



January 12, 2015

Linda Porter, Ph.D.  
National Institute of Neurological Disorders and Stroke  
National Institutes of Health  
31 Center Drive  
Bethesda, MD 20892

Re: Nomination to Interagency Pain Research Coordinating Committee

Dear Dr. Porter,

The American Society of Anesthesiologists (ASA), representing over 52,000 members, is pleased to nominate Gary Brenner, M.D., Ph.D., to the Interagency Pain Research Coordinating Committee (IPRCC) at the National Institutes of Health (NIH). ASA believes that Dr. Brenner possesses the crucial experience and expertise including the advancement of pain care research that the IPRCC seeks.

Dr. Brenner's academic activities are divided between fundamental and translational neuroscience research, clinical duties at the Massachusetts General Hospital (MGH) Department of Anesthesia, teaching, and national advocacy for the advancement of pain training. All of these activities are inter-related through their focus on pain medicine - science, clinical care, education, and national advocacy.

Dr. Brenner's initial research at MGH focused on the contribution of changes in NMDA-R phosphorylation state and subcellular trafficking to the development of central sensitization. This and other work related to pain sensitization was NIH-funded and conducted under the mentorship of Clifford J. Woolf, M.D., Ph.D., an internationally renowned neuroscientist who focuses on neuroplasticity as it relates to pain.

Dr. Brenner's more recent research efforts have focused on sensory systems, both peripheral and central, and have included the role of immune mechanisms in the generation of central sensitization; the role of bone morphogenetic protein (BMP) signaling pathways in peripheral nerve regeneration; investigation of putative pain-processing pathways in the brain via virally-delivered optical channels (i.e., 'optogenetic' modulation using channel rhodopsin and halorhodopsin); and the generation of a novel mouse-models of neurofibromatosis (NF) and the development of new therapeutic strategies - in particular, gene therapy - for the treatment of these peripheral nervous system tumors, termed schwannomas.

Dr. Brenner's interest in NF stems from his clinical practice; MGH is a major NF treatment center and Dr. Brenner has multiple patients with persistent, severe pain caused by this disease. Working with Dr. Xandra Breakefield, Dr. Brenner developed a novel gene therapy

for NF disease and in 2012 was awarded an R01 by NINDS to further investigate the mechanism of action of this gene therapy. These studies are related as they all involve investigation of the response of peripheral and central sensory systems to injury and all ultimately seek to improve the care of individuals with pain.

Dr. Brenner's primary clinical responsibility is at the MGH Center for Pain Medicine within the Department of Anesthesia, Critical Care and Pain Medicine. Since 2002, he has been the Program Director of the MGH Pain Medicine Fellowship and is responsible for the organization, oversight, and development of this ACGME-accredited training program. During his tenure as Program Director, the fellowship has grown both in number of trainees and in the scope of outside departments and institutions in which the fellows train, including neurology, neurosurgery, psychiatry, palliative care, radiology, and orthopedic spine. In addition, Dr. Brenner developed a year-long course for Pain Medicine Fellows that focuses on the fundamental neuroscience underlying the practice of pain medicine, as well as a novel medical simulation-based training program designed to improve the ability of pain fellows to respond to critical events that can occur during outpatient interventional pain practice. A manuscript related to this training program was recently published in the journal *Anesthesia and Analgesia*.

Through involvement in three national organizations, Dr. Brenner works towards the continued development of pain medicine training at the national level. He was elected and currently serves as Immediate Past President of the National Association of Pain Medicine Program Directors (APPD). He is also serving as Immediate Past President of the Association of Anesthesiology Subspecialty Program Directors (AASPD). Dr. Brenner will hold these positions until the end of 2016. He is a member of the governing council of the AASPD's parent organization - the Society of Academic Anesthesiology Associations. In addition, since 2010 Dr. Brenner has been a member of the American Board of Anesthesiologists (ABA) Pain Medicine Committee.

If selected to serve on the IPRCC, Dr. Brenner is enthusiastically willing to serve and commit to the meetings required.

ASA is pleased to have the opportunity to nominate Dr. Brenner to the IPRCC and hopes that the IPRCC will seriously consider his appointment. Dr. Brenner is a recognized leader in pain medicine and provides a diverse and broad expertise that will benefit the important mission of the committee. If you have any questions, please do not hesitate to let me know.

Respectfully yours,



J.P. Abenstein, M.S.E.E., M.D.  
President  
American Society of Anesthesiologists

## Harvard Medical School Curriculum Vitae

**Date Prepared:** December 01, 2014  
**Name:** Gary Jay Brenner, M.D., Ph.D.  
**Office Address:** MGH Center for Pain Medicine, WAC 334  
15 Parkman Street  
Boston, MA 02114-2698  
**Home Address:** 3 Oakland Circle  
Winchester, MA 01890  
**Work Phone:** (617) 726-9223  
**Work Email:** [gjbrenner@partners.org](mailto:gjbrenner@partners.org)  
**Work FAX:** (617) 724-3632  
**Place of Birth:** Newark, NJ

### Education

1982-1986	B.A.	Biology	Wesleyan University, Middleton, CT
1987-1995	M.D., Ph.D.	M.D. – Medicine Ph.D. – Immunology	University of Rochester, Rochester, NY

### Postdoctoral Training

7/95-7/96	Intern	Internal Medicine	Highland Hospital, Rochester, NY
9/96-8/99	Resident	Anesthesia and Critical Care	Massachusetts General Hospital, Boston, MA
9/99-8/00	Fellow	Pain Medicine	Massachusetts General Hospital, Boston, MA

### Faculty Academic Appointments

9/00-9/05	Instructor in Anesthesia	Department of Anesthesia Critical Care and Pain Medicine (DACCPM)	Harvard Medical School, Boston, MA
10/05-10/14	Assistant Professor	Department of Anesthesia Critical Care and Pain Medicine	Harvard Medical School, Boston, MA
11/14- present	Associate Professor	Department of Anesthesia Critical Care and Pain Medicine	Harvard Medical School, Boston, MA

### Appointments at Hospitals/Affiliated Institutions

9/96-8/00      Clinical Fellow                      Anesthesia                                      Anesthesia, MGH

### Other Professional Positions

2008-present      Children's Tumor Foundation (CTF)                      Research Advisory Board

### Major Administrative Leadership Positions

#### **Local**

2002-present      Program Director, MGH Pain Medicine Fellowship                      MGH Department of Anesthesia, Critical Care, and Pain Medicine

2004-present      Developer and Co-Director of a simulation-based course on critical event management as related to pain medicine practice.                      Harvard Center for Medical Simulation

2008                      Director (interim) MGH Inpatient Pain Service                      MGH Department of Anesthesia, Critical Care, and Pain Medicine

2012-present      Course Director, MGH Pain Medicine Rounds (CME approved)                      MGH Department of Anesthesia, Critical Care and Pain Medicine

### Committee Service

#### **Local**

2004-2005      Opioid Safety Committee                      MGH

2004-present      Resident Review Committee                      MGH Dep't. of Anesthesia

2006-present      Institutional Review Board                      Partners® Healthcare

2007-2011      Executive Committee on Education                      MGH

2013                      Executive Search Committee, MGH Pain Unit Division Chief                      MGH Dep't. Anesthesia

#### **Regional**

2004-2005      Boston Alumni Committee                      Howard Hughes Medical Institute Co-Chair

2006-2009      Institutional Review Board                      Department of Psychology, Suffolk University

#### **National**

2014-                      Pain Medicine Milestones Advisory Group                      Accreditation Council on Graduate Medical Education (ACGME)

