

Harvard Medical School Curriculum Vitae

Date Prepared: August 7, 2017
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Place of Birth: Kharkov, Ukraine

Education

1995	B.S.	Mechanical Engineering	Cornell University
1998	M.S.	Mechanical Engineering	Massachusetts Institute of Technology
2001	Ph.D.	Medical Engineering (Richard J Gilbert)	Massachusetts Institute of Technology
2002	M.Acup.	Acupuncture	New England School of Acupuncture

Postdoctoral Training

2001 - 2003	Post-Doctoral Research Fellow	Radiology (Kathleen K.S. Hui)	Martinos Center for Biomedical Imaging, MGH
2002	Visiting Acupuncturist	Acupuncture	Beijing Hospital of Traditional Chinese Medicine, P.R.C.

Faculty Academic Appointments

2004 - 2007	Instructor	Radiology	Harvard Medical School
2007 - 2013	Assistant Professor	Radiology	Harvard Medical School
2010 -	Assistant Professor	Anesthesiology	Harvard Medical School
2014 -	Associate Professor	Radiology	Harvard Medical School

Appointments at Hospitals/Affiliated Institutions

2001 - 2003	Research Fellow	Radiology	Massachusetts General Hospital
2004 -	Assistant in Neuroscience	Radiology	Massachusetts General Hospital
2005 -	Adjunct Faculty	Radiology	Logan University, Chesterfield, MO
2006 -	Acupuncturist	Pain Management Center, Anesthesiology	Brigham and Women's Hospital

Other Professional Positions

Major Administrative Leadership Positions

Local

2005 -	Scientific Coordinator	NCCAM CERC program project grant "Neuroimaging Acupuncture Effects on Human Brain Activity," PI: Bruce Rosen
2015 -	Director	Center for Integrative Pain NeuroImaging (CiPNI, https://scholar.harvard.edu/cipni/home)

Regional

National and International

2005	Co-chair	Neural Correlates of Acupuncture Action Conference, National Center for Complementary and Alternative Medicine, NIH, Bethesda, MD.
2015, 2017	Co-chair	Program Committee, Society for Acupuncture Research annual conference

Committee Service

Local

2000 - 2001	Admissions Committee	Harvard-MIT Division of Health Sciences and Technology Interviewing Member
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Regional

National and International

2016 -	External Advisory Committee	National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) Multi-Disciplinary Approach to the Study of Chronic Pelvic Pain (MAPP) Research Network
2017 -	Scientific Advisory Board	University of Michigan Center of Research Translation (CORT) program project grant for chronic musculoskeletal pain (NIAMS, P60AR070600)

Professional Societies

1998 - 2002	International Society of Magnetic Resonance in Medicine	member
2002 -	Organization for Human Brain Mapping	member
2003 - 2006	American Association of Oriental Medicine	member
2004 -	Society for Neuroscience	member
2004 -	Society for Acupuncture Research	Board of Directors
2008 - 2011	Society for Acupuncture Research	Treasurer
2009 - 2012	Society for Acupuncture Research	Chair of Scientific Review Committee, International Conference
2011 -	Society for Acupuncture Research	Co-President
2008 -	International Association for the Study of Pain	member
2010	Consortium of Academic Health Centers for Integrative Medicine	Program Committee, International Research Congress on Integrative Medicine and Health
2010 -	Society for Acupuncture Research	Program Committee, International Conference
2012 -	American Pain Society	member
2015	International Society for Complementary Medicine Research	Program Committee, International Congress on Complementary Medicine Research

Grant Review Activities

2006, 2009	Grant Review Committee	Physicians' Services Incorporated Foundation, Toronto, Ontario, Canada Ad hoc Reviewer
2007	Grant Review Committee	National Health and Medical Research Council of Australia Ad hoc Reviewer

2011	MOSS-K SBIR/STTR Study Section	NIH Ad hoc Member
2014	Peer Reviewed Medical Research Program (PMRP) of the Department Of Defense	DoD Ad hoc Member
2015	Special Emphasis Panel, ZCA1 RPRB-J M2 S	NCI, NIH Ad hoc Member
2015	MAPP Network EEP/Review Panel	NIDDK, NIH Invited Reviewer
2016	Special Emphasis Panel, ZRG1 BBBP-X (02) M	Motor Function, Speech and Rehabilitation (MFSR) committee, NIH Invited Reviewer

Editorial Activities

Arthritis & Rheumatism
 BioMed Central: Complementary and Alternative Medicine
 Brain
 Bulletin of the Museum of Comparative Zoology, Harvard University
 Clinical Journal of Pain
 Clinical Science
 Complementary Therapies in Medicine
 European Journal of Neurology
 Journal of Alternative and Complementary Medicine
 Journal of Pain
 Journal of Theoretical Biology
 MAGMA, Magnetic Resonance Materials in Physics, Biology and Medicine
 NeuroImage
 Neuroscience Letters
 Pain
 Pain Medicine
 Proceedings of the National Academy of Sciences

Other Editorial Roles

2009 -	Editorial Board	Journal of Alternative and Complementary Medicine
2010 -	Editorial Board	Evidence-based Complementary and Alternative Medicine
2011 -	Section Co-Editor	Pain Medicine

Honors and Prizes

1996-2001	Graduate Fellowship	Whitaker Foundation for Biomedical Engineering
2000	Finalist	Schnitzer Prize for the Visual Arts

Report of Funded and Unfunded Projects

Funding Information

Past

2003-2011

Neuroimaging Acupuncture Effects on Human Brain Activity

NCCAM: P01-AT002048

Project PI on a program project grant (PI: Rosen) (\$2,395,610)

The central goal of this application is to investigate the neurobiology of acupuncture. All three projects will investigate the possible brain pathways and circuitries involved in acupuncture.

