problems.

That first year my team updated the undergraduate curriculum, purchased $3M in laboratory equipment for the teaching labs, and built bioengineering teaching laboratory space. Since 2013 we hired 10 teaching faculty and 14 tenure/tenure track faculty. The program grew from 40 students in 2013 to over 850 student in 2018. Despite the real and significant challenges, my team has done a phenomenal job of hitting our goals. Our success is the direct result of the team coming together to solve major issues with the goal of building a world-class educational program. The following bulleted list are just a few of the accomplishments of my team.

1) Inaugural ABET Review: Passed with a minor concern in 2015.
2) Second ABET Review: The program was reviewed again in 2017 to align with the school. Passed with no concerns, deficiencies, or weaknesses.
3) Student assessment of program of overall quality of the classes increased from 3.1/5 in 2013 to 4.3/5 in 2018. (goal is 4.5/5)
4) Our program was ranked by US News and World Report at #62 in 2018 (goal is top 50 by 2020)
5) Annual research expenditures increased from $300,000 in 2013 to $11,000,000 in 2018 (goal was $10,000,000 by 2020)
6) Per faculty annual research expenditures increased from $100,000 in 2013 to $450,000 in 2018 (goal was $500,000 by 2020)
7) Per faculty average number of peer reviewed publications increased from 1.5 in 2013 to 4.3 in 2018 (goal was 4.5/year)
8) Total number of RAs funded by faculty increased from 5 in 2013 to 50 in 2018 (goal was 3 per T/T faculty: 60)
9) Mean number of courses taught by T/TT faculty was 2.5 (goal is 2 per year for research active faculty).

Texas Biomedical Device Center at UT Dallas

In April 2012 the President of UT Dallas, Dr. David Daniel asked me to build a world-class research center using an endowed gift from a private donor and Texas Instruments. My team and I formulated a white paper to create the Texas Biomedical Device Center. It was approved in August of 2012. The mission of the center is to develop advanced medical technologies to improve human health. The following is a list of some of the accomplishments of the center's team.

1) External funding in six years since its inception totals > $40M as of 2020
2) Published over 150 peer reviewed publications as of 01/2020
3) Developed 6 medical devices including a class 3 implantable
4) 12 patents
5) Employs over 150 researchers and administrators each year
6) Participated in 5 clinical trials
7) Funded to run 3 clinical trials starting in 2020
8) FDA IDE approval for our Class III implantable system
9) Developed a quality system

While these quantitative metrics show the great success of the team, they do not reveal the importance of the work of the center. If we succeed in our goals, we will have developed new technology for rewiring the nervous system to help individuals recover from neurological injuries. This technology has the potential to radically improve the quality of life for hundreds of millions of individuals.

TECHNOLOGIES DEVELOPED

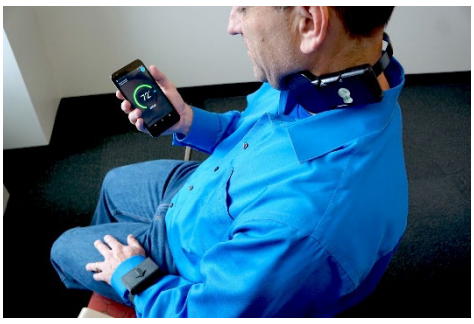
- **Neurotriage** is a handheld portable device capable of quickly measuring an individual's visual tracking abilities. Through measuring eye movements, we can detect impairments in brain function that are likely to result in poor performance. The system can capture eye movements in under 2-minutes, detecting performance metrics such as reaction time, target tracking, balance, and visual steadiness.
- **ReStore** Vagus Nerve Stimulator is a wireless implantable device is used to stimulate the vagus nerve located in your neck. When paired with the ReLay power and communication module, it delivers precise electrical stimulation to the nerve during rehabilitation, causing the release of neurotransmitters critical for learning and memory.
- **ReLief** Technology was developed to reduce the ringing sound that Tinnitus patients experience. With the use of an app on their smart phone and earbuds, therapeutic tones are played and paired with the ReStore vagus nerve stimulator while the patient performs normal daily activities. The stimulator is powered using the ReLay power and communication module which is worn around the neck during therapy. This combination of tones paired with vagus nerve stimulation reduces the patient's perception of tinnitus by reorganizing the brain.