## Professional Societies

1997-2009	American Medical Association (AMA) 1997-2000 2000-2009	Member Resident/Fellow Section Delegate Young Physicians Section Delegate
1997-present	American Society of Anesthesiologists (ASA) 1997-1998  1998-1999 1999-2000  2000-2001  2000-2003	Member  Resident Alternate-Delegate to the American Medical Association (AMA) Resident Delegate to the AMA Member, Committee on Communications  Member, Committee on Local Anesthesia and Pain Member, Committee on Performance and Outcomes Measurement
1997-present	Massachusetts Society of Anesthesiologists 1997-1998 1998-1999	Member Chair-elect, Committee on Resident Affairs Chair, Committee on Resident Affairs
1997-present	Massachusetts Medical Society 1997-2000 1999-2000 2000-2008 2002-2004	Member Resident Governing Council Compassionate Care Committee Young Physicians Governing Council Chair, Young Physicians Governing Council
2000-2004	New England Pain Association (NEPA)	Member
2000-present	American Society for Regional Anesthesia and Pain Medicine (ASRA) 2009-2012 2010-2011  2012- present 2013-present	Member  Science and Education Committee Chair, 2011 Annual Fall Meeting Science & Education Committee Member, Research Committee Vice-Chair, Research Committee
2004-2009	Society for Neuroscience (SFN)	Member
2004-2008	American Pain Society (APS)	Member
2007-present	Association of Pain Medicine Program Directors (APPD) 2007-2009 2009-2010 2010-2012 2012-2014 2014-2016	Member  Board of Directors Secretary/Treasurer President-elect President Immediate Past President

2008-present	American Board of Anesthesiologists (ABA)	
	2008-present	Pain Medicine Examination Question Developer
	2010-present	Pain Medicine Committee
2009-present	Association of Anesthesiology Subspecialty Program Directors (AASPD)	
	2009-present	Governing Council
	2011	Secretary
	2012	President-elect
	2012-2014	President
	2012	Chair, 2012 Annual Meeting
	2013	Chair, 2013 Annual Meeting
	2014-2016	Immediate Past President
2009-present	Society for Academic Anesthesiology Associations (SAAA)	Governing Council

### Grant Review Activities

2011	Anniversary Fund Review	Oesterreichische Nationalbank (ONB)
2011, 2012	Young Investigator Award Review	Children’s Tumor Foundation CTF)
2012-present	Carl Koller Award Review	ASRA Research Committee (Vice Chair)
2012-present	Chronic Pain Award Review	ASRA Research Committee (Vice Chair)

### Editorial Activities

2004-present	Reviewer	<ul style="list-style-type: none"> <li>• Anesthesiology</li> <li>• The European Journal of Neuroscience</li> <li>• International Association for the Study of Pain (IASP)</li> <li>• The Journal of Neuroscience</li> <li>• Neuroscience Letters</li> <li>• Pain</li> <li>• Pain Medicine</li> </ul>
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### **Other Editorial Roles**

2012	Special Issue Editor	Current Pain and Headache Reports, “Controversies in Interventional Pain Medicine.” 02/2012; vol. 16, #1.
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### Honors and Prizes

1986-1987	Wesleyan University Fellowship for Teaching and Study	Wesleyan University	Training award supporting study and teaching at Huazhong University, Wuhan, Peoples Republic of
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## **Report of Funded and Unfunded Projects**

### **Funding Information**

#### **Past**

- 1989-1990      Howard Hughes Medical Student Research Training Fellowship Grant  
Howard Hughes Medical Institute (HHMI)  
PI: (\$40,000, approx. total)  
Investigation of stress effects on immune function in rodent models.
- 1991-1995      Neuroimmune interactions  
National Research Service Award (NRSA) Individual MD, PhD Training Grant  
NIMH F30MH010144  
PI: (\$160,000 approx. total)  
The award supported my graduate medical (MD) and basic science (PhD) training as part of a Medical Scientist Research Program. The dissertation work focused on sympathetic nervous system (SNS) modulation of immune system function and utilizing murine models to demonstrate the capacity of the SNS to alter immune responses to viral and neoplastic challenge.
- 1998              Stress and neuroimmune function  
Medical Student Summer Training Grant  
Investigated the role of minor stress in mice on their ability to generate humoral immune responses; this work led to two publications. See numbers 1, and 2 in **Research Investigations** in the Report of Scholarship.
- 2002-2007      NMDA receptor phosphorylation and trafficking after pain  
NIH/NINDS K08NS044139  
PI: Costs: \$853,352 (total); \$790,139 (direct)  
The overriding goal of this proposal was to examine changes in dorsal horn NMDA receptor subunit phosphorylation and subcellular distribution during the generation of central sensitization. In addition, intracellular signaling pathways involved in these noxious stimulus-induced NMDA receptor subunit changes will be investigated and correlated with pain behaviors.
- 2007-2008      Schwannomas in NF2 mice: Nerve injury and development of a mouse model (PI: Miguel Sena-Esteves, Ph.D.)  
DOD  
Co-Investigator  
The overriding goal of this award was to investigate whether in floxed-NF2 transgenic mice viral vector mediated delivery of cre-recombinase to the peripheral nervous system would lead to generation of schwannomas.
- 2007-2008      Evaluation of Erlotinib in a novel schwannoma model  
Children's Tumor Foundation  
PI: Costs: \$35,000 (direct)  
The major goals of the project were to 1) create nerve tumors (schwannomas) in adult mice by implantation of human schwannoma tumor cells into the sciatic nerve, and 2) use this orthotopic mouse schwannoma model to test the efficacy of erlotinib, a drug approved by

the FDA for the treatment of other neoplasms.

2009-2011 Modulating cortical and subcortical brain circuits in chronic facial pain (PIs: Edward Boyden, Ph.D. (MIT) and Lino Becerra, Ph.D.)  
NIH/ NIDCR RC2DE020919  
Co-Investigator  
The overriding goal of the proposal was to define neural circuits of pain, using optical neural control tools in conjunction with brain imaging and behavior, thus leading to biomarkers to accelerate translation of fundamental understanding of pain processing from animal to human.

**Current**

2012-2017 Mechanisms of caspase-1 mediated schwannoma regression  
NIH/NINDS 1 R01 NS081146  
PI: Costs: \$1,866,544 (total); \$1,038,000 (direct)  
We have found that adenovirus associated (AAV) vector mediated delivery of caspase-1 leads to complete regression of experimental NF2 (schwannoma) tumors in a xenograft model. Transgene-mediated killing appears to involve both apoptotic death of transduced cells and activation of host anti-tumor responses. This grant will fund the investigation mechanisms of tumor killing by our gene therapy strategy in both the existing xenograft model in immune deficient mice and in a syngeneic schwannoma model in immune competent mice.

2014-2016 Gene therapy induced pyroptosis for tumor killing  
MGH Department of Anesthesia, Critical Care and Pain Medicine Innovation Grant  
PI: Costs: \$51,750 (total); \$45,000 (direct)  
We are performing the preclinical studies necessary to translate our schwannoma gene therapy utilizing the AAV-P0-ICE vector to clinical trials. This grant will fund generation of a subset of the data necessary to support submission of a FDA pre-IND package. The major purpose of the grant is to investigate the effect of anti-AAV immunity on the efficacy and toxicity of our gene therapy strategy.

