

CURRICULUM VITAE

The Johns Hopkins University School of Medicine

(Signature)

12/01/2022

(Typed Name)

Yun Guan, M.D., Ph.D.

DEMOGRAPHIC AND PERSONAL INFORMATION**Current Appointments**

University

3/19-present Professor,
Department of Anesthesiology and Critical Care Medicine,
Johns Hopkins University, Baltimore, MD, USA.

3/19-present Professor,
Department of Neurological Surgery,
Johns Hopkins University, Baltimore, MD, USA.

Hospital None.

Other

3/15-2022 Director, Pain Research Core, Johns Hopkins University, Baltimore, MD, USA.

7/17-present Director, Pain Neuromodulation Research, Neurosurgery Pain Research Institute (NPRI),
Johns Hopkins University, Baltimore, MD, USA.

Personal Data

Anesthesiology and Critical Care Medicine
Ross 350-351, 720 Rutland Avenue,
Baltimore, MD 21205
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Education and Training

Undergraduate

1995 B.S. (M.D. equivalent in China), Capital Medical University, Beijing, China.

Doctoral/graduate

1998 M.S. Chinese Academy of Medical Sciences & Peking Union Medical College, Beijing, China.

2003 Ph.D. Program in Neuroscience, University of Maryland, School of Medicine, Baltimore, MD, USA.
Primary mentor: Ke Ren, Ph.D and Ronald Dubner, DDS Ph.D.

Postdoctoral

2003-2005 Fellowship, Department of Anesthesiology and Critical Care Medicine, Johns Hopkins University,
Baltimore, MD, USA. Primary mentor: Dr. Srinivasa N Raja, M.D., Pain Medicine.

Professional Experience

2005-2006 Assistant Professor, Department of Organizational Systems & Adult Health,
University of Maryland, Baltimore, MD, USA.

2006-2013 Assistant Professor, Department of Anesthesiology and Critical Care Medicine,
Johns Hopkins University, Baltimore, MD, USA.

2013-2019 Associate Professor, Department of Anesthesiology and Critical Care Medicine,
Johns Hopkins University, Baltimore, MD, USA.

2017-2019 Associate Professor, Department of Neurological Surgery,
Johns Hopkins University, Baltimore, MD, USA.

2015-present Director, Pain Research Core, Johns Hopkins University, Baltimore, MD, USA.

2017-present Director, Pain Neuromodulation Research, Neurosurgery Pain Research Institute (NPRI),
Johns Hopkins University, Baltimore, MD, USA.

International Professorship.

- 2013-present Visiting Professor, Capital Medical University, Beijing, China.
2016-present Visiting Professor, Peking Union Medical College, Beijing, China.
2016-present Expert Panel: Pain and Neuroscience Research. National Institute of Pharmaceutical Education and Research (NIPER), Ahmedabad, India.

PUBLICATIONS:

NARRATIVE SUMMARY. I have published over 150 peer-reviewed research articles, review articles and book chapters. Since my promotion to Associate Professor at JHU in 2013, I have published over 120 pain- and neuroscience-related research articles in high-impact journals, such as Science Advances, Science Signaling, PNAS, Neuron, Nature Neuroscience, Anesthesiology, and Journal of Neuroscience.

Google Scholar: Citation: > 7500; h-index: 42;

Google Scholar: <https://scholar.google.com/citations?user=IZxzX94AAAAJ&hl=en>

NCBI: <http://www.ncbi.nlm.nih.gov/sites/myncbi/yun.guan.1/bibliography/47480480/public/?sort=date&direction=ascending>

Original Research [OR]

1. **Guan Y**, Fan JY, Xie YK. Changes of wide-dynamic-range spinal cord dorsal horn neuron following peripheral nerve injury. *Chinese Journal of Spine and Spinal Cord*. ISSN 1004-406X, 1997; 7 (5): 132-136.
2. Terayama R, **Guan Y**, Dubner R, Ren K. Activity-induced plasticity in brain stem pain modulatory circuitry after inflammation. *Neuroreport*. 2000;11(9): 1915-1919. *I conducted the experiment and data analysis.*
3. Guo W, Zou S, **Guan Y**, Ikeda T, Tal M, Dubner R, Ren K. Tyrosine phosphorylation of the NR2B subunit of the NMDA receptor in the spinal cord during the development and maintenance of inflammatory hyperalgesia. *J. Neurosci*. 2002; 22(14): 6208-6217. *I conducted the experiment and data analysis.*
4. Miki K, Zhou QQ, Guo W, **Guan Y**, Terayama R, Dubner R, Ren K. Changes in gene expression and neuronal phenotype in brain stem pain modulatory circuitry after inflammation. *J. Neurophysiol*. 2002; 87(2): 750-760. *I conducted the experiment and data analysis.*
5. **Guan Y**, Terayama R, Dubner R, Ren K. Plasticity in excitatory amino acid receptor-mediated descending pain modulation after inflammation. *J. Pharmacol. Exp. Ther*. 2002; 300(2): 513-520.
6. **Guan Y**, Guo W, Zou SP, Dubner R, Ren K. Inflammation-induced upregulation of AMPA receptor subunit expression in brain stem pain modulatory circuitry. *Pain*. 2003; 104 (1-2): 401-413.
7. Renn CL, **Guan Y**, Dubner R, Ren K. Enhanced AMPA Receptor GluR1 subunit expression and neuronal activation within brain stem pain modulatory circuitry after inflammation. In: Dostrovsky JO, CarDB, Koltzenburg M (Eds.). *Proc of the 10th World Congress. IASP Press*. 2003; 355-67. *I conducted the experiment and data analysis.*
8. **Guan Y**, Guo W, Robbins MT, Dubner R, Ren K. Changes in AMPA receptor phosphorylation in the rostral ventromedial medulla after inflammatory hyperalgesia in rats. *Neurosci. Lett*. 2004; 366(2): 201-205.
9. Shimizu I, Iida T, **Guan Y**, Zhao C, Raja SN, Jarvis MF, Cockayne DA, Caterina MJ. Enhanced thermal avoidance in mice lacking the ATP receptor P2X3. *Pain*. 2005; 116(1-2): 96-108. *I conducted the experiment and data analysis.*
10. Chu YC, **Guan Y**, Skinner J, Raja SN, Johns RA, Tao YX. Effect of genetic knockout or pharmacologic inhibition of neuronal nitric oxide synthase on complete Freund's adjuvant-induced persistent pain. *Pain*. 2005; 119(1-3): 113-123. *I conducted the experiment and data analysis.*
11. **Guan Y**, Borzan J, Meyer RA, Raja SN. Windup in dorsal horn neurons is modulated by endogenous spinal μ -opioid mechanisms. *J. Neurosci*. 2006; 26(16): 4298-4307. ***Co-corresponding author.***
12. **Guan Y**, Yaster M, Raja SN, Tao YX. Genetic knockout and pharmacologic inhibition of neuronal nitric oxide synthase attenuate nerve injury-induced mechanical hypersensitivity in mice. *Mol. Pain*. 2007; 3:29.
13. **Guan Y**, Johaneck LM, Hartke TV, Shim B, Tao YX, Ringkamp M, Meyer RA, Raja SN. Peripherally acting μ -opioid receptor agonist attenuates neuropathic pain in rats after L5 spinal nerve injury. *Pain*. 2008; 138(2):318-329. ***Co-Corresponding author.***
14. Xiong GX, Zhang JW, Hong Y, **Guan Y**, Guan H. Motor unit number estimation of the tibialis anterior muscle in spinal cord injury. *Spinal Cord*. 2008; 46(10): 696-702. *I conducted data analysis and contribute the manuscript writing.*
15. **Park JS**, Yaster M, Guan X, Xu JT, Shih MH, **Guan Y**, Raja SN, Tao YX. Role of spinal cord alpha-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid receptors in complete Freund's adjuvant-induced inflammatory pain. *Mol. Pain*. 2008; 4:67. *I conducted the experiment and data analysis.*
16. Singh OV, Yaster M, Xu JT, **Guan Y**, Guan X, Dharmarajan AM, Raja SN, Zeitlin PL, Tao YX. Proteome of synaptosome-associated proteins in spinal cord dorsal horn after peripheral nerve injury. *Proteomics*. 2009; 9(5): 1241-1253. *I conducted the experiment and data analysis.*