Neurotriage Technology

Re-Store Technology

Re-Lief Technology

- **RePair** Technology was developed to guide recovery of arm and leg movements after a brain, peripheral nerve, or spinal cord injury. Sensors worn on the arms and legs monitor movements and trigger the ReStore vagus nerve stimulator. This technology allows patients to improve arm and leg movement using an app on their smart phone during normal daily activities.
- **RePlay** Technology was developed to guide recovery of hand function after a brain or spinal cord injury. This therapy allows patients to play fun and engaging video games that become more challenging as the patient improves. Hand movements are monitored as patients play the games, triggering stimulation of the ReStore vagus nerve stimulator. The software is designed to run off a smart phone, tablet or computer.
- **ReLay** Technology is an externally worn power and communication device that is used to activate the ReStore implant. ReLay links your smart phone to RePlay, RePair and ReLief Technologies during Targeted Plasticity Therapy.



Re-Pair Technology

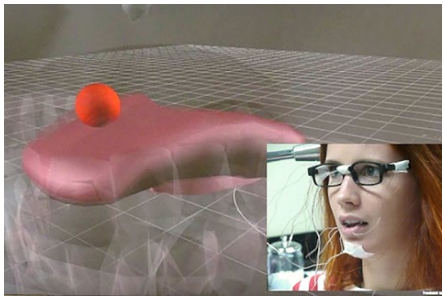
Re-Play Technology

Re-Lay Technology

- **Opti-Speech** is an interactive system that integrates tongue, lip, and jaw motion capture from 3D Electromagnetic Articulography (EMA) systems to animate a realistic 3D avatar. Users get real-time visual feedback of their tongue and jaw movements during speech therapy, which helps both them and the speech therapist to guide correct tongue positioning for speech sounds.

- **MotoTrak** is a complete, modular system designed for computer-supervised training and testing of forelimb movements in rodent models. With interchangeable behavior modules, you can isolate forelimb strength, movement speed,

pronation/supination, bradykinesia, and more. Software monitors and guides training and testing, and provides quantitative endpoint measures with no time-consuming manual analysis.



OptiSpeech

MotoTrak

PATENTS

1. 2008 US 8700145 B2: Methods, systems, and devices for pairing vagus nerve stimulation with motor therapy in stroke patients
2. 2012 US 20120203129 A1: Brain Machine Interface Device
3. 2014 US 20140228908 A1: Methods, systems, and devices for pairing vagus nerve stimulation with motor therapy in stroke patients
4. 2015 US 20150245795 A1: System for acceleration measurements and traumatic brain injury detection
5. 2015 US 20150245766 A1: System for traumatic brain injury detection using oculomotor tests
6. 2016 US 20150359285 A1: Helmet
7. 2016 US 20160279417 A1: Methods and systems for improving speech recognition
8. 2016 US 20160144176 A1: Methods and systems for therapy of multiple sclerosis
9. 2017 US 20150245766 A1: System for traumatic brain injury detection using oculomotor tests
10. 2017 US 9533152 B2: Methods, systems, and devices for pairing vagus nerve stimulation with motor therapy in stroke patients
11. 2017 US Patent App. 15/590,590; Systems and methods for switched electrode stimulation for low power bioelectronics
12. 2018- US20180221666A1: Systems and methods for optimizing targeted neuroplasticity
13. 2018- US20180085578A1: Vagus nerve stimulation for treating spinal cord injury
14. 2018- US9895099B2: System for acceleration measurements and traumatic brain injury detection

PEER-REVIEWED PUBLICATIONS

2022

1. Pruitt DT, Duong-Nguyen Y, Meyers EC, Epperson JD, Wright JM, Hudson RA, Wigginton JG, Rennaker RL, Hays SA, Kilgard MP. Usage of RePlay as a Take-Home System to Support High-Repetition Motor Rehabilitation after Neurological Injury. Games for Health Journal. In press.
2. Souza RR, Powers MB, Hays SA, Rennaker RL, McIntyre CM, Kilgard MP. Timing of Vagus Nerve Stimulation During Fear Extinction Determines Efficacy in a Rat Model of PTSD. Science Reports. 2022; 12, 16526.
3. Adcock KS, Danaphongse TT, Jacob S, Rallapalli H, Torres M, Haider Z, Seyedahmadi A, Morrison RA, Rennaker RL, Kilgard MP, Hays SA. Vagus nerve stimulation does not improve recovery of forelimb motor or somatosensory function in a model of neuropathic pain. Science Reports. 2022; 12, 9696.
4. Morrison RA, Abe ST, Danaphongse TT, Ezhil V, Somaney A, Adcock KS, Rennaker RL, Kilgard MP, Hays SA. Common cholinergic, noradrenergic, and serotonergic drugs do not block vagus nerve stimulation-mediated plasticity. Frontiers in Neuroscience. 2022; 16:849291.