**Report of Local Teaching and Training**

**Teaching of Students in Courses**

**Local**

**Harvard Medical School and Massachusetts General Hospital**

2004	HST 350 Lectured on the topic of acute pain management Approximately 25 4 <sup>th</sup> year Medical Students	Harvard Medical School 1 hour course
2008-present	2 <sup>nd</sup> Year Neuroscience Block - IN757.0c Human Nervous System and Behavior, Presented lectures on: <ul style="list-style-type: none"><li>• The pain system including mechanisms underlying physiological and</li></ul>	Harvard Medical School 1 hour course/year



pathological pain ½ hour/year

- Live patient presentation that followed above didactic lecture

Medical Students – approximately 200 participants

2008-present 2<sup>nd</sup> Year Neuroscience Block - IN757.0c Harvard Medical School  
 Human Nervous System and Behavior. 1 hour seminar/year  
 I instructed tutors and presented a case to prepare them for pain-related case-based seminar with 2<sup>nd</sup>-year medical students.  
 Tutors – approximately 25 participants

**Harvard-MIT Health, Sciences and Technology Program**

2009 Mentored Soo J. Chun, Ph.D., MBA for Harvard-MIT Health, Sciences and  
 HST 211 (Biomedical Inventions: Clinical Technology  
 Introduction). This course is a component of 4-6 hours per week.  
 the MIT Sloan School of Management Biomedical Enterprise Program.  
 Masters student.

2013 HST Clinical experience course, HST.211. Harvard-MIT Health, Sciences and  
 Lectured on the topic of Pain Medicine: Technology.  
 Underlying mechanisms and treatment of 90 minute lecture/discussion.  
 pain sensitization.  
 Approx. 20 graduate students.

**Regional**

**Tufts University**

2010-2013 PREP 230 – Neuroanatomy Tufts University  
 Neurochemistry and Pharmacology of Pain. 2 hours class/year  
 Lecturer on the pathophysiology of pain  
 Attended by 15 graduate students

**Formal Teaching of Residents, Clinical Fellows and Research Fellows (post-docs)**

**Local**

2000-2013 Mock Oral Board Examiner MGH; 6 hours per year  
 Anesthesia Residents

2000-present Pain Center Journal Club. MGH; 6-12 hours per year  
 5-7 pain fellows

2001 Pathophysiology and Clinical Approach to Department of Internal Medicine, MGH  
 Low Back Pain / Mid-day Lecture Series, 1 hour seminar  
 Presentation to Internal Medicine interns  
 (approximately 40 individuals)

2005	Use of Patient-Controlled Analgesia (PCA) 20 Palliative care fellows from Massachusetts General Hospital, The Dana- Farber Cancer Institute, and The Children's Hospital – approximately 10 fellows present	Department of Internal Medicine, Division of Palliative Care, MGH 1 hour seminar
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**Clinical Supervisory and Training Responsibilities**

2000-present	Pain Center Journal Club 2-3 rotating residents	MGH; 6 hours per year
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**Formally Supervised Trainees**

2005-2006	Ezekiel Fink, MD, PhD / Faculty in the Department of Neurology, UCLA, Los Angeles, CA  I provided mentoring of Dr. Fink during his 2-year pain medicine fellowship. He was first author in one of two chapters that we published together. See numbers 6 and 8 in <b>Reviews, chapters, monographs and editorials</b> in the <u>Report of Scholarship</u> .
2007-2008	John Keel, MD / Staff physician in the Spine Center, New England Baptist Hospital Boston, MA.  I provided daily to weekly mentoring of Dr. Keel during his MGH pain medicine fellowship. He was first author of a chapter we co-authored. See number 10 in <b>Reviews, chapters, monographs and editorials</b> in the <u>Report of Scholarship</u> .
2008-2009	Brian Wainger, MD, PhD / Instructor, Department of Anesthesia, Critical Care, and Pain Medicine, MGH, Boston, MA.  I provided daily to weekly mentoring of Dr. Wainger while he was an MGH Pain Medicine Fellow and have continued to provide guidance now that he is a junior staff member. He is senior author of a case-report we co-authored. See number 30 in <b>Research Investigations</b> in the <u>Report of Scholarship</u> . He is also first author of a chapter we co-authored. See number 9 in <b>Reviews, chapters, monographs and editorials</b> in the <u>Report of Scholarship</u> . In addition, I have helped Dr. Wainger initiate and conduct a clinical trial (he is the PI and I am a co-investigator) that is presently running.
2011-2012	Robert Griffin, MD, PhD / Director of Ambulatory Pain Medicine at the Hospital for Special Surgery, and faculty Instructor at Weill Cornell Medical Center, both in NYC.  I provided regular mentoring of Dr. Griffin during his graduate work in the laboratory of Clifford Woolf, while he was a pain medicine fellow at MGH, and continue to provide guidance now that he is faculty at Cornell. He is first author of a basic science publication focused on mechanisms of pain that we wrote together. See number 17 in <b>Research investigations</b> in the <u>Report of Scholarship</u> . He is also first author of three chapters that we co-authored. See numbers 8, 11 and 12 in <b>Reviews, chapters, monographs and editorials</b> in the <u>Report of Scholarship</u> .

- 2011-2012 Jordan Newmark, MD / Pain Medicine Fellow at Stanford University. Currently Clinical Instructor at the Stanford University Department of Anesthesia, Stanford, CA  
I mentored Dr. Newmark while he was an anesthesia resident at MGH, in particular, working with him while he rotated at the Harvard Center for Medical Simulation. This work led to a peer reviewed manuscript on the topic of medical simulation in pain medicine training. See number 27 in **Research investigations** in the Report of Scholarship. Dr. Newmark is also a author of a case-report we co-authored. See number 30 in **Research Investigations** in the Report of Scholarship.
- 2010-2012 Mehran Taherian, MD / Research Fellow in my laboratory.  
I supervised Dr. Taherian related to the laboratory's RC2-funded work on CNS pain processing pathways and a second project on the development of gene therapy for NF-2 disease. Dr. Taherian's contribution to the latter project led to co-authorship on a peer-reviewed publication. See number 29 in **Research investigations** in the Report of Scholarship.
- 2009-2011 Okay Saydam, PhD / Research Fellow in my laboratory.  
I supervised Dr. Saydam related to the laboratory's work on development of novel animal models for NF2 disease. Dr. Saydam's contribution to this work led to his senior authorship on a peer-reviewed publication. See number 23 in **Research investigations** in the Report of Scholarship.
- 2013-present Sherif Ahmed, PhD / Research Fellow in my laboratory.  
I have primary responsibility for his post-doctoral training. Dr. Ahmed is funded by our R01 and has been working on that project since April 2013.
- 2013-present Dongmei Qu, MD / Research Fellow in my laboratory.  
I have primary responsibility for her research training. Dr. Qu is funded by a scholarship from her university in the People's Republic of China.
- 2013-present Farnaz Hadaegh, DDS / Research fellow in my laboratory  
I have primary responsibility for Dr. Hadaegh's training.

### Local Invited Presentations

*No presentations below were sponsored by outside entities*

- 2001 *Mechanisms of Central Sensitization* / Dep't. of Anesthesia Grand Rounds. Presented a 20-minute talk to about 200 individuals detailing research conducted during a 6-month research fellowship during residency  
Department of Anesthesia, Critical Care and Pain Medicine, MGH, Boston, MA
- 2001 *10 Minutes of Science: Altered NMDA-Receptor Phosphorylation after Pain* / Grand Rounds. Presented to the DACCPM discussing my current research  
Department of Anesthesia, Critical Care and Pain Medicine, MGH, Boston, MA
- 2004-present *Critical Event Management in Pain Medicine Practice* / Course (with Daniel Raemer, Ph.D) In Conjunction with Dr. Raemer, I developed and ran a course for MGH Department of Anesthesia Pain Medicine Fellows, Pain Center Attendings, and Pain Center nursing/support staff. The course has also been attended by Pain Medicine Fellows from

The Children's Hospital Boston and from Spaulding Rehabilitation Hospital. The simulation was designed to provide training in the management of critical events that can occur as complications of office-based pain procedures. This is an all-day course that is offered 2 to 4 times per year.