17. Seal RP, Wang X, **Guan Y**, Raja SN, Woodbury CJ, Basbaum AI, Edwards RH. Unmyelinated low threshold mechanoreceptors are required for injury-induced mechanical hypersensitivity. *Nature*. 2009; 462 (7273): 651-655. *I conducted the experiment and data analysis.*
 18. Liu Q, Tang Z, Surdenikova L, Kim S, Patel KN, Kim A, Ru F, **Guan Y**, Weng HJ, Geng Y, Udem BJ, Kollarik M, Chen ZF, Anderson DJ, Dong X. Sensory neuron-specific GPCR Mrgprs are itch receptors mediating chloroquine-induced pruritus. *Cell*. 2009; 139(7): 1353-1365. *I conducted the experiment and data analysis.*
 19. Liu YD, Wang FY, Xu JM, **Guan Y**, Guan H. Intramedullary thoracic tuberculoma. *Spinal Cord*. 2010; 48(1): 80-82. *I contributed to experimental design, conducted data analysis and contributed the manuscript writing.*
 20. Xiong GX, **Guan Y**, Hong Y, Zhang JW, Guan H. Motor unit number estimation may be a useful method to evaluate motor function recovery after spinal cord transection in rats. *Spinal Cord*. 2010; 48(5): 363-366. *I conducted data analysis and contribute the manuscript writing.*
 21. **Guan Y**, Yuan F, Carteret AF, Raja SN. A partial L5 spinal nerve ligation induces a limited prolongation of mechanical allodynia in rats: an efficient model for studying mechanisms of neuropathic pain. *Neurosci. Lett*. 2010; 471(1): 43-77. **Corresponding author.**
 22. **Guan Y**, Wacnik PW, Carteret AF, Meyer RA, Raja SN. A model combining in vivo electrophysiological and behavioral approaches to study mechanisms of spinal cord stimulation induced analgesia in spinal nerve injured rats. *J. Pain*. 2010; 11(4). DOI:10.1016/j.jpain.2010.01.120.
 23. **Guan Y**, Raja SN. Wide-dynamic-range neurons are heterogeneous in windup responsiveness to changes in stimulus intensity and isoflurane anesthesia level in mice. *J. Neurosci. Res*. 2010; 88(10): 2272-2283. **Corresponding author.**
 24. **Guan Y**, Liu Q, Tang Z, Raja SN, Anderson DJ, Dong X. Mas-related G-protein-coupled receptors inhibit pathological pain in mice. *Proc. Natl. Acad. Sci. U. S. A*, 2010; 107 (36): 15933-15938.
 25. Guan X, Wang L, Chen CL, **Guan Y**, Li S. Roles of two subtypes of corticotrophin-releasing factor receptor in the corticostriatal long-term potentiation under cocaine withdrawal condition. *J. Neurochem*. 2010; 115(3):795-803. *I contributed to experimental design, conducted data analysis and contributed the manuscript writing.*
 26. **Guan Y**, Wacnik PW, Yang F, Carteret AF, Chung CY, Meyer RA, Raja SN. Spinal cord stimulation-induced analgesia: electrical stimulation of dorsal column and dorsal roots attenuates dorsal horn neuronal excitability in neuropathic rats. *Anesthesiology*. 2010; 113(6):1392-405. **Co-corresponding author. Accompanied by an Editorial View.**
 27. Lee CY, Perez FM, Wang W, Guan X, Zhao X, Fisher JL, **Guan Y**, Sweitzer SM, Raja SN, Tao YX. Dynamic temporal and spatial regulation of mu opioid receptor expression in primary afferent neurons following spinal nerve injury. *Eur. J. Pain*. 2011; 15(7):669-675. *I conducted the experiment and data analysis.*
 28. Donello JE, **Guan Y**, Tian M, Cheevers CV, Alcantara M, Cabrera S, Raja SN, Gil DW. A peripheral adrenoceptor-mediated sympathetic mechanism can transform stress-induced analgesia into hyperalgesia. *Anesthesiology*. 2011; 114(6):1403-1416. *I conducted the experiment and data analysis.*
 29. Park U, Vastani N, **Guan Y**, Raja SN, Koltzenburg M, Caterina MJ. TRP vanilloid 2 knock-out mice are susceptible to perinatal lethality but display normal thermal and mechanical nociception. *J. Neurosci*. 2011; 31(32):11425-11436. *I conducted the experiment and data analysis.*
 30. Yang F, Chung CY, Wacnik WP, Carteret AF, McKelvy AD, Meyer RA, Raja SN, **Guan Y**. Electrical stimulation at distinct peripheral sites in spinal nerve injured rats leads to different afferent activation profiles. *Neurosci. Lett*. 2011; 505(1):52-57.
 31. Yang F, Carteret AF, Wacnik PW, Chung CY, Xing L, Dong X, Meyer RA, Raja SN, **Guan Y**. Bipolar spinal cord stimulation attenuates mechanical hypersensitivity at an intensity that activates a small portion of A-fiber afferents in spinal nerve-injured rats. *Neuroscience*. 2011; 199:470-480.
 32. Chung C, Carteret AF, McKelvy AD, Ringkamp M, Yang F, Hartke TV, Dong X, Raja SN, **Guan Y**. Analgesic properties of loperamide differ following systemic and local administration to rats after spinal nerve injury. *Eur. J. Pain*. 2012; 16(7):1021-1032.
 33. Xiong W, Cui T, Cheng K, Yang F, Chen S-R, Willenbring D, **Guan Y**, Pan H-L, Ren K, Xu Y, Zhang L. Cannabinoids suppress inflammatory and neuropathic pain by targeting $\alpha 3$ glycine receptors. *J. Exp. Med*. 2012; 209(6): 1121-1134. *I conducted the experiment and data analysis.*
 34. Ringkamp M, Tal M, Hartke TV, Wooten M, McKelvy A, Turnquist BP, **Guan Y**, Meyer RA, Raja SN. Local loperamide injection reduces mechanosensitivity of rat cutaneous, nociceptive C- fibers. *PLoS One*. 2012; 7 (7) e42105. *I conducted the experiment and data analysis.*
 35. Han L, Ma C, Liu Q, Weng H, Cui Y, Tang Z, Kim Y, Nie H, Qu L, Patel KN, Li Z, McNeil B, He S-Q, **Guan Y**, Xiao B, LaMotte R, Dong X. A subpopulation of nociceptors specifically linked to itch. *Nature Neuroscience*. 2012; 16(2):174-182. *I conducted the experiment and data analysis.*
 36. Guan X, **Guan Y**. Proteomic profile of differentially expressed proteins in the medial prefrontal cortex after repeated cocaine exposure. *Neuroscience*. 2013; 236:262-270.
 37. Shechter R, Yang F, Xu Q, Cheong Y-K, He S-Q, Sdrulla A, Carteret AF, Wacnik PW, Dong X, Meyer RA, Raja SN, **Guan Y**. Conventional and kilohertz-frequency spinal cord stimulation produces intensity- and frequency-dependent
