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Education

1997-2003   Ph.D. in Physics and Biology, Rockefeller University, New York, NY
1992-1996   B.A. in Physics, Princeton University, Princeton, NJ

Professional Experience

2016 -   Associate Professor, Boston University, PI Laboratory of Neural Circuit Formation

2009 - 2015 Assistant Professor, Boston University

2005 – 2008 Postdoctoral Fellow, Massachusetts Institute of Technology
             Advisor: Dr. Michale Fee. Project: In-vivo two-photon imaging of songbird pre-motor cortex

2003-2004   Postdoctoral Fellow, Rockefeller University, New York, NY
             Advisor: Dr. Fernando Nottebohm. Project: Behavioral studies of vocal learning in songbirds

1997-2002   Graduate Student, Rockefeller University, New York, NY
             Advisor: Dr. Marcelo Magnasco.   Project: Mathematics of vocal dynamics & time-frequency
             analysis

1996-1997   Research Technician, NEC Research, Princeton, NJ
             Advisor: Dr. Albert Libchaber. Project: Scanning near-field microscope design

Honors & awards

2014   White House Brain Initiative Kickoff
2014   NIH Brain Initiative award
2014   Google Sci-Foo, Googleplex, Mountain View, CA
2014   Innovation Career Professorship, Boston University.
2013   National Academy of Inventors
2010   Smith Family Award for Excellence in Biomedical Research
2005   BWF Career Award at the Scientific Interface
1996   Allen G. Shenstone prize for experimental physics, Princeton University

Recent media

11/2014 Could Bird Brains Lead to Human Cures?
New technology lets BU researcher eavesdrop on avian brains
http://www.bu.edu/today/2014/could-bird-brains-lead-to-human-cures/

10/2014 BU Brain Researchers among Those Invited to White House
http://www.bu.edu/today/2014/bu-brain-researchers-among-those-invited-to-white-house/

09/2014 Professor Tim Gardner Honored with Career Development Professorship Award
http://www.bu.edu/provost/2014/09/08/2014-2015-career-development-professorship-awardees/

04/2014 http://theconversation.com/now-i-know-how-the-caged-bird-sings-14783

3/2017 http://nanotechweb.org/cws/article/tech/68261

Teaching & mentoring

2014 - present Boston University, 4 Credit Course: CAS BI449, "Neuroscience Design Lab"
2013- 2014 Boston University, 4 Credit Course: CAS BI444, "Neuroethology"
2010- present Boston University, 4 Credit Course: CAS BI502, "Topics the mathematics of biological systems"
2013- present NSF-CELEST summer undergraduate experimental workshop.
2009- present Ph.D. Candidates: Yoonseob Lim, Jeffrey Markowitz, Bill Liberti
2009- present Postdoctoral fellows: Sanne Moorman, Alket Mertiri, Jun Shen, Ben Pearre, Mikio Aoi.
2009- present Undergraduate Research Opportunities mentor
2009- present Summer Undergraduate Research Fellowship mentor
2009- present Work-study research mentor

Manuscripts in review

Peer reviewed publications

An open source, wireless miniature microscope system, William A. Liberti III,   L. Nathan Perkins, Daniel P. Leman, Timothy J. Gardner in press J. Neural Eng. (2016)

Charles A. Lissandrello, Winthrop F. Gillis, Jun Shen, Ben W. Pearre, Flavia Vitale, Matteo Pasquali, Bradley J. Holinski, Daniel J. Chew, Alice E. White and Timothy J. Gardner (2016) A Micro-Scale Printable Nanoclip for electrical Stimulation and Recording in Small Nerves" in press J. Neural Engineering. (2016)

Yoonseob Lim, Ryan Lagoy, Barbara Shinn-Cunningham, Timothy J. Gardner (2016), Transformation of temporal sequences in the zebra finch auditory system eLife 2016;10.7554/eLife.18205

Ben Pearre, L. Nathan Perkins, Jeffrey E. Markowitz, Timothy J. Gardner (2016) "A fast and accurate zebra finch syllable detector." in press PLOS One

Liberti III, William A., Jeffrey E. Markowitz, L. Nathan Perkins, Derek C. Liberti, Daniel P. Leman, Grigori Guitchounts, Tarciso Velho, Darrell N. Kotton, Carlos Lois, and Timothy J. Gardner. (2016) "Unstable neurons underlie a stable learned behavior." Nature Neuroscience.