Harvard Center for Medical Simulation, Boston, MA

- 2006 *Neuropathic Pain* / Seminar presented to CA2/CA3/faculty lecture series  
Department of Anesthesia, Critical Care and Pain Medicine, MGH, Boston, MA
- 2006 *Mechanisms of Neuropathic Pain* / Palliative Care Medicine Grand Rounds, lecture. CME credit provided.  
Division of Palliative Care Medicine, MGH, Boston, MA
- 2006 *Taxonomy and Mechanisms of Pain* / Palliative Grand Rounds, lecture. CME credit provided.  
MGH, Boston, MA and teleconferenced to 3 other hospitals (BIDMC, SRH, BWH)
- 2007 *Informed Consent* / Seminar presented to CA2/CA3/faculty lecture series  
Department of Anesthesia, Critical Care and Pain Medicine, MGH, Boston, MA
- 2008 *Taxonomy and Mechanisms of Pain* / Seminar presented to CA2/CA3/faculty lecture series  
Department of Anesthesia, Critical Care and Pain Medicine, MGH, Boston, MA
- 2009 *From Physiological to Pathological: Taxonomy and Mechanisms of Pain* / Dep't of Anesthesia and Critical Care Grand Rounds  
Massachusetts Veterans' Affairs Hospital, West Roxbury, MA
- 2009 *Neuropathic Pain and HIV-Associated Painful Neuropathy* / Invited presentation  
Internal Medicine Department; Division of Infectious Disease, MGH, Boston, MA
- 2010 *Peripheral Nerve Injury and Repair: Regeneration and Novel Therapeutic Strategies for Schwannoma Treatment* / Anesthesia Grand Rounds. CME credit provided.  
Department of Anesthesia, Critical Care and Pain Medicine, MGH, Boston, MA
- 2010-present *Mechanisms of Pain Hypersensitivity* / Chronic Pain Rounds.  
Department of Anesthesia, Critical Care and Pain Medicine, MGH, Boston, MA
- 2010 *Mechanisms of Pathological Pain* / Palliative Care Grand Rounds.  
Department of Internal Medicine, MGH, Boston, MA
- 2011-present *Current Strategies for the Evaluation and Treatment of Chronic Pain* / Invited presentation at Harvard Medical School sponsored course, "Update in General Internal Medicine for Subspecialists." 2011-2013 CME provided, in 2014 CME & Risk Management Credit provided by Harvard Medical School, Boston, MA
- 2012 *Neuropathic Pain: Mechanisms and Management* / Rheumatology Grand Rounds,  
Department of Internal Medicine, Division of Rheumatology, MGH, Boston, MA
- 2013 *Interventional Management of Chronic Low Back Pain* / Rheumatology Grand Rounds  
Department of Internal Medicine, Division of Rheumatology, MGH, Boston, MA
- 2014 *Taxonomy and Mechanisms of Pain* / Addiction Medicine Rounds. Department of

Psychiatry, Division of Addiction Medicine, MGH, Boston, MA

- 2014 *Treatment of Neuropathic Pain including Risk Mitigation with Opioid Therapy* / Invited presentation at Harvard Medical School sponsored course, “Primary Care Internal Medicine: Principles and Practice.” CME & Risk Management Credit provided by Harvard Medical School, Boston, 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 sponsors are identified.*

- 2001 Analgesic Pharmacology / Invited presentation attended by approx. 15 medical and doctoral students.  
Tufts New England Medical Center, Boston, MA
- 2004 The Pathophysiology and Treatment of Neuropathic Pain / Invited presentation, CME credit provided  
The National Initiative on Pain Control, Boston, MA (The National Initiative on Pain Control)
- 2004 The Pathophysiology and Treatment of Neuropathic Pain / Invited presentation, CME credit provided  
The National Initiative on Pain Control, Providence, RI (The National Initiative on Pain Control)
- 2007 The Use of Opioids for the Treatment of Chronic Pain / Invited presentation on behalf of the National Initiative on Pain Control and attended by approx 60 physicians, CME credit provided  
The National Initiative on Pain Control, Boston, MA (The National Initiative on Pain Control)
- 2007 The Treatment of Chronic Pain in the Elderly / Invited presentation given on behalf of the National Initiative of Pain Control, and attended by a group of approx. 50 individuals including physicians, nurses and pharmacists. CME Credit provided.  
The National Initiative on Pain Control, Providence, RI (The National Initiative on Pain Control)
- 2011 Mechanisms of Pathological Pain / Invited presentation to the Tufts School of Dental Medicine Craniofacial Pain and Headache Center.  
Tufts New England Medical Center, Boston, MA
- 2014 Schwannoma Gene Therapy via Adenoassociated Virus Mediated Caspase-1 Delivery / Invited Presentation – Headache and Facial Pain Inter-professional Rounds. Tufts School of Dental Medicine Craniofacial Pain and Headache Center.  
Tufts New England Medical Center, Boston, MA

**National**

*Those presentations below sponsored by outside entities are so noted and the sponsors are identified.*

- 2004      *The Use of Opioids for Chronic Pain Management* / Invited presentation, CME credit provided  
The National Initiative on Pain Control, Cleveland OH (The National Initiative on Pain Control)
- 2004      *The Pathophysiology and Treatment of Neuropathic Pain* / Invited presentation, CME credit provided  
The National Initiative on Pain Control, Cleveland, OH (The National Initiative on Pain Control)
- 2004      *The Pathophysiology and Treatment of Low Back Pain* / Invited presentation, CME credit provided  
The National Initiative on Pain Control, Tampa, FL (The National Initiative on Pain Control)
- 2004      *Pathophysiology and Treatment of Neuropathic Pain* / Invited presentation CME credit provided.  
The National Initiative on Pain Control, Milwaukee, WI (The National Initiative on Pain Control)
- 2007      *Physiologic and Pathologic Pain Hypersensitivity – Mechanisms and Pharmacology* / Invited presentation. CME credit provided.  
American Society of Regional Anesthesia and Pain Medicine (ASRA) Annual fall pain meeting, Boca Raton, FL
- 2007      *Role of Bone Morphogenic Protein Signaling Pathways in Peripheral Regeneration.* / Department of Anesthesia Grand Rounds  
University of Miami School of Medicine, Division of Pain Medicine, Miami, FL
- 2008      *The Use of Opioids for the Treatment of Chronic Pain* / Invited presentation. Attended by a group of approx. 50 individuals including physicians, nurses, and pharmacists. CME credit provided.  
The National Initiative of Pain Control. Roslyn, NY (The National Initiative on Pain Control)
- 2008      *The use of Opioids for the Treatment of Chronic Pain* / Invited presentation. Attended by a group of approx. 35 individuals including physicians, nurses, and pharmacists. CME credit provided  
The National Initiative on Pain Control, Atlanta GA (The National Initiative on Pain Control)
- 2009      *Neuropathic Pain* / Invited lecture. CME credit provided.  
American Society for Regional Anesthesia and Pain Medicine, Annual Meeting. San Antonio, TX.
- 2009      *Neurophysiology of Pain* / Invited Lecture. CME credit provided.  
American Society for Regional Anesthesia and Pain Medicine, Annual Meeting. San Antonio, TX.