2004-2009

Exploring Neurocircuitry of Acupuncture Action with fMRI

NCCAM: K01-AT002166

PI (\$608,750)

The goals of this study are to understand the neurobiology involved with the full duration acupuncture treatment, thereby promoting the development of this ancient healing technique into evidence-based medicine.

2006-2009

FMRI of Autonomic Regulation with Acupuncture

NCCAM: F05-AT003770

Co-investigator (PI: Rosen) (\$193,908)

The goals of this study are to decipher the brain correlates for acupuncture modulation of the autonomic nervous system using multi-modal techniques combining functional MRI with physiological monitoring.

2009-2011

Brain Plasticity in Carpal Tunnel Syndrome and its Response to Acupuncture

NCCAM: R01-AT004714 (Competitive Revision under ARRA)

PI (\$604,160)

We propose that a biobehavioral assessment of cortical disinhibition quantified by maladaptive change in adaptation metrics will be sensitive to brain abnormalities in CTS.

In this study, we will combine biobehavioral testing with fMRI neuroimaging to better delineate the central mechanisms by which acupuncture ameliorates CTS pathology.

- 2009-2011 Core Center for Multimodal Evaluation of Acupuncture Mechanisms
NCCAM: P30-AT005895
Co-investigator (PI: Rosen) (\$1,150,000)
This Center will develop multi-modal technologies including fMRI and ultrasound to evaluate mechanisms associated with acupuncture effects, and provide support for new faculty focused on enacting these methods.
- 2012-2013 SAR 2013: Impact of Acupuncture Research on 21st Century Health Care
NCCAM: R13-AT007742
PI (multi-PI: Napadow/Harris) (\$25,000)
This conference support grant will provide financial support for the 2013 Society for Acupuncture Research international conference in Ann Arbor, MI. This conference was attended by almost 300 participants from 19 different countries.
- 2008-2014 Brain Plasticity in Carpal Tunnel Syndrome and its Response to Acupuncture

NCCAM: R01-AT004714

PI (\$4,014,928)

This study will characterize brain plasticity in Carpal Tunnel Syndrome and will determine how this central fMRI biomarker is modulated by acupuncture. This study will also investigate the behavioral consequences of maladaptive cortical plasticity in this disease population.
- 2007-2014 Neuroenteric Research Program

International Foundation of Functional GI Disorders

Consultant (PI: Kuo) (\$450,000)
This project is aimed at providing resources towards the clinical care and clinical and translational research of neuroenteric disorders such as nausea, cyclic vomiting syndrome and GI motility, as well as chronic pain disorders.
- 2012-2014 Brain Mechanisms for Autonomic Outflow and Nausea in Cyclic Vomiting Syndrome
NIDDK / NIH: R21-DK097499
PI (multi-PI: Napadow/Kuo) (\$478,625)
This study will evaluate altered brain processing in patients with cyclic vomiting syndrome, and investigate how this brain circuitry contributes to abnormal autonomic

physiology and symptomatology.

- 2010-2015 An fMRI study of expectancy on acupuncture treatment outcomes in knee OA
NCCAM / NIH: R01-AT005280
Co-Investigator (PI: Gollub/Kaptchuk) (\$2,152,080)
The goal of this study is to elucidate the functional neurocircuitry associated with endogenous inhibition of pain perception in patients with chronic knee pain.
- 2014-2015 Desarrollo de un estimulador electrico transcutaneo del nervio vago regulado por movimientos respiratorios [Respiratory-gated Auricular Vagal Afferent Nerve Stimulation (RAVANS)]
ColCienias (Colombian National Science Foundation)
Co-Investigator (PI: Garcia)
This grant will aid in the development and miniaturization of the RAVANS device, invented and patented at MGH.
- 2014-2016 Vagus Nerve Stimulation: Intervention for Mood and Cardiac Modulation
NIMH / NIH: R21-MH103468
PI (multi-PI: Napadow/Goldstein) (\$275,000)
This project will evaluate biosignatures for mood changes following transcutaneous vagus nerve stimulation in major depressive disorder patients. Neuroimaging outcomes will be used to understand autonomic control circuitry and how these physiological responses relate to changes in mood.
- 2014-2016 The Role of Neuroimmune Activation in Chronic Pain and Negative Affect
NINDS / NIH: R21-NS087472
Co-Investigator (PI: Loggia) (\$275,000)
Animal studies suggest that both exposure to stressful conditions, as well as persistent pain, lead to the activation of brain microglia –the principal innate immune cells of the central nervous system. As chronic pain patients exhibit high prevalence of mood disorders, we will use integrated MR-PET imaging to investigate whether brain microglia are also involved in pain and negative affect, as well as alterations in brain physiology, in chronic low back pain patients.

Current

- 2011-2016 Neuroimaging Acupuncture Effects on Brain Activity in Chronic Low Back Pain
NCCAM / NIH: P01-AT006663
Project PI on a program project (PI: Rosen) (\$6,333,600)
This program project grant will investigate the different neurophysiological mechanisms underlying the clinical response for different acupuncture interventions in chronic low back pain patients.
- 2012-2017 Martinos Center / KIOM Research Program
Korean Institute for Oriental Medicine
PI (\$201,250)
This agreement with KIOM supports a broader scope for our on-going NIH-funded

program project grant (P01-AT006663) and sets up continuing collaboration between our Center and the Korean Institute for Oriental Medicine.