Cannon, J., Kopell, N., Gardner, T., & Markowitz, J. (2015). Neural Sequence Generation Using Spatiotemporal Patterns of Inhibition. *PLoS Comput Biol*, *11*(11), e1004581.

Oberlin, T Gardner, TJ, Meignen, S (2015) Time-Frequency Ridge Analysis Based on the Reassignment Vector. in press EUSIPCO-2015

Markowitz JE, Liberti WA, Guitchounts G, Velho T, Lois C, Gardner TJ (2015). Mesoscopic Patterns of Neural Activity Support Songbird Cortical Sequences. *DOI: 10.1371/journal.pbio.1002158,* PLOS Biology

Liu, H., Totachawattana, A., Mërtiri, A., Hong, M. K., Gardner, T., Erramilli, S., & Sander, M. Y. (2014, September). Mid-IR photothermal imaging with a compact ultrafast fiber probe laser. In *SPIE Optical Engineering+ Applications* (pp. 919808-919808). International Society for Optics and Photonics.

Mertiri, A., Totachawattana, A., Liu, H., Hong, M. K., Gardner, T., Sander, M. Y., & Erramilli, S. (2014, June). Label Free Mid-IR Photothermal Imaging of Bird Brain With Quantum Cascade Laser. In *CLEO: Applications and Technology* (pp. AF1B-4). Optical Society of America.

Aoi MC, Lepage KQ, Eden UT, Lim Y, Gardner TJ. (2014) An approach to time-frequency analysis with the ridges of the continuous chirplet transform.   DOI 10.1109/TSP.2014.2365756, IEEE Transactions on Signal Processing

Lim Y, Shinn-Cunningham BG, Gardner TJ. (2013) Stable Time-Frequency Contours for Sparse Signal Representation, EUSIPCO-2013

Guitchounts G, Markowitz JE, Liberti WA, Gardner TJ. (2013) A carbon-fiber electrode array for long-term neural recording. Journal of Neural Engineering, 10:046016

Markowitz, JE, Ivie E, Kligler, K, Gardner TJ (2013). Long-range order in canary song. PLoS Comp. Bio. 2013:9(5) : e1003052.

Lim Y , Shinn-Cunningham B, Gardner TJ (2012). Sparse contour representations of sound, Signal Processing Letters, IEEE 19 (10), 684-687

Poole B, Markowitz JE, Gardner TJ (2012), The Song Must Go On: Resilience of the Songbird Vocal Motor Pathway PloS one 7 (6), e38173

Scott BB, Gardner TJ, Ji N, Fee MS, Lois C. (2012) Wandering neuronal migration in the postnatal vertebrate forebrain, The Journal of Neuroscience 32 (4), 1436-1446

Lim Y, Shinn-Cunningham BG, and Gardner TJ (2011). Contour representations of sound, Proceedings of the 2011 IEEE Workshop on Applications of Signal Processing to Audio and Acoustics, New Paltz, NY, 16-19 October.

Ölveczky BP, Gardner TJ (2011). A bird's eye view of neural circuit formation. Current Opinion in Neurobiology. 21(1):124–131.

Gardner TJ, Magnasco MO (2006). Sparse time-frequency representations. Proceedings of the National Academy of Sciences of the United States of America. 103(16):6094–6099.

Gardner TJ, Naef F, Nottebohm F. (2005). Freedom and rules: the acquisition and reprogramming of a bird's learned song. Science. 2005; 308(5724):1046.

Gardner TJ, Magnasco MO. (2005) Instantaneous frequency decomposition: an application to spectrally sparse sounds with fast frequency modulations. Journal of the Acoustic Society of America. 117(5):2896–2903.

Liu W-C, Gardner TJ, Nottebohm F. (2004) Juvenile zebra finches can use multiple strategies to learn the same song. Proceedings of the National Academy of Sciences of the United States of America 101(52):18177–18182.

Ribeiro S, Mello CV, Velho T, Gardner TJ, Jarvis ED, Pavlides C. (2002) Induction of hippocampal long-term potentiation during waking leads to increased extrahippocampal zif-268 expression during ensuing rapid-eye-movement sleep. Journal of Neuroscience. 22(24):10914–10923.