- 2009 *Epidural Steroid Injection* / Chair, Problem-Based Learning Discussion. CME credit provided.  
American Society for Regional Anesthesia and Pain Medicine, Annual Meeting. San Antonio, TX.
- 2010 *Mechanisms of Neuropathic Pain* / Invited lecture. CME credit provided.  
American Society of Regional Anesthesia and Pain Medicine, Annual Meeting. Phoenix, AZ.
- 2010 *Evidence for Efficacy of Epidural Steroid Injections* / Chair, problem-based learning discussion. CME credit provided.  
American Society of Regional Anesthesia and Pain Medicine, Annual Meeting. Phoenix, AZ.
- 2010 *Transforaminal and Interlaminar Epidural Steroid Injection for the Treatment of Pain: Relative Efficacy of the Two Techniques* / Invited lecture, CME credit provided.  
American Society of Regional Anesthesia and Pain Medicine, Annual Meeting. Phoenix, AZ.
- 2011 *Bone Morphogenetic Protein: A New Player in Peripheral Regeneration* / Visiting Professor, Anesthesia Grand Rounds. CME credit provided.  
Visiting Professor, Department of Anesthesia, Vanderbilt University, Nashville, TN
- 2011 *Nociception and Hypersensitivity: Underlying Mechanisms of Pain* / Invited speaker; resident seminar.  
Visiting Professor, Department of Anesthesia, Vanderbilt University, Nashville, TN
- 2011 *Evidence for Efficacy of Epidural Steroid Injection - Route and Injectate* / Panel Moderator. CME credit provided.  
American Society of Anesthesiologists, Annual Meeting, New Orleans, LA
- 2011 *Epidural Steroid Injection* / Invited lecture, problem-based learning discussion. CME credit provided.  
American Society of Regional Anesthesia and Pain Medicine, Annual Meeting, New Orleans, LA
- 2011 *Expert Roundtable on the Future of Pain Medicine* / Presenter and roundtable discussant. CME credit provided.  
American Academy of Pain Medicine, Annual Meeting, Palm Springs, CA.
- 2011 *New Pain Curriculum and Challenges for Program Directors* / Invited lecture. CME credit provided.  
American Academy of Pain Medicine, Annual Meeting, Palm Springs, CA.
- 2011 *Injury and Repair in the Peripheral Nervous System* / Invited speaker: Dept of Anesthesia Grand Rounds.  
Visiting Professor, Department of Anesthesia, Case Western University, Cleveland, OH.
- 2011 *Mechanisms of Nociceptive Sensitization* / Invited speaker: Dept of Anesthesia, Pain Medicine Rounds.

- Visiting Professor, Department of Anesthesia, Case Western University, Cleveland, OH
- 2012 *From Central Sensitization to Gene Therapy for Schwannoma: A Transition to Translational Pain Research* / Visiting Professorship, Department of Anesthesia Grand Rounds. CME credit provided. Cleveland Clinic, Cleveland, OH.
- 2012 *Neuropathic Pain: Underlying Mechanisms* / Invited lecture. CME credit provided. American Academy of Pain Medicine, Annual Meeting, Miami, FL.
- 2012 *Epidural Steroid Injection* / Invited lecture, problem-based learning discussion. CME credit provided. American Academy of Pain Medicine, Annual Meeting, Miami, FL.
- 2012 *Two Year Pain Medicine Fellowships: Pros and Cons.* / Invited lecture, problem-based learning discussion. American Academy of Pain Medicine, Annual Meeting, Miami, FL.
- 2013 *The future of Pain Medicine Training* / Plenary Lecture. CME credit provided. American Academy of Pain Medicine, Annual Meeting. Ft. Lauderdale, FL.
- 2013 *Pain Medicine Breakout* / Session Moderator. CME credit provided. Association of Anesthesiology Subspecialty Program Directors, Annual Meeting, Philadelphia, PA.
- 2013 *Refresher Course: Implications of Chronic Pain - Spinal Surgery* / Panel Moderator. CME credit provided. American Society of Regional Anesthesia and Pain Medicine, Annual Meeting, Phoenix, AZ.
- 2013 *Refresher Course: Spinal Cord Stimulation* / Panel Moderator. CME credit provided. American Society of Regional Anesthesia and Pain Medicine, Annual Meeting, Phoenix, AZ.
- 2014 *Opioid Therapy for Chronic Pain: Controversies and Evidence* / Invited lecture, point-counterpoint session with Rene Przkora, MD, PhD. CME credit provided. American Society of Anesthesiologists, Annual Meeting, New Orleans, LA.
- 2014 *Professionalism and Fellow Training* / Panel Moderator. CME credit provided. Association of Anesthesiology Subspecialty Program Directors, Annual Meeting, Chicago, IL.
- 2014 *Pain Medicine Breakout* / Session Moderator. CME credit provided. Association of Anesthesiology Subspecialty Program Directors, Annual Meeting, Chicago, IL.
- 2014 *Epidural Steroids and Radicular Pain: Potential Mechanisms of Efficacy* / Invited lecture, refresher course. CME credit provided. American Society of Regional Anesthesia and Pain Medicine, Annual Meeting, San Francisco, CA.



- 2014 *Ethical Challenges in Interventional Pain Medicine* / Invited lecture. CME credit provided.  
American Society of Regional Anesthesia and Pain Medicine, Annual Meeting, San Francisco, CA.
- 2014 *Curriculum and Cases for Pain Medicine Crisis Resource Management Education* / Invited lecture. CME credit provided.  
American Society of Regional Anesthesia and Pain Medicine, Annual Meeting, San Francisco, CA.
- 2014 *Refresher course 1: Neuropathic Pain* / Panel moderator. CME credit provided.  
American Society of Regional Anesthesia and Pain Medicine, Annual Meeting, San Francisco, CA.
- 2014 *Refresher course 2: Spine and Discogenic Back Pain - Where are we in 2014?* / Panel moderator. CME credit provided.  
American Society of Regional Anesthesia and Pain Medicine, Annual Meeting, San Francisco, CA.
- 2014 The Pain Medicine Match Application/Interview/Selection Process / Invited speaker, resident program.  
American Society of Regional Anesthesia and Pain Medicine, Annual Meeting, San Francisco, CA.

**International**

*No presentations below were sponsored by outside entities*

- 2006 *Taxonomy and Mechanisms of Chronic Pain* / Invited presentation.  
Wuhan University of Science and Technology, Wuhan, Peoples Republic of China
- 2006 Chaired seminar for nursing faculty focused on pain medicine in the hospital setting / Panel Chairman.  
Wuhan University of Science and Technology, Wuhan, Peoples Republic of China
- 2006 *Mechanisms and Treatment of Neuropathic Pain* / Grand Rounds presentation  
Wuhan University Medical College, Wuhan, Peoples Republic of China
- 2006 *Mechanisms of Neuropathic Pain* / Grand Rounds presentation  
Peking University Medical College, Beijing, Peoples Republic of China
- 2008 *Taxonomy of Pain and Mechanisms of Hyperalgesia in Terminally Ill Patients* / Invited presentation  
National Cancer Hospital, Hanoi, Vietnam.
- 2008 *Interventional Approaches to the Control of Cancer and Terminal Pain* / Invited presentation  
National Cancer Hospital, Hanoi, Vietnam

- 2008 *The Role of Immune Responses in the Generation of Neuropathic Pain* / Plenary lecture  
Annual Joint Meeting on Immunology Teaching and Research (AJMITR), Hanoi, Vietnam
- 2010 *From Physiology to Pathology: Taxonomy and Mechanisms of Pain* / Keynote lecture  
Multidisciplinary Mediterranean Pain Forum, Menorca, Spain
- 2011 *Neuroplasticity and Pain: Why do We Care?* / Visiting professorship  
Toronto City-Wide Anesthesia Grand Rounds, Toronto, Canada
- 2012 *Mechanisms of Pain Sensitization* / Plenary lecture  
Jilin University Medical School, Changchun, Peoples Republic of China
- 2012 *Clinical Treatment of Neuropathic Pain* / Plenary lecture  
Jilin University Medical School, Changchun, Peoples Republic of China
- 2014 *Gene Therapy and Pain Treatment for Schwannoma* / Plenary lecture.  
Foro Internacional de Medicina del Dolor y Paliativa. Mexico City, Mexico.
- 2014 *Genetic Basis of Neuropathic Pain* / Plenary lecture.  
Foro Internacional de Medicina del Dolor y Paliativa. Mexico City, Mexico.
- 2014 *Caspase-1 based schwannoma gene therapy* / Visiting professorship  
Comprehensive Cancer Center, Medical University of Vienna, Vienna, Austria.