2021

1. Timir Datta-Chaudhuri, Theodoros Zanos, Eric H Chang, Peder S Olofsson, Stephan Bickel, Chad Bouton, Daniel Grande, Loren Rieth, Cynthia Aranow, Ona Bloom, Ashesh D Mehta, Gene Civillico, Molly M Stevens, Eric Głowacki, Christopher Bettinger, Martin Schüettler, Chris Puleo, Robert Rennaker, Saroj Mohanta, Daniela Carnevale, Silvia V Conde, Bruno Bonaz, David Chernoff, Suraj Kapa, Magnus Berggren, Kip Ludwig, Stavros Zanos, Larry Miller, Doug Weber, Daniel Yoshor, Lawrence Steinman, Sangeeta S Chavan, Valentin A Pavlov, Yousef Al-Abed, Kevin J TraceyThe Fourth Bioelectronic Medicine Summit “Technology Targeting Molecular Mechanisms”: current progress, challenges, and charting the future. Bioelectronic medicine 7, 1-9 (3) 2021

2. Jesse E Bucksot, Collin R Chandler, Navaporn M Intharuck, Robert L Rennaker, Michael P Kilgard, Seth A Hays; Validation of a parameterized, open-source model of nerve stimulation; Journal of neural engineering 18 (4), 042001 (1) 2021

3. Rimenez R Souza, Nicole M Robertson, Christa K McIntyre, Robert L Rennaker, Seth A Hays, Michael P Kilgard; Vagus nerve stimulation enhances fear extinction as an inverted-U function of stimulation intensity, Experimental Neurology 341, 113718 (12) 2021

4. Rimenez R Souza, Cecily R Oleksiak, Michel N Tabet, Robert L Rennaker, Seth A Hays, Michael P Kilgard, Christa K McIntyre; Vagus nerve stimulation promotes extinction generalization across sensory modalities, Neurobiology of Learning and Memory 181, 107425 (5) 2021

5. Robert A Morrison, Tanya T Danaphongse, Stephanie T Abe, Madison E Stevens, Vikram Ezhil, Armin Seyedahmadi, Katherine S Adcock, Robert L Rennaker, Michael P Kilgard, Seth A Hays; High intensity VNS disrupts VNS-mediated plasticity in motor cortex;
6. Brain research 1756, 147332 (13) 2021

7. David T Pruitt, Tanya T Danaphongse, Megan Lutchman, Nishi Patel, Priyanka Reddy, Vanesse Wang, Anjana Parashar, Robert L Rennaker, Michael P Kilgard, Seth A Hays; Optimizing dosing of vagus nerve stimulation for stroke recovery
8. Translational stroke research 12 (1), 65-71 (30) 2021

9. Michael J Darrow, Tabarak M Mian, Miranda Torres, Zainab Haider, Tanya Danaphongse, Armin Seyedahmadi, Robert L Rennaker II, Seth A Hays, Michael P Kilgard; The tactile experience paired with vagus nerve stimulation determines the degree of sensory recovery after chronic nerve damage. Behavioural brain research 396, 112910

2020

1. A suite of automated tools to quantify hand and wrist motor function after cervical spinal cord injury; KM Grasse, SA Hays, KC Rahebi, VS Warren, EA Garcia, JG Wigginton, ...Journal of NeuroEngineering and Rehabilitation 16 (1), 48, 2019
2. Optimizing Dosing of Vagus Nerve Stimulation for Stroke Recovery; David T Pruitt, Tanya T Danaphongse, Megan Lutchman, Nishi Patel, Priyanka Reddy, Vanesse Wang, Anjana Paraar, Robert L Rennaker, Michael P Kilgard, Seth A Hays; Translational Stroke Research; 2020/6/25
3. A limited range of vagus nerve stimulation intensities produce motor cortex reorganization when delivered during training; Robert A Morrison, Tanya T Danaphongse, David T Pruitt, Katherine S Adcock, Jobin K Mathew, Stephanie T Abe, Dina M Abdulla, Robert L Rennaker, Michael P Kilgard, Seth A Hays; Behavioural Brain Research; 2020/5/28
4. Efficient parameters of vagus nerve stimulation to enhance extinction learning in an extinction-resistant rat model of PTSD; Rimenez R Souza, Nicole M Robertson, Ezek Mathew, Michel N Tabet, Jesse E Bucksot, David T Pruitt, Robert L Rennaker, Seth A Hays, Christa K McIntyre, Michael P Kilgard; Progress in Neuro-Psychopharmacology and Biological Psychiatry 2020/4/20
5. Vagus nerve stimulation produces immediate dose-dependent anxiolytic effect in rats; Ezek Mathew, Michel N Tabet, Nicole M Robertson, Seth A Hays, Robert L Rennaker, Michael P Kilgard, Christa K McIntyre, Rimenez R Souza; Journal of Affective Disorders, 2020/3/15
6. Vagus Nerve Stimulation Paired With Rehabilitative Training Enhances Motor Recovery After Bilateral Spinal Cord Injury to Cervical Forelimb Motor Pools; Michael J Darrow, Miranda Torres, Maria J Sosa, Tanya T Danaphongse, Zainab Haider, Robert L Rennaker, Michael P Kilgard, Seth A Hays; Neurorehabilitation and neural repair; 2020/3
7. Restoration of somatosensory function by pairing vagus nerve stimulation with tactile rehabilitation; Michael J Darrow, Tabarak M Mian, Miranda Torres, Zainab Haider, Tanya Danaphongse, Robert L Rennaker Jr, Michael P Kilgard, Seth A Hays; Annals of Neurology, 2020/2