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- pain inhibition in a rat model of neuropathic pain. *Anesthesiology*. 2013;119(2): 422-432. *Featured in "This Month in Anesthesiology." Accompanied by an Editorial View. Promoted for Press Release by American Society of Anesthesiologists (ASA) and by Pain Research Forum.* <http://painresearchforum.org/news/30637-spinal-cord-stimulation-promising-variation-theme>
38. Xu Q, Li WY, Guan Y. Mu-opioidergic modulation differs in deep and superficial wide-dynamic range dorsal horn neurons in mice. *Neurosci. Lett.* 2013; 549:157-162.
 39. He S-Q, Yang F, Perez F, Xu Q, Shechter R, Cheong YK, Carteret AF, Dong X, Sweitzer, SM, Raja SN, Guan Y. Tolerance to the anti-allodynic effects of the peripherally acting opioid, loperamide hydrochloride, develops in nerve-injured rats. *Pain.* 2013; 154 (11):2477-2486.
 40. He S-Q, Li Z, Chu Y-X, Han L, Xu Q, Li M, Yang F, Liu Q, Tang Z, Wang Y, Hin N, Tsukamoto T, Slusher B, Tiwari V, Shechter R, Wei F, Raja SN, Dong X, Guan Y. MrgC agonism at central terminals of primary sensory neurons inhibits neuropathic pain. *Pain.* 2014; 155 (3):534-544.
 41. He S-Q, Han L, Li Z, Xu Q, Tiwari V, Yang F, Guan XW, Wang Y, Raja SN, Dong X, Guan Y. Temporal changes in MrgC expression after spinal nerve injury. *Neuroscience.* 2014; 261(3):43-51.
 42. Yang F, Xu Q, Cheong YK, Shechter R, Sdrulla A, He S-Q, Tiwari V, Dong X, Wacnik PW, Meyer RA, Raja SN, Guan Y. Comparison of intensity-dependent inhibition of spinal wide-dynamic range neurons by dorsal column and peripheral nerve stimulation in a rat model of neuropathic pain. *European J. Pain.* 2014; 18(7):978-988.
 43. Xu Q, Cheong Y-K, Yang F, Tiwari V, Li J, Liu J, Raja SN, Li WY, Guan Y. Intrathecal carbenoxolone inhibits neuropathic pain and spinal wide-dynamic range neuronal activity in rats after an L5 spinal nerve injury *Neurosci. Lett.* 2014; 563(3):45-50.
 44. Xu Q, Cheong Y-K, He S-Q, Tiwari V, Liu J, Wang Y, Raja SN, Li J, Guan Y, Li WY. Suppression of spinal connexin 43 expression attenuates mechanical hypersensitivity in rats after an L5 spinal nerve injury. *Neurosci. Lett.* 2014; 566:194-199. *I contributed to experimental design, conducted data analysis and contributed the manuscript writing.*
 45. Guo R, Zhao Y, Zhang M, Wang Y, Shi R, Liu Y, Xu J, Wu A, Yue Y, Wu J, **Guan Y, Wang Y.** Downregulation of stargazin inhibits the enhanced surface delivery of AMPA receptor GluR1 subunit in rat dorsal horn and ameliorates postoperative pain after plantar incision. *Anesthesiology.* 2014; 121(3):609-619. *I contributed to experimental design, conducted data analysis and contributed the manuscript writing.*
 46. Li Z, He S-Q, Xu Q, Yang F, Tiwari V, Liu Q, Tang Z, Han L, Chu Y-X, Wang Y, Hin N, Tsukamoto T, Slusher B, Guan X, Wei F, Raja SN, Dong X, Guan Y. Activation of MrgC receptor inhibits N-type calcium channels in small-diameter primary sensory neurons in mice. *Pain.* 2014; 155 (8):1613-1621.
 47. Yang F, Zhang C, Xu Q, Tiwari V, He S-Q, Wang Y, Dong X, Vera-Portocarrero LP, Wacnik PW, Raja SN, Guan Y. Electrical stimulation of dorsal root entry zone attenuates wide-dynamic range neuronal activity in rats. *Neuromodulation.* 2015;18(1):33-40.
 48. Weng H, Patel KN, Jeske NA, Bierbower SM, Zou W, Tiwari V, Zheng Q, Tang Z, Mo G, Wang Y, Geng Y, Zhang J, Guan Y, Akopian A, Dong X. Trpm100 is a regulator of TRPA1-TRPV1 complex and contributes to persistent pain. *Neuron.* 2015; 85(4):833-846. *I conducted data analysis and contributed the manuscript writing.*
 49. Chen Z, Xie F, Bao M, Li X, Chao Y, Lin C, Guo R, Zhang C, Wu A, Yue Y, **Guan Y, Wang Y.** Activation of p38 MAPK in the rostral ventromedial medulla by visceral noxious inputs transmitted via the dorsal columns may contribute to pelvic organ cross-sensitization in rats with endometriosis. *Neuroscience.* 2015; 291:272-278. *I contributed to experimental design, conducted data analysis and contributed the manuscript writing.*
 50. Sdrulla AD, Xu Q, He S-Q, Tiwari V, Yang F, Zhang C, Shechter R, Raja SN, Wang Y, Dong X, Guan Y. Electrical stimulation of low-threshold afferent fibers induces a prolonged synaptic depression in lamina II dorsal horn neurons to high-threshold afferent inputs in mice. *Pain.* 2015; 156(6):1008-1017.
 51. Pang Z, Sakamoto T, Tiwari V, Kim YS, Yang F, Dong X, Guler AD, Guan Y, Caterina MJ. Selective Keratinocyte stimulation is sufficient to evoke nociception in mice. *Pain.* 2015; 156(4):656-665. *I contributed to experimental design, conducted data analysis and contributed the manuscript writing.*
 52. Wang Y, Zhang M, Xie F, Li X, Bao M, Yang N, Shi R, Wang Z, Wu Z, **Guan Y, Yue Y.** Upregulation of $\alpha 2\delta$ -1 Calcium Channel Subunit in the Spinal Cord Contributes to Pelvic Organ Cross-Sensitization in a Rat Model of Experimentally-Induced Endometriosis. *Neurochemical Research.* 2015; 40(6):1267-1273. *I contributed to experimental design, conducted data analysis and contributed the manuscript writing.*
 53. Xu Q, Yang F, Sdrulla AD, Raja SN, Dong X, Guan Y. Electrophysiologic mechanisms of "pain gating" in the superficial dorsal horn by activation of low-threshold afferent fibers. *J. Pain.* 2015; 6(4):S63.
 54. Sacré P, Sarma SV, Guan Y, Anderson WS. Electrical neurostimulation for chronic pain: on selective relay of sensory neural activities in myelinated nerve fibers. 2015; <http://de.arxiv.org/pdf/1507.02716>. *I contributed to experimental design, conducted data analysis and contributed the manuscript writing.*
 55. Li Z, He S-Q, Tseng P-Y, Xu Q, Tiwari V, Yang F, Shu B, Zhang T, Tang Z, Raja SN, Wang Y, Dong X, Guan Y. The inhibition of high-voltage-activated calcium current by activation of MrgC11 involves phospholipase C-dependent mechanisms. *Neuroscience.* 2015; 300:393-403.