## **Report of Clinical Activities and Innovations**

### **Current Licensure and Certification**

- 1999-present Full Massachusetts Licensure  
2001-2011 Board Certification in Anesthesiology (ABA)  
2002-present Board Certification in Pain Medicine (ABA)

### **Practice Activities**

2001-	Ambulatory Care	Outpatient Clinic, MGH Center for Pain Medicine, Massachusetts General Hospital	2-3 clinical days per week
2001-	Acute Care	Inpatient Pain Consultation Service, Massachusetts General Hospital	8 weeks per year (including night/weekend call and rounding on weekends)
2001-	Surgical Placement of Implantable Devices for Pain	Operating Rooms, Massachusetts General Hospital	Frequency highly variable (0-3 procedures per month)
2000-2002	Pain Center Scheduling	MGH Dep't. Anesthesia Pain Center	6 hours per month

## Report of Technological and Other Scientific Innovations

Gene therapy induced pyroptosis for the treatment of neoplasm. a) **Brenner GJ**, Fulci G, and Breakfield XO. US Patent submitted 30 January 2014.  
b) Prabhakar S, Taherian M, Gianni D, Conlon TJ, Fulci J, Brockmann J, Stemmer-Rachamimov A, Sena-Esteves M, Breakfield XO and **Brenner GJ**. Regression of Schwannomas induced by AAV-mediated delivery of Caspase-1. Hum Gene Ther. 2013;24(2):152-62.

We developed the first, and currently only, gene therapy for the treatment of nerve sheath tumors (schwannomas) and are presently working with Partners Research Ventures and Licensing and Industry representatives to move this therapeutic strategy to clinical trials. This is also the first example in which a pyroptosis-inducing transgene has been utilized for the treatment of neoplasm.

Medical simulation training in pain medicine. **Brenner GJ**, Newmark JL and Raemer D. A curriculum and cases for pain medicine crisis resource management education. Anesth and Analg. 2013;116:107-10. I have a long-standing interest in the use of medical simulation for training critical-event management and communication and its application to pain medicine. I developed, in collaboration with Daniel Raemer, Ph.D., a simulation-based curriculum designed to train pain medicine physicians to optimally manage critical events. This course has been run multiple times each year since its launch in 2004 and the work led to publication of the first peer-review manuscript describing the use of simulation for pain medicine training.

Palliative care training in Vietnam **Brenner GJ**, Krakauer EL. Neurobiology of pain. In: Krakauer EL, editor. Palliative care for HIV/AIDS and cancer patients in Vietnam: Advanced training curriculum. 2009. pp. 51-74. Working with Eric Krakauer I assisted in the development of the first palliative care training program in Vietnam. My contribution related to the neurobiology of pain (pain mechanisms) and interventional treatment strategies for the care of pain in dying patients. In addition to generation of curricular materials, I traveled to Vietnam to provide didactics in pain medicine to physicians from a variety of primary specialties.

## Report of Innovation in Pain Medicine Education

I have a long-standing interest in the use of medical simulation for training critical-event management and communication and its application to pain medicine. I developed, in collaboration with Daniel Raemer, Ph.D., a simulation-based curriculum designed to train pain medicine physicians to optimally manage critical events. This course has been run multiple times each year since its launch in 2004 and the work led to publication of the first peer-review manuscript (#27 in Research investigations; I am the first author) describing the use of simulation for pain medicine training.

## Report of Education of Patients and Service to the Community

### Recognition

2010-2014	Designated as one of Boston's Best Doctors	Boston Magazine
2010-2014	Regional Top Doctor	Castle Connolly
2012	Designated as one of the nation's top pain medicine physicians	U.S. News & World Report
2014	New Investigator of the Month (April 2014)	American Society of Gene and Cell Therapy

## **Report of Scholarship**

### **Publications**

#### **Peer reviewed publications in print or other media**

#### **Research investigations**

1. Moynihan JA, Koota D, **Brenner G**, Cohen N and Ader R. Repeated intraperitoneal injections of saline attenuate the antibody response to a subsequent intraperitoneal injection of antigen. *Brain, Behavior, and Immunity*. 1989;3:90-96.
2. Moynihan JA, **Brenner G**, Koota D, Breneman S, Cohen N and Ader R. The effects of handling on immune function, spleen cell number, and lymphocyte subpopulations. *Life Sci*. 1990;46:1937-44.
3. Moynihan JA, **Brenner GJ**, Ader R and Cohen N. The effects of handling adult mice on immunologically-relevant processes. *Ann NY Acad Sci*. 1990;650:252-67.
4. **Brenner GJ**, Cohen N, Ader R. and Moynihan JA. Increased pulmonary metastases and natural killer cell activity in mice following handling. *Life Sci*. 1990;47:1813-19.
5. **Brenner GJ**, Felten SY, Felten DL, Cohen N and Moynihan JA. Chemical sympathectomy is associated with increased pulmonary metastases. *J Neuroimmunol*. 1992;37:191-202.
6. Madden KS, Moynihan JA, **Brenner GJ**, Felten SY, Felten DL and Livnat S. Sympathetic nervous system modulation of the immune system. III. Alterations in T and B cell proliferation and differentiation in vitro following chemical sympathectomy. *J Neuroimmunol*. 1994;49:77-87.
7. **Brenner GJ**, Cohen N and Moynihan JA. Similar immune response to nonlethal infection with Herpes Simplex virus-1 in sensitive (BALB/c) and resistant (C57Bl/6) mice. *Cell Immunol*. 1994;157:510-24.
8. **Brenner GJ** and Moynihan JA. Stressor-induced alterations in immune response and viral clearance following infection with Herpes Simplex virus-type 1 in BALB/c and C57Bl/6 mice. *Brain, Behavior, and Immunity*. 1997;11:9-23.
9. Moynihan JA, Kruszewska B, **Brenner GJ** and Cohen N. Neural, endocrine and immune system interactions: Relevance for health and disease. *Advances in experimental medicine and biology*. 1998;438:541-49.
10. Ji RR, Baba H, **Brenner GJ** and Woolf CJ. Nociceptive specific activation of ERK in spinal neurons contributes to pain hypersensitivity. *Nature Neurosci*. 1999;2:1114-9.