2019

8. A suite of automated tools to quantify hand and wrist motor function after cervical spinal cord injury; KM Grasse, SA Hays, KC Rahebi, VS Warren, EA Garcia, JG Wigginton, ...Journal of NeuroEngineering and Rehabilitation 16 (1), 48, 2019
9. ReStore: a wireless peripheral nerve stimulation system; V Sivaji, DW Grasse, SA Hays, JE Bucksot, R Saini, MP Kilgard, , Journal of neuroscience methods, 2019
10. Vagus nerve stimulation intensity influences motor cortex plasticity; RA Morrison, DR Hulsey, KS Adcock, RL Rennaker II, MP Kilgard, ...Brain stimulation 12 (2), 256-262, 1, 2019
11. Flat Electrode Contacts for Peripheral Nerve Stimulation; JE Bucksot, AJ Wells, KC Rahebi, V Sivaji, M Romero-Ortega, MP Kilgard, ...BioRxiv, 593467, 2019
12. Vagus nerve stimulation promotes generalization of conditioned fear extinction and reduces anxiety in rats; LJ Noble, VB Meruva, SA Hays, RL Rennaker, MP Kilgard, CK McIntyre, Brain stimulation 12 (1), 9-18
13. Michael J Darrow, Tabarak M Mian, Miranda Torres, Zainab Haider, Tanya Danaphongse, Robert L Rennaker, Michael P Kilgard, Seth A Hays; Restoration of somatosensory function by pairing vagus nerve stimulation with tactile rehabilitation, Annals of Neurology; 2019
14. Eric C Meyers, Nimit Kasliwal, Bleyda R Solorzano, Elaine Lai, Geetanjali Bendale, Abigail Berry, Patrick D Ganzer, Mario Romero-Ortega, Robert L Rennaker, Michael P Kilgard, Seth A Hays; Enhancing plasticity in central networks improves motor and sensory recovery after nerve damage; 2019, 10 (1)

2018

15. Kristofer W Loerwald, Elizabeth P Buell, Michael S Borland, Robert L Rennaker II, Seth A Hays, Michael P Kilgard; Varying stimulation parameters to improve cortical plasticity generated by VNS-tone pairing, Neuroscience 388, 239-247, 2, 2018
16. David Pruitt, Tanya Danaphongse, Megan Lutchman, Nishi Patel, Seth Hays, Michael Kilgard, Robert Rennaker; PARAMETRIC VARIATION OF VAGUS NERVE STIMULATION AMPLITUDE TO OPTIMIZE MOTOR FUNCTION RECOVERY AFTER BRAIN TRAUMA, JOURNAL OF NEUROTRAUMA 35 (16), A282-A282, 2018

17. MJ Sobhanian, R Agarwal, E Meltzer, E Kildebeck, BS Frohman, RL Rennaker, Identification and treatment of the visual processing asymmetry in MS patients with optic neuritis: The Pulfrich phenomenon, Journal of the neurological sciences 387, 60-69, 1, 2018

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20. Millad J Sobhanian, Rohit Agarwal, Ethan Meltzer, Eric Kildebeck, Benjamin S Frohman, Ashley N Frohman, Steven L Galetta, Shiv Saidha, Owen White, Pablo Villoslada, Friedemann Paul, Axel Petzold, Robert L Rennaker, Elena H Martinez-Lapiscina, Laura J Balcer, Randy Kardon, Elliot M Frohman, Teresa C Frohman; Identification and treatment of the visual processing asymmetry in MS patients with optic neuritis: The Pulfrich phenomenon, Journal of the Neurological Sciences 387, 60-69, 2018

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PEER-REVIEWED CONFERENCE PAPERS