- 2013-2018 Neuroimaging Approaches to Deconstructing Acupuncture for Chronic Pain
NCCAM / NIH: R01-AT007550
PI (multi-PI: Napadow/Harris) (\$3,370,545)
This study will evaluate novel brain biomarker response, including resting state connectivity and magnetic resonance spectroscopic assessed glutamate and GABA, to acupuncture versus non-somatosensory sham acupuncture in fibromyalgia.
- 2014-2019 Brain mechanisms underlying CBT-related reductions in fibromyalgia
NIAMS / NIH: R01-AR064367
PI (multi-PI: Napadow/Edwards) (\$3,844,035)
We hypothesize that CBT in this study will reduce catastrophizing early in treatment, resulting in adaptive changes in the brain's responses to an externally applied noxious stimulus.
- 2014-2017 An In-Vivo Investigation of Brain Inflammation in Gulf War Illness with Integrated PET/MR Imaging
DoD: GW130100
Co-Investigator (PI: Loggia) (\$200,000)
The goal of this project is to demonstrate in vivo the pathological occurrence of microglial activation in the brain of GWI patients, and to document the effects of this activation on GWI symptomatology and brain anatomophysiology, using novel imaging approaches.
- 2016-2018 Mapping the linkage between auricular vagus nerve receptors and cardiovagal modulation
NIH Office of Director: OT2-TR001978
PI (\$1,367,236)
Vagus nerve stimulation may be an important neuromodulatory approach to impact heart function, and cutaneous vagal receptors can be targeted as a non-invasive approach to vagus nerve stimulation. Our proposal will apply non-invasive ultrahigh field MRI in humans, and cervical vagus nerve activity recording in rats to map the neurophysiological pathway from the auricular branch of the vagus nerve to the heart.
- 2016-2021 New England Gastroparesis Consortium: Neurobiology of Gastroparesis
NIDDK / NIH: U01-DK112193
Co-I (PI: Kuo) (\$1,274,670)
This Center will develop and apply imaging approaches to better understand the brain circuitry changes in gastroparesis and how this circuitry can be targeted to make meaningful quality of life improvements for gastroparesis patients.
- 2016-2018 Optimization of brain-based mechanism supporting psychosocial aspects of acupuncture therapy – a hyperscanning fMRI study
NCCIH / NIH: R61-AT009306
PI (\$958,588)
The patient-clinician interaction is central to mind-body therapies, and key mechanisms of action likely include brain circuitries supporting social mirroring networks underlying clinician empathy and therapeutic alliance. We will use hyperscanning functional MRI to

link patient/acupuncturist brain activity concordance in social mirror neuron regions during treatment, and relate this concordance with ratings of therapeutic alliance and analgesia. Our proposal will define an augmented acupuncture interaction style based on brain concordance to optimize healthcare outcomes for acupuncture and other medical therapies.

- 2016-2021 In-vivo imaging of spinal and brain glial activation in low back pain patients
NINDS / NIH: R01NS095937
Co-I (PI: Loggia)(\$2,060,000)
In this project, we will use PET/MR imaging to image brain and spinal glial activation in patients with subacute and chronic low back pain, and the effects of its pharmacological modulation. The identification of a role for glia in the development and/or maintenance of persistent pain will have important practical implications for the management of pain, and the development of tailored preventive interventions focused on glial modulation.
- 2016-2021 The role of brain glial activation in human knee osteoarthritis
NIAMS / NIH: R01-NS094306
Co-I (PI: Loggia)(\$2,057,895)
In this project, we will use PET/MR imaging to test the hypothesis that low brain levels of the translocator protein (TSPO), which is upregulated in activated glial cells, predict higher likelihood of developing post-TKA pain.
- 2016-2018 An Exploratory Randomized, 2-Part, Single-blind, 2-Period Crossover Study Comparing the Effect of Albiglutide with Exenatide on Regional Brain Activity Related to Nausea in Healthy Volunteers
Glaxo Smith Kline study 201840
Co-I (PI: Rosen)(\$910,000)
The study is designed to evaluate if albiglutide and exenatide modulate nausea-related brain activity and connectivity as assessed by MRI.

Report of Local Teaching and Training

Teaching of Students in Courses

2006, 2008	HST-583: Functional Magnetic Resonance Imaging: Data Acquisition and Analysis Graduate and undergraduate students	Massachusetts Institute of Technology 1 1-hour lecture and discussion
2006	22.013 MIT: Freshman Seminar: Careers in Biomedical Engineering undergraduate students	Massachusetts Institute of Technology 1 2-hour lecture and discussion
2008 - 2010	Evidence-based Complementary and Alternative Medicine Medical school students	Tufts Medical School 1 1-hour lecture and discussion
2017	Medical Acupuncture elective Medical and Health Professional school	Tufts Medical School 1 1-hour lecture and discussion

students

Laboratory and Other Research Supervisory and Training Responsibilities

2005-present	Supervision of post-doctorate research fellow(s)	Daily mentorship
2006-present	Supervision of research assistant(s)	Daily mentorship
2008-2012	MIT Traditional Medicine Society advisory board	Undergraduate student mentorship