11. Ji RR, Befort K, **Brenner GJ**, Billet S and Woolf CW. ERK activation in the spinal cord mediates gene expression and persistent inflammatory pain. *J Neurosci.* 2002;2:478-85.
12. **Brenner GJ**, Ji RR, Shaffer S and Woolf CJ. Peripheral noxious stimulation induces phosphorylation of the NMDA receptor NR1 subunit at the PCK-dependent site, serine-896, in spinal cord dorsal horn neurons. *European J Neurosci.* 2004;20:375-84.
13. Kawasaki Y, Kohno T, Zhuang ZY, **Brenner GJ**, Wang H, Van Der Meer C, Befort K, Woolf CJ, and Ji RR. Iontropic and metabotropic receptors, PKA, PKC and Src contribute to C-fiber-induced ERK activation and cAMP response element-binding protein phosphorylation in dorsal horn neurons, leading to central sensitization. *J of Neurosci.* 2004;24:8310-21.
14. Xia Y, Sidis Y, Mukherjee A, Samad T, **Brenner G**, Woolf C, Lin HY, and Schneyer A. Localization and action of Dragon (RGMb), a novel BMP co-receptor, throughout the reproductive axis. *Endocrinology.* 2005;146:3614-21.
15. Wang H, Kohno T, Amaya F, **Brenner GJ**, Ito N, Allchorne A, Ji RR, and Woolf CJ. Bradykinin produces pain hypersensitivity by potentiating spinal cord glutamatergic synaptic transmission. *J Neurosci.* 2005;25(35):7986-92.
16. Agarwal N, Pacher P, Tegeder I, Amaya F, Constantin C, **Brenner GJ**, Rubino T, Michalski CW, Marsicano G, Monory K, Mackie K, Marian C, Batkai C, Parolaro D, Fischer MJ, Reeh P, Kunos G, Kress M, Lutz B, Woolf CJ and Kuner R. Cannabinoids mediate analgesia largely via peripheral type 1 cannabinoid receptors in nociceptors. *Nature Neurosci.* 2007;10(7):870-9.
17. Griffin RS, Costigan M, **Brenner GJ**, Ma CHM, Scholz J, Moss A, Allchorne AJ, Stahl GL, Woolf CJ. Induction of complement in microglia in the spinal cord results in C5a anaphylatoxin release and pain hypersensitivity. *J Neurosci.* 2007;27(32):8699-8708.
18. Binshtok A, Wang H, Zimmermann K, Amaya F, Vardeh D, Shi L, **Brenner GJ**, Ji RR, Bean B, Woolf CJ, and Samad TA. Nociceptors are interleukin-1 $\beta$  sensors. *J Neurosci.* 2008;28(52):14062-73.
19. Costigan M, Moss A, Latremoliere A, Johnston C, Verma-Gandhu M, Herbert TA, Barrett L, **Brenner GJ**, Vardeh D, Woolf CJ, Fitzgerald M. T-Cell infiltration and signaling in the adult dorsal spinal cord is a major contributor to neuropathic pain-like-hypersensitivity. *J Neurosci.* 2009;18(46):14415-22.
20. Prabhakar S, **Brenner GJ**, Tannous BA, Sena-Esteves M and Breakefield XO. Imaging and therapy of experimental schwannomas using HSV amplicon vector encoding apoptotic protein under control of a Schwann cell promoter. *Cancer Gene Therapy.* 2010;17(4):266-74.
21. Xia Y, Babitt JL, Bouley R, Zhang Y, Da Silva N, Chen S, Zhuang Z, Samad TA, **Brenner GJ**, Anderson JL, Hong CC, Schneyer AL, Brown D, Lin HY. Dragon enhances BMP signaling and increases transepithelial resistance in kidney epithelial cells. *Journal Am Soc of Nephrology.* 2010;21(4):666-77.
22. Del Camino D, Murphy S, Heiry M, Barrett LB, Earley TJ, Cook CA, Petrus MJ, Zhao M, D'Amours M, Deering N, **Brenner GJ**, Costigan M, Hayward NJ, Chong JA, Fanger CM, Woolf CJ, Patapoutian A, Moran MM. TRPA1 contributes to cold hypersensitivity. *J Neurosci.* 2010;30(45):15165-74.
23. Saydam O, Ozdener GB, Senol O, Mizrak A, Prabhakar P, Stemmer-Rachamimov AO, Breakefield XO and **Brenner GJ**. A novel imaging-compatible sciatic nerve schwannoma model. *J Neurosci*

Methods. 2011;195(1):75-77.

24. Saydam O, Senol O, Wurdinger T, Mizrak A, Ozdeber GB, Stemmer-Rachamimov AO, Yi M, Stephens RM, Krichevsky AM, **Brenner GJ**, Breakefield XO. Low microRNA-7 in schwannomas stimulates growth through upregulation of three oncogenic signaling pathways. *Cancer Res.* 2011;71(3):852-61.
25. Ma CH, Omura T, Cobos EJ, Latremoliere A, Ghasemlou N, **Brenner GJ**, van Veen E, Barrett L, Sawada T, Gao F, Coppola G, Gertler F, Costigan M, Geschwind D and Woolf CJ. Accelerating axonal growth promotes motor recovery after peripheral nerve injury in mice. *J Clin Invest.* 2011;121(11):4332-47.
26. Ma CH\*, **Brenner GJ**\*#, Omura T\*, Samad OA, Costigan M, Inquimbert P, Niederkofler V, Salie R, Sun CC, Lin HY, Arber S, Coppola G, Woolf CJ, Samad TA. The BMP coreceptor RGMb promotes while the endogenous BMP antagonist Noggin reduces Neurite outgrowth and peripheral nerve regeneration by modulating BMP signaling. *J Neurosci.* 2011;31(50):18391-400 (\*these authors contributed equally, #corresponding author).
27. **Brenner GJ**, Newmark JL and Raemer D. A curriculum and cases for pain medicine crisis resource management education. *Anesth and Analg.* 2013;116:107-10.
28. Mizrak A, Bolukbasi MF, Ozdener GB, **Brenner GJ**, Madlener S, Erkan EP, Ströbel T, Breakefield XO and Saydam O. Genetically engineered microvesicles carrying suicide mRNA/protein inhibit schwannoma tumor growth. *Molecular Therapy.* 2013;21(1):101-8.
29. Prabhakar S, Taherian M, Gianni D, Conlon TJ, Fulci J, Brockmann J, Stemmer-Rachamimov A, Sena-Esteves M, Breakefield XO and **Brenner GJ**. Regression of Schwannomas induced by AAV-mediated delivery of Caspase-1. *Hum Gene Ther.* 2013;24(2):152-62.
30. Giblin K, Newmark JL, **Brenner GJ**\*, and Wainger BJ. Headache plus: Trigeminal and autonomic features in a case of cervicogenic headache responsive to third occipital nerve radiofrequency ablation. *Pain Med.* 2014;15(3):473-8. (\*corresponding author)

**Other peer reviewed publications e.g., case reports, proceedings of meetings which are full-length manuscripts)**

1. Wang H, Ehnert C, **Brenner GJ**, Woolf CJ. Minireview: Bradykinin and peripheral sensitization. *Biol Chem.* 2006;387:11-14.

**[Non-peer reviewed scientific or medical publications/materials in print or other media](#)**

**Reviews, chapters, monographs, and editorials**

**Proceedings of meetings or other non-peer reviewed research publications**

1. Ji RR, **Brenner GJ**, Schmold R, Baba H and Woolf CJ. Phosphorylation of ERK and CREB in nociceptive neurons following noxious stimulation. *Proceedings of the 9th World Pain Congress. Progress in Pain Research and Management.* 2000;16:191-8.
2. **Brenner GJ**, Kueppenbender K, Mao J and Spike J. Ethical challenges and interventional pain medicine. In: **Brenner GJ**, section editor. *Current pain and headache reports.* 2012;16(1):1-8.