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4. Liu, C.C.; Jian Chang; Sitong Yuan; Johnson, L.G.; Rennaker, R.L., "A low noise bandpass neuro-amplifier with adjustable bandwidth for bio-medical applications," Green Circuits and Systems (ICGCS), 2010 International Conference on, vol., no., pp.438,441, 21-23 June 2010
5. Venkataraman, S.; Hutchens, C.; Rennaker, R.L., "RF-front end for wireless powered neural applications," Circuits and Systems, 2008. MWSCAS 2008. 51st Midwest Symposium on, vol., no., pp.682,685, 10-13 Aug. 20081
6. Hutchens, C.; Rennaker, R.L.; Venkataraman, S.; Ahmed, R.; Ran Liao; Ibrahim, T., "Implantable radio frequency identification sensors: Wireless power and communication," Engineering in Medicine and Biology Society,EMBC, 2011 Annual International Conference of the IEEE , vol., no., pp.2886,2892, Aug. 30 2011-Sept. 3 2011
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9. Yuan S., Johnson L., Liu C., Hutchens C., Rennaker RL; Current Biased Pseudo-Resistor for Implantable Neural Signal Recording Applications, 2008 IEEE Midwest Symposium on Circuits and Systems, Knoxville Tn, August 10-13, 2008.
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CONFERENCE ABSTRACTS/PRESENTATIONS

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1. S. A. Hays, N. Khodaparast, A. Ruiz, M. Iyengar, P. Das, E. Nutting, I. Kushner, V. Land, N. Houshmandi, Rennaker RL, M. Kilgard; Vagus nerve stimulation paired with rehabilitative training improves recovery of forelimb function in clinically relevant models of stroke Wed, Nov 19, 2014, 8:00 AM - 12:00 PM 716.21/DD2
2. N. Khodaparast, R Casavant, SA Hays, A Ruiz, N Jones, B Nguyen, M Thomas, C Le, R Rennaker, MP Kilgard; Translational potential of vagus nerve stimulation to enhance recovery of motor function after stroke Wed, Nov 19, 2014, 8:00 AM - 12:00 PM; 716.20/DD1
3. A Nguyen, N Khodaparast, S Hays, MP Kilgard, RL Rennaker; Vagus nerve stimulation and healthy limb training modify stroke recovery Wed, Nov 19, 2014 8:00 AM - 12:00 PM; 716.19/CC36
4. E Meyers, A Sindhurakar, S Hays, A Sloan, J Carmel, MP Kilgard, R Rennaker; A novel automated method for isolating and quantifying supination performance in a rat model of ischemic stroke Wed, Nov 19, 2014, 8:00 AM - 12:00 PM; 715.16/CC16
5. D Pruitt, A Schmid, C Choua, L Kim, J Trieu, C Abe, K Flanagan, MP Kilgard, RL Rennaker; Pairing vagus nerve stimulation with rehabilitative training enhances functional recovery after traumatic brain injury; Tue, Nov 18, 2014, 8:00 AM - 12:00 PM 522.08/AA12

6. D Hulsey, S Hays, N Khodaparast, R Casavant, A Ruiz, P Das, E Nutting, X Carrier, M Iyengar, I Quareshi, S Sultana, R Rennaker, MP Kilgard; Vagus nerve stimulation dependent enhancement of cortical plasticity requires cholinergic innervation of the cortex Tue, Nov 18, 2014, 8:00 AM - 12:00 PM; 542.20/NN21
7. D Pruitt, A Schmid, C Choua, L Kim, J Trieu, C Abe, T Danaphongse, M Kilgard, RL Rennaker; Pairing Vagus Nerve Stimulation with Rehabilitative Training Enhances Functional Recovery After Traumatic Brain Injury. Tue, Nov. 18, 2014, 11:00 AM - 12:00 PM; 522.08/AA12
8. C Choua, A Schmid, L Kim, J Trieu, D Machuca, S Sterling, S Shah, S Khan, D Pruitt, RL Rennaker; Controlled-Cortical Impact Reduces Rats Ability to Sustain Application of Submaximal Force, Journal of Neurotrauma, 31 (12) A125-A125