56. Yang F, Zhang T, Tiwari V, Shu B, Zhang C, Wang Y, Vera-Portocarrero LP, Raja SN, Guan Y. Effects of combined electrical stimulation of the dorsal column and dorsal roots on wide-dynamic range neuronal activity in nerve-injured rats. *Neuromodulation*. 2015; 18(7):592-597.
57. Xie F, Li X, Bao M, Guo R, Zhang C, Wu A, Yu Y, **Guan Y**, Wang Y. Plerixafor may treat intractable post-herpetic neuralgia. *Medical Hypothesis*. 2015; 85(4):491-493. *I contributed to experimental design, conducted data analysis and contributed the manuscript writing.*
58. Wang C, Yang Y, Wang Z, Zhu C, Yu G, Wu G, Yang N, Shi H, Tang M, Meng Y, Yang F, Peng Y, Hu D, Liu Q, **Guan Y**, Dong X, Duan J, Tang Z. Pirt contributes to uterine contraction-induced pain in mice. *Molecular Pain*. 2015; 11(1):57. *I contributed to experimental design, conducted data analysis and contributed the manuscript writing.*
59. Xie F, Li X, Bao M, Shi RL, Yu Y, **Guan Y**, Wang Y. Anesthetic propofol normalized the increased release of glutamate and γ -amino butyric acid in hippocampus after paradoxical sleep deprivation in rat. *Neurological Research*. 2015; 37(12):1102-1107. *I contributed to experimental design, conducted data analysis and contributed the manuscript writing.*
60. Zhu W, Mao Z, Zhu C, Li M, Gao C, **Guan Y**, Yuan J, Xie G, Guan XW. Adolescent exposure to cocaine increases anxiety-like behavior and induces morphologic and neurochemical changes in the hippocampus of adult rats. *Neuroscience*. 2016; 313:174-183. *I contributed to experimental design, data analysis and contributed the manuscript writing.*
61. Tiwari V, Yang F, He S-Q, Shechter R, Zhang C, Shu B, Zhang T, Tiwari V, Wang Y, Dong X, Guan Y, Raja SN. Activation of Peripheral μ -opioid Receptors by Dermorphin [D-Arg2, Lys4] (1-4) Amide Leads to Modality-preferred Inhibition of Neuropathic Pain. *Anesthesiology*. 2016; 124(3):706-720. **Co-corresponding author.** *I contributed to experimental design, conducted data analysis and contributed the manuscript writing.*
62. Hu P, Zhu W, Zhu C, Jin L, **Guan Y**, Guan XW. Resveratrol fails to affect cocaine conditioned place preference behavior, but alleviates anxiety-like behaviors in cocaine withdrawn rats. *Psychopharmacology (Berl)*. 2016; 233(7):1279-1287. *I contributed to experimental design, conducted data analysis and contributed the manuscript writing.*
63. Tang M, Wu G, Wang Z, Yang N, Shi H, He Q, Zhu C, Yang Y, Yu G, Wang C, Yuan X, Liu Q, **Guan Y**, Dong X, Tang Z. Voltage-Gated Potassium Channels Involved in Regulation of Physiological Function in MrgprA3-Specific Itch Neurons. *Brain Research*. 2016; 1636:161-171. *I contributed to experimental design, conducted data analysis and contributed the manuscript writing.*
64. Chao Y, Xie F, Li X, Guo R, Yang N, Zhang C, Shi R, **Guan Y**, Yue Y, Wang Y. Demethylation regulation of BDNF gene expression in dorsal root ganglion neurons is implicated in opioid-induced pain hypersensitivity in rats. *Neurochemistry International*. 2016; 97:91-98. *I contributed to experimental design, conducted data analysis and contributed the manuscript writing.*
65. Yang F, Xu Q, Shu B, Tiwari V, He S-Q, Vera-Portocarrero LP, Dong X, Linderoth B, Raja SN, Wang Y, Guan Y. Activation of cannabinoid CB1 receptor contributes to suppression of spinal nociceptive transmission and inhibition of mechanical hypersensitivity by A β -fiber stimulation. *Pain*. 2016; 157(11):2582-2593. PMID: 27589093; PMCID: PMC5069149.
66. Kim YS, Anderson M, Park K, Zheng Q, Agarwal A, Gong C, Saijilafu Young L, He S-Q, LaVinka PC, Zhou F, Bergles D, Hanani M, **Guan Y**, Spary DC, Dong X. Coupled activation of primary sensory neurons contributes to chronic pain. *Neuron*. 2016; 91(5):1085-1096. *I contributed to experimental design, conducted data analysis and contributed the manuscript writing.*
67. Sun SH, Xu Q, Guo C, **Guan Y**, Liu Q, Dong X. Leaky gate model: intensity-dependent coding of pain and itch in spinal cord. *Neuron*. 2017; 93(4):840-853. *I contributed to experimental design, conducted data analysis and contributed the manuscript writing.*
68. Li Z, Tseng P-Y, Tiwari V, Xu Q, He S-Q, Wang Y, Zheng Q, Han L, Wu Z, Blobaum AL, Cui Y, Tiwari V, Sun S, Cheng Y, Huang-Lionnet J, Geng Y, Xiao B, Peng J, Hopkins CR, Raja SN, Guan Y, Dong X. Targeting human Mas-related G-protein-coupled receptor X1 to inhibit persistent pain. *Proc. Natl. Acad. Sci. U. S. A.* 2017; 114(10): 1996-2005. **Co-corresponding author. Press/News release (portion)**
Pain Research Forum. <http://www.painresearchforum.org/news/79796-itch-periphery-pain-spinal-cord-dual-nature-mrgprx1>
69. Shu B, Yang F, Guan Y. Intra-spinal microstimulation may alleviate chronic pain after spinal cord injury. *Med Hypotheses*. 2017 Jul;104:73-77. doi: 10.1016/j.mehy.2017.05.028. Epub 2017 May 27.. PMID: 28673596; PMCID: PMC5519132
70. Liu Y, Kong C, Cui L, Yuan X, Zhao P, Zhang Y, **Guan Y**, Chen X. Correlation between diffusion tensor imaging parameters and clinical assessments in cervical spondylotic myelopathy patients with and without high signal intensity. *Spinal Cord*. 2017;55(12):1079-1083. doi: 10.1038/sc.2017.75 *I contributed to analysis, discussion and the manuscript writing.*
71. Zhu W, Ge X, Gao P, Li M, **Guan Y**, Guan X. Adolescent cocaine exposure induces prolonged synaptic modifications in medial prefrontal cortex of adult rats. *Brain Structure and Function*. 2018 May;223(4):1829-1838. doi: 10.1007/s00429-017-1590-0. Epub 2017 Dec 15. *I contributed to experimental design data analysis and manuscript writing.*
72. Li X, Guo R, Sun Y, Li H, Ma D, Zhang C, **Guan Y**, Li J, Wang Y. Botulinum toxin type A and gabapentin attenuate postoperative pain and NK1 receptor internalization in rats. *Neurochemistry International*. 2018 Mar 20;116:52-62. *I contributed to experimental design data analysis and manuscript writing.*
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73. Yang F, Anderson M, He S-Q, Stephens K, Zheng Y, Chen ZY, Raja SN, Aplin, F, **Guan Y**, Fridman G. Differential expression of voltage-gated sodium channels in afferent neurons renders selective neural block by ionic direct current. *Science Advances*. 2018; Apr 11;4(4):eaq1438. doi: 10.1126/sciadv.aq1438. **Co-corresponding author.**
Press/News release (portion):
<https://www.sciencedaily.com/releases/2018/04/180418092026.htm>
<https://www.hopkinsmedicine.org/news/articles/a-new-concept-for-neural-implants>
<http://healthmedicinet.com/i/direct-electrical-current-used-to-preferentially-inhibit-pain-transmitting-neurons/>
<http://www.healthnewsdigest.com/news/pain%20issues0/Direct-Electrical-Current-Used-to-Preferentially-Inhibit-Pain-Transmitting-Neurons.shtml>
<https://www.alnmag.com/news/2018/04/direct-electrical-current-used-preferentially-inhibit-pain-transmitting-neurons>
<https://www.mdtmag.com/news/2018/04/direct-electrical-current-used-preferentially-inhibit-pain-transmitting-neurons>
<https://www.news-medical.net/news/20180418/Direct-electrical-current-can-be-delivered-to-nerves-for-blocking-pain-signals.aspx>
<https://www.rdmag.com/news/2018/04/direct-electrical-current-used-preferentially-inhibit-pain-transmitting-neurons>
74. Tiwari V, Anderson M, Yang F, Tiwari V, Zheng Q, He S-Q, Zhang T, Shu B, Chen XM, Grenald S, Stephens K, Chen Z, Dong X, Raja SN, **Guan Y**. Peripherally Acting μ -Opioid Receptor Agonists Attenuate Ongoing Pain-associated Behavior and Spontaneous Neuronal Activity after Nerve Injury in Rats. *Anesthesiology*. 2018 Jun; 128(6):1220-1236.
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2. Raja SN, Sivanesan E, **Guan Y**. Central Sensitization, N-methyl-D-aspartate Receptors, and Human Experimental Pain Models: Bridging the Gap between Target Discovery and Drug Development. *Anesthesiology*. 2019 Aug;131(2):233-235. doi: 10.1097/ALN.0000000000002808.