Formally Supervised Trainees

2005-2007	Rupali Dhond, PhD / Instructor, Harvard Medical School Mentored Polly as post-doc and senior-authored her several first-author manuscripts in top peer-reviewed journals including Pain and JACM, as well as mentored her successful K01 training grant submission to NCCAM, NIH.
2006-2009	Kyungmo Park, PhD / Associate Professor, Dept. Biomedical Engineering, Kyunghee University, Korea Mentored Kyungmo when he was a visiting research fellow at MGH, co-authored several manuscripts with him in leading peer-reviewed journals such as Neuroimage.
2006-2007	Calvin Yeh, MS / Industry Supervised Calvin as a research assistant. Calvin was co-author on a manuscript with our Lab published in Pain.
2007-2010	Lauren LaCount, BS / Research Assistant at MGH Supervised Lauren as a research assistant. Senior authored several manuscripts with Lauren as both first-author and/or co-author.
2010-2011	Ang Li, BS / Research Assistant at MGH Supervised Ang as research assistant, who is a co-author on several manuscripts, in preparation.
2007-2015	Jieun Kim, PhD / Post-Doctoral Research Fellow at MGH Supervised Jieun as a visiting doctoral student, served on her PhD thesis committee, and am now supervising Jieun as a post-doc in my lab, where she has co-authored several important publications.
2007-2015	Steve Cina, LicAc / Research Assistant at MGH As a research assistant in my lab, Steve has first-authored an abstract and is working on a manuscript detailing his research.
2008-2011; 2015-	Jeungchan Lee, MS / Doctoral Student at Kyunghee University, Korea; Post-doc Fellow As doctoral student advisee, Jeungchan co-authored several abstracts and manuscripts. He then returned as a post-doctoral fellow, and has been instrumental in the Lab on several projects, resulting in numerous first author publications.

- 2008-2015 Yumi Maeda, DDS PhD / Post-Doctoral Research Fellow at MGH
Supervised Yumi as a post-doc in my lab. Yumi has been lead author on multiple manuscripts in high impact journals, including Brain, and I appear as senior author.
- 2009-2013 Marco Loggia, PhD / Instructor at Dept. Radiology, MGH
Supervised Marco on projects related to deep receptor pain processing in healthy adults and patients suffering from fibromyalgia. Marco has published several manuscripts in high impact journals such as Pain and Arthritis & Rheumatism stemming from this research, and I appear as senior author.
- 2009 - Gaelle Desbordes, Ph. D. / Post-Doctoral Research Fellow at Boston University
Supervised Gaelle in the combined collection of autonomic and fMRI data in a study evaluating the neural mechanisms of meditation. Several manuscripts are in preparation.
- 2010-2012 Florian Pfab MD PhD / visiting associate professor
Supervised Florian on a DFG-funded research project aimed at evaluating brain mechanisms underlying acupuncture relief of itch in atopic dermatitis patients. Several manuscripts have been published with several more in preparation.
- 2011-2012 Jaehyun Im, BS / Research Assistant at MGH
Supervised Jay as an RA. Jay was a co-author on several manuscripts.
- 2011-2012 Wei-Ta Chen, MD / visiting fellow
Co-Supervised Wei-Ta on a project evaluating MEG response to somatosensory stimulation in migraine patients treated by acupuncture and resting brain connectivity using fMRI data.
- 2012-2013 Sabina Lim, PhD / visiting professor
Mentored Sabina, providing training and expertise in fMRI project design and fostering inter-institutional communication between Kyunghee University in Korea and HMS.
- 2012- Jessica Gerber, MS / research coordinator
Jessica has been a research coordinator and acupuncturist on our studies for many years. She has matured into a lab manager and organizational role, coordinating the fellows and RA's in our lab on multiple projects. She has assisted in multiple aspects of study design and has co-authored publications from several projects.
- 2013-2014 Florian Beissner, PhD / visiting fellow
Mentored Florian on projects related to autonomic neuroimaging and brainstem response to pain and acupuncture. Publications include autonomic neuroimaging meta-analyses for central autonomic networks, published in Journal of Neuroscience.
- 2012-2014 Alexandra Libby, BS / Research Assistant
Supervised Alex as an RA. Alex will first author at least one publication on dynamic brain connectivity analyses of nausea perception
- 2013-2015 Hyungjun Kim, PhD / visiting fellow
Mentored Hyungjun, who is a visiting fellow from the Korean Institute of Oriental

Medicine. Publications from several projects resulted from his stay.

- 2013 - Roberta Sclocco, PhD / visiting fellow, post-doctoral research fellow
Mentored Roberta during her visiting fellowship as graduate student and post-doc. She has co-authored and primary authored numerous publications under my supervision.
- 2014 - 2017 Ishtiaq Mawla, BA / Research Assistant
Supervised Ishtiaq, who played a role on studies involving neuroimaging effects of acupuncture on low back pain and itch. Ishtiaq has been a co-author on publications and has prepared abstracts for presentation at international conferences.
- 2014 - 2017 Ekaterina Protsenko, BA / Research Assistant
Supervised Katerina on projects involving brain correlates of cognitive behavioral therapy and spinal manipulative therapy.
- 2014- Ronald Garcia, MD PhD / Post-doctoral Research Fellow
Ronald joined the lab to work on research aimed at using neuroimaging to evaluate the central autonomic network. His focus has expanded to also include neuromodulatory approaches stemming from autonomic stimulation. He has been primary author on several publications, has received grant support from the national science foundation of Colombia and aims to develop an independent career with both clinical responsibilities and research focus.
- 2015- Dan-Mikael Ellingsen PhD / post-doctoral research fellow
I have supervised Dan-Mikael, who is supported by a EU training grant from Norway. He has been instrumental in setting up our hyperscan fMRI study to evaluate brain circuitries for clinician/patient interactions. He has published several manuscripts with my mentorship.
- 2016 - Changjin Jung, MS / visiting fellow
Changjin is a visiting lab member from KIOM in Korea, and has been instrumental in setting up a technologically complex hyperscanning fMRI study.
- 2016 - Jacqueline Lutz, PhD / post-doctoral research fellow
As a post-doc shared between Cambridge Health Alliance and MGH, Jacqueline has been setting up an running a meditation neuroimaging study, bridging our two institutions.
- 2016- Catherine Hubbard, PhD / post-doctoral research fellow
Catherine is a senior post-doctoral fellow with expertise in both human and animal research. She is focused on project involving rat vagus nerve electrophysiology and neuroimaging applications with humans suffering from functional dyspepsia and nausea.
- 2016- Kylie Isenburg, BA / Research Assistant
Supervised Kylie on projects involving nausea processing in the brain and neural correlates of clinician / patient interactions
- 2017 - Michael Berry, BS / Research Assistant
Supervised Michael on projects involving imaging of mechanisms supporting cognitive