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2011

10. Chris Hutchens, R.L. Rennaker, Tamer Ibrahim; Implantable Radio Frequency Identification Sensors: for treatment of neurological disorders; IEEE RFID 2011 Orlando Florida, April 12-14, 2011
11. R.L. Rennaker, Adam Lovitz, Donald Wilson; Behavioral Learning of Complex Odor Mixtures ACHEMS 2011 St. Pete Beach, Florida, April 13-17, 2011
12. T. M. Rosen, A. M. Sloan, R. L. Rennaker, M. P. Kilgard; Evaluating neural correlates of compressed speech discrimination in the adult rat; SFN Washington DC November 12-16, 2011
13. M. Sloan, O. T. Dodd, K. Houck, T. Palmer, A. H. Fagg, R. L. Rennaker; Multi-unit responses in behaving rat auditory cortex predict frequency discrimination behavior; SFN Washington DC November 12-16, 2011
14. R. L. Rennaker, C. Hutchens, Wireless distributed neural interface system; SFN Washington DC November 12-16, 2011
15. N. Khodaparast, T. Fayyaz, S. Ahamed, R. Cheung, C. May, F. Naqvi, D. Ratra, M. Javidnia, A. Ruiz, D. Cao, R. L. Rennaker, M. P. Kilgard; The effects of VNS paired with rehabilitative motor training on the behavioral recovery following ischemic brain damage, SFN Washington DC November 12-16, 2011
16. N. Markwardt, J. Stokol, R. L. Rennaker; Submeningeal implantation reduces chronic immune response to neural interfaces. SFN Washington DC November 12-16, 2011
17. E. J. Donzis, R. L. Rennaker, L. T. Thompson; Interaction between basolateral complex of the amygdala and hippocampal CA1 in auditory fear conditioning effects on place cell activity, SFN Washington DC November 12-16, 2011
18. M. Kapolowicz. J. Lek, S. Templet, R. Rennaker, L. T. Thompson; Hippocampal place-cell plasticity and basolateral amygdala responses to auditory stimuli in a rat model of tinnitus; SFN Washington DC November 12-16, 2011

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21. Sloan, A., Rennaker RL; Neural correlates of fine-grain frequency discrimination in behaving rats. Society for Neuroscience Annual Meeting, Washington DC, 2008
22. Markwardt N., Rennaker RL.; The effect of surface texturing on the immune response to neural interfaces. Society for Neuroscience Annual Meeting, Washington DC, 2008
23. Rennaker RL, Hutchens C., Ibrahim T., Miller L., Cogan S.; Development of a Distributed Neural Interface System; NIH Neural Interface Conference, Cleveland Ohio, 2008

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25. Sloan AM, Tang H, and Rennaker RL.; Effect of minocycline administration on chronic neural interfaces in rats: recording quality and glial response. Society for Neuroscience Annual Meeting; Atlanta, GA. October, 2006.

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28. Wilson DA, Ruyle AM, and Rennaker RL.; Analysis of odorant-evoked spatial and temporal patterns in piriform cortex. Society for Neuroscience Annual Meeting; Atlanta, GA. October, 2006.
29. Sloan AM and Rennaker RL.; The effect of MK801 on auditory cortex receptive fields in the awake rat. Tucker-Davis Symposium on Advances and Perspectives in Auditory Neurophysiology; Atlanta, GA. October, 2006.
30. R.L. Rennaker, A. M. Ruyle, C.F. Chen, D.A. Wilson; Microelectrode array analysis of odorant-evoked spatial activity patterns in piriform cortex. Association for Chemoreception Sciences April, 2006

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31. A.M. Sloan, R.L. Rennaker; Habituation in Awake Rat A1 is Dependent on Stimulus Presentation Rate; Washington DC; The Tucker-Davis Symposium on Advances and Perspectives in Auditory Neurophysiology, November, 2005
32. A.M. Sloan, T.N. Slavens, R.L. Rennaker; A Behavioral Paradigm for Assessing Perception of ICMS in Primary Auditory Cortex of Rats; Washington DC; Society for Neuroscience, November, 2005
33. Ruyle, H. McClenathan, M.P. Kilgard, R.L. Rennaker; A Comparison of Neural Response Dynamics to Broadband Repetitive Stimuli in Auditory Cortex of the Unanesthetized and Ketamine Anesthetized Rat; Washington DC; Society for Neuroscience, November, 2005
34. A.M. Sloan, T.N. Slavens, R.L. Rennaker; Perception of Intra-cortical Micro-stimulation in Primary Auditory Cortex: Bethesda Maryland; NIH- Neural Prosthetics Meeting, September, 2005

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36. Ruyle, M.A. Fletcher, D.A. Wilson, R.L. Rennaker; Ensemble single-unit activity recorded with chronic indwelling microelectrode arrays in rat piriform cortex. Society for Neuroscience, (531.19) 2004