FUNDING

NARRATIVE SUMMARY. I have a demonstrated record of productive research projects in areas that are of high relevance for patients suffering from chronic pain. Currently, I have successfully competed for an aggregate amount of ~\$1.5 million/year (including indirect cost) in external and intramural research funding from NIH and industry, including 2 new 5-yr R01s as PI through 2024/2025, a 5-yr R01 as PI through 2022, 3 new 5-yr R01 as MPI/Co-I through 2025, and 2 other R01s as Co-I. I also have fully executed awards from Medtronic Inc. and from TissueTech Inc.

EXTRAMURAL Funding (total direct cost amount)

Research Extramural Funding – Current

- 7/1/20 - 6/31/25 Birth Tissue Products for Non-opioid Treatment of Post-surgical Pain.
R01 NS117761 NIH/NINDS
\$1,850,000 (DIC)
Role: PI, 25%. The current submission is a multidisciplinary proposal to discover and validate the use of human birth tissues (e.g., amniotic membrane, umbilical cord) as a novel non-opioid treatment of post-surgical pain, and to unravel the dual mode of anti-pain action.
- 3/1/19 - 1/31/24 Mechanistic Study of Pain Inhibition by Activation of Non-nociceptive Afferent Fibers.
R01 NS110598 NIH/NINDS
\$1,500,000 (DIC)
Role: PI, 25%. The current submission is a multidisciplinary proposal to study the neurobiological mechanisms that underlie pain inhibition by electrical stimulation of low-threshold afferent A β -fibers (A β -ES). We further examine an innovative strategy of “circuitry-specific enhancement of pain inhibition” to improve A β -ES pain therapies, such as dorsal column stimulation.
- 4/1/16 - 3/31/23 Mrgs, A New Target for the Treatment of Neuropathic Pain.
R01 NS070814-06 (NCE) NIH/NINDS
\$1,150,000 (DIC)
Role: PI, 16%; We will use complementary animal behavioral, electrophysiological, and molecular biological approaches to better assess the therapeutic utility of MrgrprX1 agonist for the treatment of neuropathic pain and to understand the cellular and molecular mechanisms underlying the drug action. This study may identify a new pain-specific treatment target and lead to a novel mechanism-based approach to the treatment of neuropathic pain.
- 9/1/21 - 8/31/26 CRCNS Research Proposal: Restoration from Chronic Pain to Healthy via Closed-Loop Peripheral Nerve Stimulation.
R01 AT011844-01 NIH/NCCIH
\$1,250,000 (DIC)
PI: Sarma S (JHU, Biomedical engineering), Guan Y.
Role: Multi-PI. 5 % and \$100,000 DIC/year, Guan allocation. The proposed program will build a computational framework for a novel adaptive, model-based closed-loop peripheral nerve stimulation approach for the restoration of the dysfunctional pain system back to a healthy state.
- 10/1/20 - 9/31/24 Subchondral Bone Cavities in Osteoarthritis Pain.
R01 AG068997 NIH/NIA
\$1,250,000 (DIC)
PI: Cao X (Dept. Orthopedics, JHU), Guan Y.
Role: Multi-PI, 10% and \$100,000 DIC/year, Guan allocation. We will test the hypothesis that osteoclast-initiated uncoupled bone remodeling induces sensory innervation in the subchondral bone by elevated secretion of netrin-1 to mediate OA pain. We will determine the therapeutic potential by inhibition of osteoclast-initiated subchondral aberrant bone remodeling to reduce sensory innervations and OA pain.
- 7/1/20 - 6/31/25 Safe Direct Current Stimulator (SDCS) technology for blocking chronic peripheral pain.
R01NS110893 NIH/NINDS
\$2,450,000 (DIC)
PI: Fridman G (JHU, Biomedical engineering),
Role: Co-I, 10% and \$100,000 DIC/year, Guan allocation. The central goal of this project is to advance the technology toward achieving efficient suppression of the nervous system and to improve the application of neural prostheses for the treatment of chronic pain.
- 2/1/21 - 1/31/25 Development of MRGPRX1 positive allosteric modulators as non-addictive therapies for neuropathic pain.
R01UH3NS115718 NIH/NINDS
-