behavioral therapy for fibromyalgia

2017 - Harrison Fisher, BS / Research Assistant
Supervised Harris on projects involving imaging of brainstem response to auricular vagus nerve stimulation

Formal Teaching of Peers (e.g., CME and other continuing education courses)

2005 - Neuroimaging applications to acupuncture Single presentation per year
HMS AP101 - Structural Acupuncture for Physicians Boston, MA

2008-2010 Resting State Brain Connectivity with fMRI – State or Trait? Single presentation per year
Advanced Neuroimaging Techniques, Continuing Boston, MA
Education Department, Harvard Medical School

Local Invited Presentations

2004 Employing functional MRI for the study of acupuncture: Experiment design and the neurocorrelates of acupuncture deqi sensation / Invited Lecture
Osher Institute, Harvard Medical School

2006, 2009 The Role of Acupuncture in Chronic Pain Management / Invited Lecture
Pain Management Center, Brigham and Women’s Hospital, Harvard Medical School

2006 Sham and Placebo Acupuncture in Clinical Trials: The Neuroimaging Evidence / Invited Lecture
Harvard Medical School

2006 Evidence of Somatosensory Cortical Plasticity in Carpal Tunnel Syndrome Treated with Acupuncture - an fMRI Assessment / Invited Lecture
Martinos Center for Biomedical Imaging, Dept. Radiology, MGH

2007 Acupuncture Modulation of Resting State Networks / Invited Lecture
Martinos Center for Biomedical Imaging, Dept. Radiology, MGH

2011 How does Acupuncture work? Brain activity underlying acupuncture efficacy / Invited Lecture
Massachusetts General Hospital CSSA

2012 Neuroimaging markers for chronic pain disorders - objective outcomes for evaluating acupuncture therapy / Invited Lecture
Brainmap Lecture, Martinos Center for Biomedical Imaging, MGH

2012 Acupuncture for the Treatment of Chronic Pain: Integrating Clinical and Neuroimaging Research / Invited Lecture
Osher Center for Integrative Medicine at Harvard Medical School and Brigham and Women's Hospital

- 2013 Neuroimaging evaluation of acupuncture mechanisms - from carpal tunnel syndrome to fibromyalgia / Invited Lecture
The Fellowship in Integrative Medicine at Beth Israel Deaconess Medical Center, Boston MA
- 2013 Neuroimaging Approaches to Acupuncture Research: from localized to widespread pain syndromes / Invited Lecture
Tufts University School of Medicine, Boston, MA
- 2013 Investigating the autonomic brain and pain / autonomic interactions with neuroimaging / Invited Lecture
Children's Hospital, Waltham, MA
- 2013 Neuroimaging for non-invasive assessment of brain circuitry supporting nausea in humans / Invited Lecture
Man Vehicle Laboratory Seminar, Massachusetts Institute of Technology, Cambridge, MA
- 2014 Sex-differences in brain circuitry supporting nociception, pain, and pain empathy: the neuroimaging evidence / Invited Lecture
Conference on pain in women, Connors-Bri Center for Research on Women's Health and Gender Biology, Brigham and Women's Hospital, Boston, MA
- 2014 Overview of Integrative Medicine Programs / Osher Inaugural Integrative Medicine Research Forum / Session Chair
Joseph B. Martin Conference Center, Harvard Medical School, Boston, MA
- 2015 Integrated Care: Exploring Diverse Approaches to Health / Tufts University Chapter of Minority Association for Pre-Health Students (MAPS) / Invited Panelist
Tufts University, Medford, MA
- 2016 What is acupuncture? From research to clinical practice / Course CPSYC-1451-BH01, Bunker Hill Community College / Invited Speaker
Charlestown, MA
- 2017 Neuroimaging applied to assess objective outcomes for acupuncture in carpal tunnel syndrome / Invited Grand Rounds Lecture
Osher Center for Integrative Medicine at Harvard Medical School and Brigham and Women's Hospital, Boston, MA
- 2017 Brain Imaging at the MGH Martinos Center / Invited Lecture
Lunch and Learn series, Partners Healthcare Research Management, Somerville MA

Report of Regional, National and International Invited Teaching and Presentations

[Invited Presentations and Courses](#)

Regional

Those presentations below sponsored by outside entities are so noted and the sponsor(s) is (are) identified