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37. R.L. Rennaker, Hoang Ho, Pradeep Kilambi, Michael Kilgard; Dynamic Filtering in Rat Auditory Cortex, Association for Research in Otolaryngology Feb 2003
38. P.K. Pandya, D.L. Rathbun, N. D. Engineer, R.M. Moucha, R.L. Rennaker, M.P. Kilgard; Representation of Complex Sounds in Auditory Thalamus, Primary and Non-Primary Cortex Feb 2003
39. A.M. Sloan; S.E. Street; P.L. Kilambi; R.L. Rennaker; M.P. Kilgard; Parametric Study of Habituation in Unanaesthetized Rat A1; The society for neuroscience Nov 2003
40. S.E. Street; A.M. Sloan; R.L. Rennaker; Temporal Response Rates of Primary Auditory Cortex Neurons in the Unanestetized Rat; The Society for Neuroscience Nov 2003

BOOK CHAPTERS

1. Donald A Wilson, Robert L Rennaker; The Neurobiology of Olfaction Chapter 14: Cortical Activity Evoked by Odors; CRC Press 2010

	Total Current Active Grant Funding	$25,104,423
CDMRP DM190663	RESTORE Congressionally Directed Medical Research Program Restoring Sensory Function After Upper Limb Nerve Injury with Vagus Nerve Stimulation; Co-PI	$1,499,729
NINDS-R01 5R01NS103803-02	Enhancing Recovery after Chronic Bilateral Cervical Spinal Cord Injury with Targeted Plasticity Therapy: Role Co-PI	$1,912,500
DARPA BAA-16-24	Targeted Neuroplasticity Training (TNT) to Accelerate Complex Skill Learning *Role: Co-PI*	$5,972,836
DARPA 15-06-Office-Wide-BAA-FP-014	Closed-loop Neuromodulation to Treat PTSD *Role: Co-PI*	$7,245,347
DARPA 14-38-Office-Wide-BAA-FP-014	Platform technology for Sensory, Motor and Affective Disorders *Role: PI*	$636,785
NINDS-R01 1R44NS086344-01A1	Vagus Nerve Stimulation Paired with Rehabilitative Training to Enhance Plasticity *Role: Co-PI*	$2,361,325
NIH 1 UG3 NS109497-01	Wireless Nerve Stimulation Device To Enhance Recovery After Stroke: Co-PI	$3,563,401
NIH 5R01DC017480-02	Enhancing Speech Processing In A Rat Model of Autism Using Vagus Nerve Stimulation; Role: Co-I	$1,912,500

	Total Completed Research Support	**$13,667,896**
Once Upon A Time Foundation	Targeted Plasticity Therapy for Multiple Sclerosis: Role- Co-PI	$1,000,000
W.W. Caruth Jr. Foundation	Development of Targeted Plasticity System for Spinal Cord Injury Rehabilitation *Role: PI*	$2,000,000
Fast-Track SBIR (NIH/ NINDS) 1R43DC013467-01A1	Development of a turnkey system for assessing forelimb function in rats *Role: Project Manager*	$1,233,800
DARPA DARPA-14-38-Office-Wide-BAA-FP-014	Platform Technology for Sensory, Motor and Affective Disorders- seed grant	$632,609
NIH 5R01NS085167-05	Vagus Nerve Stimulation Paired with Rehabilitative Training to Enhance Plasticity Role- Co-PI	$1,940,125
DARPA DARPA-14-38-Office-Wide-BAA-FP-014	Platform Technology for Sensory, Motor and Affective Disorders	$707,785
GSK Innovation Challenge for Bioelectronics	Develop a neural interface for peripheral nerves that can be powered via RF	$200,000
TIBIR UTSW	The Predictive Role of White Matter Injury for Motor Function Recovery in a Rat TBI Model	$60,000
Phase I SBIR (NIH/ NIDCD) 1R43DC013467-01A1	Development of a software package for speech therapy *Role: Project Manager*	$209,650
Phase I SBIR (NIH/ NIDCD) 1R43NS084598-01	Development of shape memory polymer-based implantable electrode systems *Role: Project Manager*	$332,278
NINDS-R01 5R01NS062065-04	A Distributed Wireless Neural Interface System *Role: Co-PI*	$1,265,000
NINDS-R01 5R01DC008982-06	Ensemble Coding in Olfactory Cortex *Role: Co-PI*	$1,827,924
NSF-PFI 1114211	Multifunctional Microelectrode Arrays for Neuroscience Research and Technology Development *Role: Co-PI*	$599,783
SBIR-R43 1R43NS084598	Development of Shape Memory Polymer-Based Implantable Electrode Systems *Role: Co-I*	$332,278
U.S. ED-GAANN	Graduate Assistance in Areas of National Need: Promoting Versatility in Doctoral Bioengineering Education. *Role: Advisor to (2) Fellows*	$506,688
NIDCD-R21 1R21DC007112-01A1	Ensemble Coding in Olfactory Cortex *Role: Co-PI*	$407,000
OCAST	Distributed Neural Interface *Role: PI*	$135,000
DOE-SC-23.2 DE-FG02-06ER64245	Carbon Nanotube Technology Center *Role: Co-I*	$960,000