\$ 1,524,982/year
PI: Tsukamoto T (BSI)

Role: Co-I, 10% and \$120,000 DIC/year, Guan allocation. The central goal of this proposal is to develop a novel, central nervous system (CNS)-penetrant small molecule MRGPRX1 PAM that can be given orally to treat chronic neuropathic pain conditions.

9/1/20 - 8/31/25

Skeleton and Joint Degeneration with Aging.

P01AG066603 NIH/NIA

\$2,398,671 (DIC)

PI: Cao X (Dept. Orthopedics, JHU),

Role: Co-I, 5%. The in vivo Animal model & histology core is to consolidate key personnel and equipment to provide a centralized facility that will enhance collaborative and multidisciplinary investigations into age related skeletal degenerative disease.

10/1/16 - 9/30/22

Injury-Induced Pain: Chemical Modulation of Nociceptors.

R01 NS26363-26 (NCE) NIH/NINDS

\$1,250,000

PI: Raja SN (Dept. Anesthesiology/CCM, JHU)

Role: Co-I, 15%. We aim to enhance peripheral cannabinoid and opioid analgesia to attenuate ongoing pain, and examine the underlying mechanisms.

8/1/16 - 10/31/22

Pre-clinical Study of Subliminal High Density Stimulation for Pain Treatment.

Medtronic Inc.

\$250,000

Role: PI, 5%; We will compare the inhibitory actions of subliminal high-density stimulation and those of conventional spinal cord stimulation on neuropathic pain-related behavior in rats to reveal spinal segmental mechanisms that may underlie the pain relief induced by subliminal high-density stimulation in nerve-injured rats.

7/1/18 - 6/30/22

Study of Human Birth Tissue Products in Various Animal Models Stimulation.

Tissue Tech, Inc.

\$103,200

Role: PI, 3%; We will examine compound X-containing birth tissue products in various animal models of clinical-relevant pain conditions.

Research Extramural Funding – Pending

12/1/23 - 11/30/28

Developing non-opioid pain treatments through a context-dependent inhibition of TRPA1 activity in primary sensory neurons

R01 TBA NIH/NINDS

\$2,2305,085

Role: PI, Patients with nerve-generated pain experience significant suffering, but effective nonopioid therapy is lacking. We aim to determine if cell-permeable peptides (P2-Mut, h2F2) that we developed will attenuate neuropathic pain by selectively inhibiting a cell membrane channel called TRPA1 in primary sensory neurons. We envision that these peptides will provide effective pain relief without causing the side effects of conventional TRPA1 blockers, which block all TRPA1 channels, and not just those involved in pain.

2/1/21 - 1/31/26

Discovery of novel non-opiate pain therapy targeting sodium channels.

R01 DA048041 NIH/NIDA (Resubmission, 2020.7)

\$2,250,000

PI: James Barrow (Liber Institute)

Role: Co-I, 15% and \$150,000 DIC/year, Guan allocation. This proposal is multidisciplinary in nature to develop novel centrally acting Na_v1.8 inhibitors that are both efficacious in models of

inflammatory and neuropathic pain, as well as rescuing identified physiological and behavioral abnormalities seen in TCF4 haploinsufficient mice.

Research Extramural Funding – Previous

- 3/1/06 - 2/28/11 Injury-Induced Pain: Chemical Modulation of Nociceptors.
R01 NS26363-16 NIH/NINDS
\$1,100,000
PI: Raja SN
Role: Co-I, 15%; The major goals of the project were to examine the role and mechanisms of peripheral mu-opioid receptor-mediated analgesia in neuropathic pain. Studies examined whether enhancing peripheral MOR-mediated analgesia leads to decreases in systemic opioid requirement.
- 3/1/06 - 2/28/11 PKC-dependent spinal GluR2 internalization triggered by NMDARs in neuropathic pain.
R01 NS 058886 NIH/NINDS
\$1,195,000
PI: Tao Y
Role: Co-I, 5%; The major goals of this project were to examine whether peripheral nerve injury leads to spinal GluR2 internalization and whether spinal cord NMDA receptors and PKC are required in this response.
- 12/30/07 - 6/30/10 Spinal Cord Stimulation for Pain Treatment: Identifying the optimal SCS stimulation site in a neuropathic pain model: Effects of Spinal Cord Stimulation on Dorsal Horn Neuronal Responses in Rats After L5 Spinal Nerve Injury
Medtronic Inc.
\$434,034
PI: Raja SN
Role: Co-I, 40%; The main goal of this study was to examine the potential mechanisms of the antinociceptive/antihyperalgesic actions of SCS in alleviating chronic neuropathic pain, and to identify the most effective site(s) of stimulation.
- 1/22/10 - 6/30/12 Spinal Cord Stimulation for Pain Treatment (Second addendum): Examine compound action potential to different peripheral stimulations and study the intensity-response relationships for conditioning stimulation at peripheral and central structures on WDR neuronal response.
Medtronic Inc.
\$330,050
PI: Raja SN
Role: Co-I, 10%; This study evaluated differential effects of different forms of peripheral tissue/nerve stimulation on pain, and identified the intensity-dependent features of conditioning stimulation at central and peripheral nervous tissue on modulating WDR neuronal responsiveness.
- 4/27/11 - 7/31/12 Spinal Cord Stimulation for Pain Treatment (Third addendum): The Effects of Ultra-High Frequency SCS on Animal Pain and Dorsal Horn Activity in Rats after Spinal Nerve Injury.
Medtronic Inc.
\$87,863
PI: Raja SN
Role: Co-I, 25%; We identified the effective parameters for high-frequency SCS to inhibit neuropathic pain in a well-established neuropathic pain model in rat. Further, the study examined the feature and neuronal mechanisms through which UHF-SCS inhibits neuropathic pain. This work may provide an important rationale and biological basis for applying UHF-SCS in the treatment of chronic disabling pain.
- 7/1/11 - 6/30/12 Examining the Analgesic Effect of Fatty Acid Amide Hydrolase (FAAH) Inhibitors on Neuropathic Pain in Rats.
NIAAA-Federal Contract NIH/NIAAA
\$20,000
-