- 2004 What can functional MRI tell us about acupuncture and the “Sea of Marrow” that we don’t already know? / Invited Lecture
New England School of Acupuncture, Newton, MA
- 2004 The Modulatory Effects of Acupuncture on the Brain as Imaged by fMRI / Invited Lecture
Tufts School of Medicine, Boston, MA
- 2005 Pain Relief and Acupuncture Research: from Endorphins to fMRI / Invited Lecture at
Biomatrix Evening Colloquium
Massachusetts Institute of Technology, Cambridge, MA
- 2006 Neuroplasticity in Carpal Tunnel Syndrome Treated by Acupuncture: An fMRI
Evaluation / Invited Lecture
Dept. PM&R, Tufts-New England Med Center, Boston, MA
- 2007 Neuroimaging the Effects of Acupuncture for Carpal Tunnel Syndrome / Grand Rounds
Massachusetts Institute of Technology Medical Clinic, Cambridge, MA
- 2007 Acupuncture in Pain Management: From Philosophy to Brain Imaging / Pain Management
Deep Learning Summit: Future of Pain Prevention and Treatment
Massachusetts Institute of Technology Faculty Club, Cambridge, MA (Johnson and
Johnson)
- 2010 An Overview of Acupuncture Research: from clinical trials to neuroimaging
Intercollegiate Taiwanese American Students Association (ITASA) Annual Meeting,
Massachusetts Institute of Technology, Cambridge, MA
- 2010 Neuroimaging for Complex Pain Syndromes / Future of Pain Management Summit
Massachusetts Institute of Technology Faculty Club, Cambridge, MA (Johnson and
Johnson)
- 2011 Paradoxes in Acupuncture Research: A Brain’s-eye View Using Neuroimaging / New
England Society of Medical Acupuncture, Children’s Hospital, Waltham, MA
- 2012 Neuroimaging Potential Brain Mechanisms for Acupuncture – from Carpal Tunnel
Syndrome to Fibromyalgia / Neuroscience Grand Rounds, University of Vermont,
Burlington, VT

National

Those presentations below sponsored by outside entities are so noted and the sponsor(s) is (are) identified

- 2003 The Modulatory Effects of Acupuncture on the Brain as Imaged by fMRI / Grand Rounds
Physical Rehabilitation Branch, National Institutes of Health, Bethesda, MD

- 2003 A Biomechanical Investigation of the Structure-Function Relationships in the Tongue / Grand Rounds
Physical Rehabilitation Branch, National Institutes of Health, Bethesda, MD
- 2003 A Biomechanical Investigation of the Structure-Function Relationships in the Tongue / Grand Rounds
Physical Rehabilitation Branch, National Institutes of Health, Bethesda, MD
- 2005 Evidence of Cortical Plasticity in Carpal Tunnel Syndrome Treated with Acupuncture / Invited Lecture
National Center for Complementary and Alternative Medicine (NCCAM), National Institutes of Health, Bethesda, MD
- 2007 NCCAM Center of Excellence: Neuroimaging Acupuncture Effects on Brain Activity / Invited Lecture
NCCAM Centers Meeting. Bethesda, MD
- 2007 Acupuncture for Carpal Tunnel Syndrome: Neuroimaging Cortical Plasticity and Acupuncture Processing for Chronic Pain / Keynote Lecture
American Academy of Medical Acupuncture 19th Annual Symposium, Baltimore, MD
- 2008 Acupuncture Modulates Resting Brain Networks / Invited Lecture
Chronic Pain and Fatigue Research Center, University of Michigan. Ann Arbor, MI
- 2008 Evaluating Acupuncture with fMRI: From Characterization to Translational Research / Grand Rounds
Physical Medicine and Rehabilitation Branch, National Institutes of Health, Bethesda, MD
- 2009 Neuroimaging in basic and translational acupuncture research / Invited Lecture in the Integrative Medicine Lecture Series
College of Pharmacy, University of Texas at Austin.
- 2009 Neuroimaging of CAM techniques / Invited Lecture in the 3rd National Symposium on Complementary & Alternative Geriatric Health Care
Logan College of Chiropractic, Chesterfield, MO
- 2013 Functional Brain Connectivity: A Potential Biomarker for the Chronic Pain State? / Invited plenary Lecture in the American Academy of Pain Management annual meeting, Fort Lauderdale, FL
- 2013 Martinos Center CERC for Acupuncture Neuroimaging: Application of MRI Biomarkers to Better Understand Acupuncture Analgesia / Invited plenary lecture at the CAM preconference symposium of the American Pain Society annual conference, New Orleans, LA
- 2014 Neuroimaging Approaches to Acupuncture and CAM Research: What Do We Know? What Lies Ahead? / Invited keynote lecture at the New York Chiropractic College, Seneca Falls,

NY

- 2014 Neuroimaging outcomes as biomarkers for acupuncture analgesia / Invited symposium lecture at the American Academy of Pain Management, Phoenix, AZ
- 2014 As We Better Understand the Brain, We Better Understand Acupuncture: Neuroimaging Approaches to Acupuncture Research / Invited keynote lecture at the 26th Annual American Academy of Medical Acupuncture Symposium, Denver, CO
- 2014 Brain neuroplasticity in carpal tunnel syndrome treated by acupuncture / Invited symposium lecture in “Neural Basis of Nonpharmacological Pain Treatments” at American Pain Society Annual Meeting, Tampa, FL
- 2015 Neuroimaging altered brain circuitries and neurotransmitter levels in cyclic vomiting syndrome / Invited symposium lecture for Biology and Control of Nausea and Vomiting 2015, Pittsburgh, Pennsylvania
- 2016 Acupuncture - a somatosensory conditioning neuromodulatory therapy / Invited lecture at the National Center for Complementary and Integrative Health, NIH, Bethesda, Maryland
- 2016 A view from above: Investigating acupuncture mechanisms for chronic pain with brain functional MRI / Invited lecture at Integrative Medicine Lecture Series, University of Texas MD Anderson Cancer Center, Houston, TX
- 2017 Neuroimaging Acupuncture Effects for Neuropathic Pain and the Role of Objective Outcomes in CTS / Invited keynote lecture at the American Academy of Medical Acupuncture 30th Annual Symposium, Pittsburgh, PA