Mindlin GB, Gardner TJ, Goller F, Suthers R. (2003) Experimental support for a model of birdsong production. Phys Rev E Stat Nonlin Soft Matter Phys. 68(4 Pt 1):041908.

 Laje R, Gardner T, Mindlin G. (2002) Neuromuscular control of vocalizations in birdsong: A model. Phys. Rev. E. 65:051921.

Laje R, Gardner T, Mindlin GB (2001). Continuous model for vocal fold oscillations to study the effect of feedback. Phys Rev E Stat Nonlin Soft Matter Phys. 64(5 Pt 2):056201.

Gardner T, Cecchi G, Magnasco M, Laje R, Mindlin GB. (2001) Simple motor gestures for birdsongs. Physical Review Letters. 87(20):208101.

Patents

Splayable microfiber electrode arrays, U.S. Patent Application No. 61/843,124. July , 2014

Nano-clip Neural Interfaces, US & European provisional patent Aug 2016.

Active Grants

Gardner (PI)   09/01/2016 – 08/31/2018
NIH 1R21EY027588-01   (T. Gardner PI)

High-density microfiber interfaces for deep brain optical recording and stimulation
This project develops a minimally-invasive, high-density microfiber array for optical recording and stimulation of biological tissues. In particular it targets deep brain areas inaccessible through existing microscopy methods. The array is composed of hundreds to thousands of individually addressable flexible optical waveguides with a diameter of 7 μm.

NIH 1R24NS098536-01 (T.Gardner PI)   06/01/2016 – 05/31/2020
A platform for innovation in miniature microscopy

This project develops and disseminates an open-source miniature fluorescence microscope for chronic monitoring of biological signals in freely moving animals. New features realized in our miniature microscope include: a 3D-printed housing for easy reconfiguration and light weight (<1.7 grams), wireless telemetry options, and color CMOS sensors for simultaneous recording of multiple fluorescent indicators.

R21 - RNS087531-01 (C. Lois, PI)   09/15/2015 - 08/31/2017
 Agency: NIH (NINDS)   Role Co-Investigator
A transgenic songbird to image brain premotor sequence

Goal: A collaboration to create and image a transgenic zebra finch expressing the calcium sensitive protein Gcamp6.

Biolelectric research network (T. Gardner, PI)   10/01/2014-12/31/2016
Agency: Glaxo Smith Kline (Glaxo Smith Kline)

Goal: To develop a high density electrode array for chronic recording and stimulation of small peripheral nerves.

1U01NS090454-01   (T. Gardner, PI)   10/01/14 –09/30/17
Agency: NIH (Brain Initiative)
High-Density Recording and Stimulating Micro-electrodes

Goal: This project seeks to develop next generation self-splaying carbon fiber electrode arrays for recording and stimulation. The proposed work includes development of advanced manufacturing methods for high channel count arrays, and in-vivo tests of chronic stimulation using charge-steering paradigms.

R01 - NS089679-01 (T. Gardner, PI)   12/01/2014 – 11/30/2019
Agency: NIH (NINDS)
Single neuron mechanisms of sensory-motor learning

Goal: This project examines the cell-type specific rules of sensory-motor learning through the use of a brain-machine interface paradigm developed for songbirds. Employs both electrical and optical recording methods.

Completed Grants

R21 - RNS087531-01 (T. Gardner, PI)   04/01/2014 - 03/31/2016
 Agency: NIH (NINDS)

Tunneling microfiber electrode arrays for stable neural recording
Goal: This grant supports two-photon imaging of carbon fiber electrode arrays in the brain to examine how these electrodes interact with vasculature.

SMA-0835976 (B. Shinn-Cunningham, PI)   2004-2015
Agency: NSF. Role: Sr. Key Person
CELEST: Center of excellence for learning in education, science, and technology.
Goal: By synthesizing systems-level neuroscience and computational modeling, CELEST aims
to understand brain mechanisms responsible for learning in real-world situations and to translate
this knowledge into intelligent technologies. Tim Gardner serves on the board of directors for
this center grant.

Smith Family Award for Excellence in Biomedical Research (T. Gardner, PI)
The role of sleep in neural circuit formation.   2/1/2010 – 2/1/2013

BWF 1005049 (T. Gardner, PI)   01/01/09-12/31/2014
Agency: Burroughs Wellcome Fund Career award at the scientific interface

Professional service and affiliations

Center affiliations

Boston University Photonics Center

Boston University Center for Systems Neuroscience

Boston University Neurophotonics Center.