- Role: PI, 5%;** The work involved tests of FAAH-related compounds in preclinical rat models of neuropathic pain.
- 4/1/11 - 3/31/16 Mrgs, A New Target for the Treatment of Neuropathic Pain.
R01 NS070814-01 NIH/NINDS
\$925,000
Role: PI, 40%; We examined the role of MrgC in neuropathic pain to understand the cellular and molecular mechanisms underlying the drug action.
- 8/1/11 - 7/31/16 Injury-Induced Pain: Chemical Modulation of Nociceptors.
R01 NS26363-21 NIH/NINDS
\$1,250,000
PI: Raja SN
Role: Co-I, 20%; We examined ways to enhance peripheral opioid analgesia and attenuate tolerance to peripherally acting opioids by modulating the interactions of mu-opioid receptors and delta-opioid receptors in the peripheral nervous system.
- 7/31/12 - 7/31/13 Spinal Cord Stimulation for Pain Treatment (fourth addendum): The Effects of Low Intensity (10-20% MT) & The Intensity-Response Relationship.
Medtronic Inc.
\$162,056
Role: Co-PI, 25%; We conducted behavioral studies to examine the effects of low intensity (10-20% motor threshold) spinal cord stimulation of different frequencies on mechanical hypersensitivity in rats after spinal nerve injury. Electrophysiology studies examined the intensity-response relationship for tibial nerve stimulation on wide-dynamic-range neuronal responses in nerve-injured rats.
- 4/1/12 - 3/31/14 Transgenic Regulation of Keratinocyte to Nociceptor Signaling.
R21 AR062826-01 NIH/NINDS
\$270,000
Role: Co-I, 5%; We generated and characterized transgenic mice in which selectively activatable molecules were expressed in defined keratinocyte subpopulations. We addressed the hypotheses that keratinocyte stimulation is sufficient to activate nociceptive neurons *in vivo* and that such signaling is epidermal layer-specific nonpainful heat stimuli.
- 8/1/12 - 7/31/16 Neuronal Subtype-Specific Plasticity in the Acute to Chronic Pain Transition.
R01DE022750- 01 NIH/NIDCR
\$1,584,000
PIs: Ginty D, Caterina M, Dong X.
Role: Co-I, 3%; The goal of this proposal was to develop novel imaging, transgenic, and behavioral tools to examine what changes account for the transition from acute to chronic pain in mice.
- 1/1/14 - 12/31/15 Spinal Cord Stimulation for Pain Treatment (fifth addendum): Pilot Study of High Density Stimulation.
Medtronic Inc.
\$208,400
Role: Co-PI, 15%; We tested whether combining different frequencies of spinal cord stimulation (4 Hz, 50 Hz, 500 Hz) at the dorsal column and the dorsal root, either as a concurrent or alternate patterns, resulted in additive or synergistic interactions to better inhibit spinal pain transmission in neuropathic rats.
- 10/1/16 - 9/30/19 Developing Novel Direct Current Stimulation Technology for Safe Precision Pain Treatment
R21 NS099879-01 NIH/NINDS
\$270,000
Role: PI, 25%; Neural prostheses can deliver reliable and efficient functional excitation of the nervous system to enable technology such as cochlear implants, retinal implants, pacemakers, spinal cord stimulators, and deep brain stimulators. The central goal of this project is to advance

the technology toward achieving efficient suppression of the nervous system and to improve the application of neural prostheses for the treatment of chronic pain.

- 11/1/18 - 11/1/19 Preemptive SCS for CIPN Pain Treatment
Thompson Family Foundation Initiative
\$ 93,000
Role: PI, 3%; We will examine whether different patterns of spinal cord stimulation can alleviate the pain induced by chemotherapy drugs in animal models.
- 8/1/16 - 5/31/21 Towards Pain Control: Synergizing Computational and Biological Approaches to Develop an Integrated Model of the Closed-Loop Pain System.
R01 AT009401-01 NIH/NCCIH
\$969,024 (NCE)
PI: Sarma S (Dept. BME, Institute of Computational Science, JHU)
Role: Co-I, 9% and \$100,000 DIC/year, Guan allocation. The proposed program involves developing a computer modeling framework of the closed-loop pain system that enables tractable analysis of pain transmission to the brain in healthy and pathological conditions and the modulatory effects of neurostimulation.

INTRAMURAL Funding (total direct cost amount)

Research Intramural Funding - Current

- 10/1/17 - 9/30/22 Pain Neuromodulation Center Grant.
Neurosurgery Pain Research Institute (NPRI), Johns Hopkins University.
\$1,250,000
Role: Director; We will promote and expand neuromodulation pain research at the Johns Hopkins University.

Research Intramural Funding – Pending none

Research Intramural Funding – Previous

- 7/1/07 - 6/30/08 Novel Mechanisms in Spinal Pain Processing May Involve Mrg Signaling System.
Blaustein Pain Fund Award, Johns Hopkins University.
\$40,864
Role: PI, 25%; This neurophysiological study delineated novel functional roles for the Mrg system in spinal pain transmission, particularly in regulating spinal neuronal sensitization induced by repetitive electrical stimulation or mustard oil-induced intense noxious chemical stimuli.
- 7/1/08 - 6/30/09 Exploring Mechanisms of Peripheral Opioid Analgesic Tolerance in an Experimental Model of Neuropathic Pain.
Blaustein Pain Fund Award, Johns Hopkins University.
\$20,000
Role: PI, 15%; This study established a novel animal model that could be used in future studies to explore mechanisms underlying peripheral opioid tolerance, particularly under clinically relevant chronic pain conditions.
- 7/1/11 - 6/30/12 Pain After Lumbar-Spinal Cord Injury: Novel Animal Model and Treatment Strategy.
Blaustein Pain Fund Award, Johns Hopkins University.
\$32,000
Role: PI, 5%; We established novel animal models for better studying at-level pain induced by lumbar spinal cord injury (SCI), and to determine if intra-spinal microstimulation (ISMS, at the injury level) and dorsal root entry zone stimulation (DREZ, in the injured and uninjured spinal segment) inhibits the activity of spinal pain-processing neurons in SCI rats.
- 7/3/11 - 7/5/13 Studying Pain by Novel *In Vivo* Recording and Imaging of DRG Neurons in Transgenic Mice
Brain Science Institute, Johns Hopkins University.
\$218,000
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Role: M-PI, 20%; Using high-throughput approaches and pharmacologic tools (e.g., capsaicin and agonists for MrgC and MrgD), we examined the functions of distinct subgroups of DRG neurons in acute pain and chronic neuropathic pain conditions, and tested drug effects on neuronal activity.