International

Those presentations below sponsored by outside entities are so noted and the sponsor(s) is (are) identified

- 2006 Sham / Placebo Controls in Acupuncture: The Evidence from Neuroimaging / Invited seminar lecture
North American Research Conference on Complementary and Integrative Medicine.
Edmonton, Alberta, Canada
- 2007 Evaluating Acupuncture with Functional MRI: From Characterization to Translational Research / Invited lecture
Society for Acupuncture Research Annual Conference: The Status and Future of Acupuncture Research: 10 Years Post-NIH Consensus Conference, Baltimore, MD
- 2008 Evaluating Acupuncture with fMRI: From Characterization to Translational Research /

- Keynote lecture
Acupuncture Research Resource Council Annual Conference, London, UK
- 2009 Elucidating Acupuncture Mechanisms of Action with fMRI / Invited lecture
1st Sino-German Conference in Acupuncture and Moxibustion, Chengdu, Sichuan Province, People's Republic of China (Chinesisch-Deutsches Zentrum für Wissenschaftsförderung)
- 2010 Neuroimaging in Basic and Translational Acupuncture Research / Invited lecture
York Neuroimaging Centre, University of York, York, United Kingdom
- 2010 Acupuncture Neuroimaging Research / Invited lecture
Kyunghee University, Seoul, Republic of Korea
- 2010 Neuroimaging in Basic and Translational Acupuncture Research / Invited plenary lecture
Symposium on Acupuncture and Meridian Studies, Pusan, Republic of Korea
- 2011 The Research Matrix: Mapping Acupuncture Effects on the Human Brain / Invited Keynote Lecture
AACP (Acupuncture Association of Chartered Physiotherapists) Annual Conference, Wyboston, United Kingdom
- 2011 Neuroimaging Acupuncture: acupoint specificity and potential mechanisms of action / Invited Keynote Lecture
DAGfA (Deutsche Arztesgesellschaft für Akupunktur, German Medical Acupuncture Association), Bad Nauheim, Germany
- 2012 Neuroimaging evaluation of acupuncture mechanisms / Invited Plenary Lecture
Korean Institute for Oriental Medicine Acupuncture Neuroimaging Symposium, Daejeon, Korea
- 2013 Neuroimaging Approaches to Acupuncture Research: What Do We Know? What Lies Ahead? / Invited Keynote Lecture
Society for Acupuncture Research International Conference, Ann Arbor, MI
- 2013 Brain mechanisms supporting anti-pruritic effects of acupuncture / Invited plenary lecture
International Scientific Acupuncture and Meridian Symposium, Stockholm, Sweden
- 2013 Brain circuitry supporting nocebo itch perception in atopic dermatitis / Invited plenary lecture
7th World Congress on Itch, Boston, MA
- 2014 International Scholar: Visiting Professorship in the Department of Biomedical Engineering at Kyunghee University, Yongin, Korea.
- 2014 Acupuncture modulates brain neuroplasticity in carpal tunnel syndrome / Invited Lecture
Chengdu University of Traditional Chinese Medicine, Chengdu, China
- 2014 Neuroimaging Correlates of Acupuncture: What Do We Know? What Lies Ahead? /

Report of Technological and Other Scientific Innovations

Respiratory-gated Auricular Vagal Afferent Nerve Stimulation (RAVANS)	US Patent awarded (2013): US Patent 8,428,719 Envisioned and built a prototype of a novel device which can be used to provide a form of non-invasive vagal nerve stimulation to treat chronic pain and other disorders. This device is currently being evaluated for clinical efficacy.
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Report of Education of Patients and Service to the Community

Activities

2005	Presented research talk to acupuncturists and lay public entitled “Cortical Plasticity in Carpal Tunnel Syndrome Treated with Acupuncture”	Acupuncture and Oriental Medicine Society of Massachusetts Annual Meeting
2006	Presented research talk to bodyworkers and lay public entitled “Neuroimaging of Acupuncture for Carpal Tunnel Syndrome.”	American Organization for Bodywork Therapies of Asia
2009	Authored a review for acupuncture professionals entitled “Promise of Neuroimaging of Acupuncture Research.”	American Acupuncturist Journal
2017	Publicity for 2017 Brain publication on brain mechanisms of acupuncture treatment of Carpal Tunnel Syndrome	New York Times, Popular Science, Time magazine, Boston Magazine, Daily Mail (UK), Korean Broadcasting Service, Le Figaro

Report of Scholarship

Publications

Peer reviewed publications in print or other media

Research investigations

1. **Napadow V**, Chen Q, Wedeen VJ, Gilbert RJ. Intramural mechanics of the human tongue in association with physiological deformation. *Journal of Biomechanics*. 1999; 32 (1):1-12.