Boston University Leadership

2015 - 2016   Provost's task force on collaboration with industry

2015 - present   Executive board, Center for System Neuroscience

2016 - present   Executive board, Center for Neuro-Photonics

2011 - 2015   Executive board, NSF Science of Learning Center (CELEST):

2013 - 2014   Steering Committee, Graduate Program in Neuroscience Boston University

2010-2015 CAS/BIO Junior neuroscience Faculty Search Committee.

2011-2012 CAS/BIO Senior neuroscience Faculty Search committee.

2009-2010 CAS/BIO Cell and Molecular Systems Biology Faculty Search Committee

National and international conferences co-organized

2015 NeuroHAM, A three day conference on neural processing in humans, animals, and machine. June 10-12
      Boston University

2012 Temporal Dynamics in Learning   May 13-16, 2013 HHMI, Janelia Farm

Peer Review

Grants: NIH SMI study section, NSF.

Journals: PNAS, PLOS Biology, PLOS computational biology, Science, Nature, Neuron, Nature Neuroscience,
      Physical review letters, Journal of the acoustic society of America, Frontiers in Neuroscience, Neural
      Networks, Journal of Neurophysiology, J. Neuroscience

Invited talks

02/2017   Neuralink Inc. San Francisco, CA
02/2017   UCSF San Francisco, CA

02/2017	ISAT "Neural Processing, Encoding and Generalization (NPEG)" Workshop Seattle, WA
11/2016	Glaxo Smith Kline Bioelectronics Research Consortium, Investigator's meeting
10/2016	Italian Institute of Technology. Genoa, IT.
09/2016	Institute for Neuroinformatics, University of Zurich.
09/2016	University of Washington, Institute for Neural Engineering
09/2016	Case Western Reserve, Cleveland, OH.
09/2016	University Of Washington, Seattle, WA.
07/2016	Living Materials, Talloires France
02/2016	NSF Science of Learning Center, Symposium, Washington, DC
02/2016	DARPA proposers day, NESD program, Washington, DC
01/2016	University of Utah, Salt Lake City, UT
12/2015	International Symposium on Neural Regeneration, Monterrey, CA
12/2015	NIH Brain Investigator's meeting, Bethesda, MD
11/2015	Rice University, Houston, TX
08/2015	Brandeis University, Braindeis, MA
08/2015	University of Oregon, Eugene, OR
07/2015	Living Materials, Talloires France
06/2015	DARPA "The Future of Neural Interface Technologies Workshop" New York, NY
05/2015	Glaxo Smith Kline Innovation Challenge Partnering Meeting, Los Angeles, CA
04/2015	Bioelectrics symposium, IEEE Neural Engineering Conference, Montpelier, France.
01/2015	MURI winter school. Dynamics of Multifunction Brain Networks, UCSD
12/2015	Glaxo Smith Kline Bioelectronics consortium meeting, Durham, NC
11/2014	NIH Brain Initiative Kickoff meeting, Bethesda, MD
10/2014	NSF workshop on Organismal Sensing. Arlington, VA
10/2014	Brain Initiative press event, The White House
08/2014	Google Sci-Foo, Googleplex, Mountain View, CA
07/2014	National Institute of Science and Technology, Gaithersburg, MD
07/2014	Glaxo Smith Kline Bioelectronics consortium meeting, Dallas Texas
02/2014	COSYNE Meeting. Salt Lake City, Utah.
12/2013	Harvard Center for Brain Science, Boston, MA
09/2013	European Signal Processing Society, Marrakech, Morocco.
05/2013	Temporal sequences and neural ensembles in songbirds, HHMI, Janelia Farms
11/2012	Harvard University Center for Brain Science, Boston, MA
09/2012	Sensory Coding the Natural Environment, Klosterneuburg, Austria
02/2012	Harvard medical school, Eaton Peabody Labs, Boston, MA
10/2011	Rockefeller University center for physics and biology seminar, New York, NY
08/2011	Oxford University, Auditory neuroscience group. Oxford, UK
07/2011	Aspen Center for Physics Workshop talk. Aspen, CO
06/2011	HHMI Janelia Farm Systems Neuroscience Seminar.
08/2010	Rockefeller University Center for Physics and Biology Seminar. New York, NY
01/2010	Breaking Barriers Conference, Bangalore, India