Doctoral Graduates

2. Andrew Sloan, 2008, SPECTROTEMPORAL DYNAMICS OF NEURAL RESPONSES IN AUDITORY CORTEX DURING FREQUENCY DISCRIMINATION
3. Tyler Dodd, 2013, NEURAL CORRELATES OF DETECTION AND DECISION IN AUDITORY CORTEX DURING FREQUENCY DISCRIMINATION
4. Neil Markwardt, 2014, BIOCOMPATIBILITY OF CORTICAL NEURAL INTERFACES
5. David Pruitt, 2016, PAIRING VAGUS NERVE STIMULATION WITH MOTOR TRAINING ENHANCES FUNCTIONAL RECOVERY AFTER TRAUMATIC BRAIN INJURY
6. Eric Meyers, 2017, ENHANCING PLASTICITY USING VAGUS NERVE STIMULATION IMPROVES RECOVERY FOLLOWING NEUROLOGICAL INJURY
7. Daniel Hulsey, 2018, NEUROMODULATORY PATHWAYS REQUIRED FOR TARGETED PLASTICITY THERAPY
8. Katy Millay, 2018, THE REPLAY SYSTEM: A NOVEL APPROACH TO AUTOMATE MEASUREMENT AND TRAINING OF HAND AND WRIST MOTOR FUNCTIONS
9. Sivaji Vishnoukumaar, 2018: WIRELESS DEVICES FOR PERIPHERAL NERVE STIMULATION AND RECORDING

Classroom Teaching **Total # Students: 2097**

2003	Spring	AME 5710	Neurophysiology for Engineers	8 students
2003	Fall	AME2113	Statics	60 students
2003	Fall	AME3112	Solid Mechanics Lab Lecture	163 students
2003	Fall	AME3112	Solid Mechanics Lab	21 students
2004	Spring	AME5710	Biomaterials	15 students
2004	Spring	AME2113	Statics	74 students
2004	Fall	AME3112	Solid Mechanics Lab Lecture	149 students
2004	Fall	AME3112	Solid Mechanics Lab	60 students
2004	Fall	AME 5710	Fundamentals of Bioengineering	25 students
2005	Spring	AME2113	Statics	61 students
2005	Fall	AME 5710	Neurophysiology for Engineers	18 students
2006	Spring	AME2533	Dynamics	80 students
2006	Spring	AME4553	Design Practicum	20 students
2006	Fall	AME5710	Neural Engineering	7 students
2006	Fall	AME4163	Principles of Engineering Design	61 students
2007	Spring	AME2533	Dynamics	58 students
2007	Spring	AME4553	Design Practicum	22 students
2007	Fall	AME4163	Principles of Engineering Design	22 students
2007	Fall	AME5710	Neurophysiology for Engineers	19 students
2008	Spring	AME2533	Dynamics	59 students
2008	Spring	ENGR1112	Introduction to Engineering	43 students
2008	Fall	AME3143	Solid Mechanics	30 students
2009	Spring	ENGR1112	Introduction to Engineering	40 students
2009	Fall	NSC4356	Neurophysiology	27 students
2010	Spring	NSC 3563	Neurophysiology	30 students
2010	Spring	NSC 4356	Neuroscience Lab Methods	15 students
2010	Fall	NSC4353	Neuroscience Laboratory Methods	16 students
2010	Fall	EE2300	Linear Algebra	42 students
2011	Spring	NSC4353	Neuroscience Laboratory Methods	17 students
2011	Spring	NSC4356	Neurophysiology	119 students
2012	Spring	NSC4356	Neurophysiology	149 students
2012	Spring	EEgr5v80	Neurophysiology for Engineers	3 students

2013	Spring	NSC4356	Neurophysiology	138 students
2013	Fall	MECH3310	Thermodynamics	50 students
2014	Spring	BMEN 1208	Intro to Biomedical Engineering	16 students
2014	Spring	BMEN 3330	Engineering Physiology	96 students
2014	Spring	NSC 4356	Neurophysiology	166 students
2014	Fall	ECS 1200	Intro to Engineering and CS	17 students
2015	Fall	BMEN 1100	Intro to Bioengineering I	19 students
2016	Fall	BMEN 1100	Intro to Bioengineering I	19 students
2020	Spring	NSC 4V90.501	Entrepreneurship Neuroscientists	32 students
2020	Fall	NSC 4350.501	Entrepreneurship Neuroscientists	11 students