2. **Napadow V**, Chen Q, Wedeen VJ, Gilbert RJ. Biomechanical basis for lingual muscular deformation during swallowing. *American Journal of Physiology*. 1999; 40 (3):G695-G701.
3. Wedeen V, Reese TG, **Napadow V**, Gilbert RJ. Demonstration of primary and secondary muscle fiber architecture of the Bovine tongue by diffusion tensor MRI. *Biophysical Journal*. 2001; 80 (2):1024-8.
4. **Napadow V**, Wedeen VJ, Chen Q, Mai V, So PTC, Gilbert RJ. Quantitative analysis of 3D-resolved lingual fiber architecture in intact tissue with diffusion tensor MRI and two-photon microscopy. *Biophysical Journal*. 2001; 80 (6):2968-75.
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6. **Napadow V**, Mai V, Bankier AA, Gilbert RJ, Edelman R, Chen Q. Determination of regional pulmonary parenchymal strain during normal respiration using spin inversion tagged magnetization MRI. *Journal of Magnetic Resonance Imaging*. 2001; 13 (3):467-74.
7. **Napadow V**, Kamm RD, Gilbert RJ. A biomechanical model of sagittal tongue bending. *Journal of Biomechanical Engineering*. 2002; 124 (5):547-56.
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11. Gilbert RJ, **Napadow VJ**. Three-dimensional muscular architecture of the human tongue determined in vivo with diffusion tensor magnetic resonance imaging. *Dysphagia*. 2005 Winter;20(1):1-7.
12. Hui KK, Liu J, Marina O, **Napadow V**, Haselgrove C, Kwong KK, Kennedy DN, Makris N. The integrated response of the human cerebro-cerebellar and limbic systems to acupuncture stimulation at ST 36 as evidenced by fMRI. *Neuroimage*. 2005 Sep;27(3):479-96.
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15. **Napadow V**, Dhond R, Kennedy D, Hui KKS, Makris N. Automated Brainstem Co-registration

(ABC) for MRI. *Neuroimage*. 2006, 32(3):1113-9.

16. Gilbert RJ, Wedeen VJ, Magnusson LH, Benner T, Wang R, Dai G, **Napadow VJ**, Roche KK. Three-dimensional myoarchitecture of the bovine tongue demonstrated by diffusion spectrum magnetic resonance imaging with tractography. *Anat Rec A Discov Mol Cell Evol Biol*. 2006, 288A(11):1173-1182.
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20. Dhond RP, Yeh C, Park K, Kettner N, **Napadow V**. Acupuncture modulates resting state connectivity in default and sensorimotor brain networks. *Pain*. 2008, 136(3):407-18. PMID: 18337009
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Letters to the Editor

1. Schnyer R, Lao L, Hammerschlag R, Wayne P, Langevin HM, **Napadow V**, Harris R, Park J, Milley R, Cohen M, MacPherson H. Society for Acupuncture Research: 2007 conference report: "The status and future of acupuncture research: 10 years post-NIH Consensus Conference". *J Altern Complement Med.* 2008 Sep;14(7):859-60. PMID: 18803494
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("What is a proper control group in fibromyalgia study?"). *Arthritis Rheumatol.* 2014, 66(6): 1684-5. PMID: 24515749

Thesis

A biomechanical investigation of the structure – function relationships in the human tongue [dissertation]. Cambridge (MA): Massachusetts Institute of Technology; 2001.

Abstracts, Poster Presentations and Exhibits Presented at Professional Meetings

Narrative Report (limit to 500 words)

My research is aimed at elucidating the neural mechanisms underlying chronic pain and potential therapies such as acupuncture. While my efforts are mainly focused on research, I maintain a part-time clinical acupuncture service at the Pain Management Center at BWH. My laboratory has produced one of the most extensive publication records for acupuncture neuroimaging in the world, and we continue to push technological and experimental design boundaries in order to move this nascent field forward.

Currently, my laboratory is using functional magnetic resonance imaging (fMRI) and magnetoencephalography (MEG) to probe the changes in brain activation associated with chronic pain, and its treatment by acupuncture. A recent publication in *Arthritis and Rheumatism* [29] detailed how resting brain functional connectivity is associated with the spontaneous pain in fibromyalgia patients. We have also found that acupuncture modulates such resting connectivity [20], which may help explain mechanisms of action. Our results also suggest that acupuncture modulates the brainstem [23] and limbic system; a network of regions including the amygdala, hippocampus, and cingulate cortex, which are important in emotion processing and influence cognitive and affective components of pain [10, 12].

My lab is also investigating the effects of acupuncture on cortical plasticity in carpal tunnel syndrome (CTS). Cortical plasticity has been reported for other chronic pain conditions, including low back pain. Our studies were the first to apply fMRI in CTS patients. We found that CTS patients respond to tactile stimulation of median nerve innervated fingers with hyperactivation of primary sensory and motor areas of the brain [13]. Furthermore, adjacent fingers have overlapping or blurred representations in the primary sensory homunculus [13]. After a five-week session of acupuncture, we found evidence for clinical improvement, release from hyperactivation, and more separated finger representations for CTS patients [15]. We are currently following up on these promising preliminary results with an NIH R01-funded multi-arm placebo-controlled longitudinal trial incorporating neuroimaging biomarkers.

Other pilot projects investigate the brain circuitry underlying other pathological interoceptive states such as nausea and itch. We are using fMRI in combination with novel, recently developed models for inducing nausea or itch, and will be exploring the potential brain mechanisms by which acupuncture helps ameliorate these aversive interoceptive states.

In addition to lecturing both locally and internationally, I continue to mentor students and research fellows

in my laboratory. Currently, I am mentoring three post-doctoral research fellows, several research assistants, and a visiting associate professor on various neuroimaging projects related to either pain or acupuncture.

My administrative obligations include a significant leadership role in the Society for Acupuncture research, an international organization focused on advancing acupuncture research. I serve as co-President on the organizational board of directors, and chair the scientific review committee for our bi-annual international meetings.

In summary, while my academic focus lies squarely within biomedical research, I continue to support both clinical and teaching obligations. My research pursuits are focused on employing neuroimaging to unravel the mysteries of the chronic pain state, as well as how it may be treated by acupuncture therapy.