**Chapters**

1. Moynihan JA, **Brenner GJ**, Cocke R, Karp JD, Breneman SM, Dopp JM, Ader R, Cohen N, Grota

- LJ and Felten SY. Stress-induced modulation of immune function in mice. In: Kiecolt-Glaser JK and Glaser R, editors. Handbook of human stress and immunity. Orlando: Academic Press, Inc; 1994. p. 1-21.
2. **Brenner GJ**. The pain system. In: Ballantyne J, Fishman S and Abdi S, editors. The Massachusetts General Hospital handbook of pain management. Philadelphia: Lippincott, Williams, and Wilkins; 2001. p. 8-13.
  3. **Brenner GJ**, Mao J and Rosow C. The opioid receptors. In: Antognini JF and Carstens E, editors. Contemporary clinical neurosciences: Neural mechanisms of anesthesia. Totowa NJ: Humana Press; 2003. p. 413-26.
  4. **Brenner GJ**. The neurophysiologic basis of pain. In: Ballantyne J, editor. The Massachusetts General Hospital handbook of pain management. Philadelphia: Lippincott, Williams, and Wilkins; 2005. p. 3-18.
  5. Black D, **Brenner GJ**, Abdi S and Gill J. Drugs commonly used in pain practice. In: Ballantyne J, editor. The Massachusetts General Hospital handbook of pain management. Philadelphia: Lippincott, Williams, and Wilkins; 2005. p. 565-88.
  6. Fink E and **Brenner GJ**. Anti-inflammatory medications in pain management. In: Mao J, editor. Translational pain research: Comparing preclinical studies and clinical pain management. Lost in translation? Hauppauge NY: Nova Science Publishers, Inc; 2006. p. 155-167.
  7. **Brenner GJ** and Woolf CJ. Mechanisms of chronic pain. In: Longnecker DE, Brown DL, Newman MF and Zapol WM, editors. Anesthesiology. New York: McGraw Hill Companies, Inc; 2008. p. 2000-19.
  8. Griffin R, Fink E and **Brenner GJ**. Functional neuroanatomy of the nociceptive system. In: Fishman SM, Ballantyne JC and Rathmell JP, editors. Bonica's management of pain. New York: Lippincott Williams & Wilkins; 2009. p. 98-119.
  9. Wainger B and **Brenner GJ**. Mechanisms of chronic pain. In: Longnecker DE, Brown DL, Newman MF and Zapol WM, editors. Anesthesiology, 2nd Edition. New York: McGraw Hill Companies, Inc.; 2012. p. 1516-31.
  10. Keel JC and **Brenner GJ**. Functional anatomy and imaging of the spine. In: Deer, TR and Leong MS, editors. Comprehensive treatment of chronic pain by medical, interventional, and integrative approaches: The American Academy of Pain Medicine textbook on patient management. New York: Springer; 2013. p. 237-55.
  11. Griffin R and **Brenner GJ**. Neuropathic pain. In: Mashour G and Avidan MS, editors. Neurologic outcomes in surgery and anesthesia. New York: Oxford; 2013. p. 77-86.
  12. Griffin R and **Brenner GJ**. Future directions in pain management. In: Aminoff M and Aaroff R, editors. Encyclopedia of the neurological sciences, 2<sup>nd</sup> Edition. New York: Elsevier; In press.

#### Newsletter articles

1. **Brenner GJ** and Barach, PR. Collective bargaining and the resident. ASA Newsletter. 1998;62:4.

#### [Professional educational materials or reports, in print or other media](#)

1. **Brenner GJ**. Development of didactic materials for the Vietnam National Palliative Care Core

Curriculum, National Cancer Hospital, Hanoi, Vietnam, 2008.

2. **Brenner GJ**, Krakauer EL. Neurobiology of pain. In: Krakauer EL, editor. Palliative care for HIV/AIDS and cancer patients in Vietnam: Advanced training curriculum. 2009. pp. 51-74.

### Thesis

1. **Brenner GJ**. Neural modulation of immune function: Studies of stress and the sympathetic nervous system [dissertation]. Rochester (NY): Department of Microbiology and Immunology. University of Rochester School of Medicine and Dentistry; 1995.

### Abstracts, Poster Presentations and Exhibits Presented at Professional Meetings

#### Abstracts

1. Prabhakar S, Taherian M, Gianni D, Conlon TJ, Stemmer-Rachamimov A, Sena-Esteves M, Breakefield XO, **Brenner GJ**. *Regression of schwannomas induced by AAV-mediated delivery of Caspase-1*. Oral presentation (**G. Brenner**). American Society of Gene and Cell Therapy (ASGCT). 2013 Annual Meeting. Philadelphia, USA.
2. Przkora R, Rosenquist R, **Brenner GJ**, Mesrobian J, Abouleish A. *Do pain medicine fellowship programs provide education in practice management? A survey of pain medicine fellowship directors*. Poster presentation. American Society of Regional Anesthesia and Pain Medicine. 2013 Annual Meeting. Phoenix, AZ.

### Narrative Report

#### Area of Excellence: Clinical Expertise and Innovation

My professional activities are focused on making a lasting contribution to the care of patients with persistent, pathological pain, and my activities are divided between: (1) **clinical duties**; (2) NIH-funded **fundamental and translational neuroscience research**; (3) **graduate medical education** focused via my decade-plus role as Director of the MGH Pain Medicine Fellowship; and (4) **advocacy** via my major national leadership positions. Through this work I have established a national - and a developing international - reputation as a leader in pain medicine.

#### **Clinical expertise**

Following residency (anesthesia) and fellowship (pain medicine) training I chose to devote my clinical practice entirely to the treatment of patients with poorly controlled pain. Within the broad spectrum of patients presenting with pain, my greatest clinical expertise is within the realm of pathological pain. I have written extensively and lectured nationally and internationally on both the mechanisms and treatment of pathological pain. As noted below, I have also developed a specific expertise in the development of novel therapy for the pathological pain that is frequently associated with schwannomas – benign neoplasms occurring in association with peripheral nerves and part of the group of diseases known as the neurofibromatoses.



## **Clinical innovation through fundamental and translational research**

My initial research at MGH focused on mechanisms underlying states of pain sensitization. This work was funded by a NIH K08 and conducted under the mentorship of Clifford J. Woolf, M.D., Ph.D. and resulted in a first-author publication on spinal cord NMDA-receptor phosphorylation following activation of nociceptors. My later work in the Woolf laboratory focused on signaling pathways involved in peripheral nerve regeneration - important to an understanding of the pathological pain that frequently occurs as a consequence of nerve injury. This work led to a first-author publication describing a role of bone morphogenetic protein signaling in regeneration.

My laboratory currently focuses on developing novel therapies for the treatment of schwannomas – nerve sheath tumors that can be exceptionally painful. This interest grew out of both my scientific background related to peripheral nerve injury in conjunction with my clinical experience treating patients with pain caused by these tumors. Under the support of a Children’s Tumor Foundation grant, I developed an orthotopic sciatic nerve schwannoma model to allow development of novel therapeutic strategies for these tumors. Subsequently I utilized this schwannoma model to develop the first, and still only, gene therapy strategy for treatment of schwannoma. I was awarded an R01 to further investigate this gene therapy, and a formal patent application to protect the therapeutic strategy has been submitted by Partners Healthcare.

## **Innovative use of medical simulation for pain medicine training**

I have a long-standing interest in the use of medical simulation for training critical-event management and communication and its application to pain medicine, and developed a simulation-based curriculum designed to train pain medicine physicians to optimally manage critical events. This course has been run multiple times each year since its launch in 2004 and the work led to publication of the first peer-review manuscript (I am the first author) describing the use of simulation for pain medicine training.

## **Innovation in pain medicine fellowships**

I have obtained major leadership positions in 4 national organizations related to pain medicine and used these positions to advance postgraduate pain medicine training. The organizations are the Society of Academic Anesthesia Associations (SAAA), the Association of Pain Program Directors (APPD), the American Board of Anesthesiology (ABA), and the American Society of Regional Anesthesia and Pain Medicine (ASRA). I am president of the subspecialty program director component of the SAAA, president of the APPD, on the ABA Pain Medicine Committee, and vice-chair of the ASRA Research Committee. The most personally rewarding accomplishment enabled by this work was convincing the pain medicine program directors to accept a ‘Match’ for fellowship applicant selection. This had been under discussion for well over a decade prior to my recent efforts - over approximately 2 years – leading to acceptance of a matching program.