- 9/1/11 - 8/31/12 Mrgs as Potential Anti-Chronic Pain Targets.
Brain Science Institute, Johns Hopkins University.
\$50,000
Role: Co-PI, 5%; The goal of this translational study was to directly examine the analgesic properties of MrgX1 agonist in preclinical neuropathic pain models.
- 1/1/13 - 12/30/13 Safe Spinal Direct Current Stimulation: A Novel Approach for Neuropathic Pain Inhibition.
Blaustein Pain Fund Award, Johns Hopkins University.
\$24,000
PI: Fridman G
Role: Co-I, 5%; We used *in vivo* electrophysiological approaches in nerve-injured rats to establish the optimal location and electrode specification for the salt-bridge tube electrodes to attenuate dorsal horn neuron activity. Based on this specification we will design and manufacture the optimal electrodes to deliver safe DC inhibition to the spinal cord
- 7/1/14 - 6/30/15 Spinal Mechanisms of Pain Inhibition from Electric Stimulation of Large Afferent Fibers.
Blaustein Pain Fund Award, Johns Hopkins University.
\$39,413
Role: PI, 5%; The goal of this project was to identify novel spinal substrates and neurophysiologic mechanisms that may contribute to pain inhibition from electrical stimulation of A β -fibers in animal models of neuropathic pain.
- 4/1/16 - 3/30/17 Developing Safe Direct Current Stimulation Technology as a Novel Precision Pain Therapy.
StAAR award, Department of Anesthesiology, Johns Hopkins University.
\$45,250
Role: PI, 5%; We will uncover the neurophysiologic mechanisms that underlie pain inhibition by iDC, optimize the stimulation parameters and advance the development of SDCS technology for precision pain treatment.
- 7/1/16 - 9/30/18 Developing Novel Neuromodulation Technology for Pain-specific Treatment.
Neurosurgery Pain Research Institute (NPRI), Johns Hopkins University.
\$559,890
Role: PI, 5%; We will test the hypothesis that weak electrical field neuromodulation in peripheral nerves can be used for pain-specific inhibition. Our study will provide experimental evidence and establish the biological basis for developing innovative technologies, including hybrid electrical neuromodulation(HEN) for personalized pain treatment.

CLINICAL ACTIVITIES: N/A

EDUCATIONAL ACTIVITIES

Educational Focus

Teaching

Classroom instruction

- 1996-1998 Physiology and laboratory techniques for medical students, Peking Union Medical College, Beijing, China.
2005-2006 Biochemistry, NS616. CRNA program, University of Maryland, School of Nursing, Baltimore, Maryland, USA.
2005-2006 Laboratory techniques for Ph.D. student and faculty, University of Maryland, School of Nursing, Baltimore, Maryland, USA.

Clinical instruction: N/A

CME instruction: none

Workshops/seminars: none

Mentoring

Pre-doctoral Advisees /Mentees

- 1996 – 1997 Jianzhen Xie, BS, [technician], currently researcher at Chinese Academy of Medical Sciences & Peking Union Medical College, Beijing, China.
- 1997 – 1998 Chao Ma, MD, [Medical student], currently professor at the basic science institute of Chinese Academy of Medical Sciences, Peking Union Medical College, Beijing, China; Previously assistant professor at Yale University, Department of Anesthesiology, CT, USA; Co-authored article OR 35.
- 2007-2009 Frank Yuan, BS [technician], Division of Pain Medicine, ACCM, Johns Hopkins University, Maryland, current situation: n/a. Co-authored articles OR 21,26.

Post-doctoral Advisees/Mentees

- 2005 – 2006 Sherry Lesley, RN, PhD. [doctoral student], currently assistant professor at School of Nursing, University of Maryland, MD. USA.
- 2006 – 2007 Jang-Su Park, MD, [visiting scientist], currently associate professor, attending physician, Inje University Ilsan Paik Hospital, Goyan-Si, Gyeonggi-do, Korea; Co-authored article OR 15.
- 2006-2007 Xuehong Shang, MS, [technician], Division of Pain Medicine, ACCM, Johns Hopkins University, Maryland, currently senior technician, Boston University, MA, USA.
- 2009-2010 Liqiang Xing, MD, [visiting scientist], Division of Pain Medicine, ACCM, Johns Hopkins University, Maryland, currently director of laboratory of electronic microscope, experiment center, Hebei North University, Zhangjiakou, China. Co-authored articles OR 31.
- 2009-2012 Alene F Carteret, MS, [technician], Division of Pain Medicine, ACCM, Johns Hopkins University, Maryland, currently laboratory manager and Blaustein Pain Conference coordinator. Co-authored articles OR 21,22,26,30,31,32,37,39.
- 2009-2010 Chi-Yang Chung, MD, [post-doctoral fellow], Division of Pain Medicine, ACCM, Johns Hopkins University, Maryland, currently attending anesthesiologist, Far Eastern Memorial Hospital, Department of Anesthesiology, Pan-Chiao City, Taiwan. Co-authored articles OR 26,30-32.
- 2010-2012 Alvin McKelvy, PhD, [T32 post-doctoral fellow], Division of Pain Medicine, ACCM, Johns Hopkins University, Maryland, currently unknown. Co-authored articles OR 30,32.
- 2010-2018 Fei Yang, PhD, [post-doctoral fellow], Division of Pain Medicine, ACCM, Johns Hopkins University, Maryland, currently Professor at Department of Neurobiology, School of Basic Medical Sciences, Advanced Innovation Center for Human Brain Protection, Capital Medical University, China. Co-authored articles OR 30-32, 37,39, 40-43,46,47,50,53,55,56,61,65.
- 2011-2013 Ronen Shechter, MD, [T32 post-doctoral fellow], Division of Pain Medicine, ACCM, Johns Hopkins University, Maryland, currently faculty at Assistant Professor rank, ACCM, Johns Hopkins University. Co-authored articles OR 37,39,40,42,50,61.
- 2012-2014 Qian Xu, MD, [graduate student/trainee], Joint-Training Program with Medical School of Nanjing University, China, currently attending physician, Department of Anesthesiology, Nanjing Chinese Medical University. Co-authored articles OR 38,39,41-44.
- 2012-2014 Yong-Kwan Cheong, MD, PhD, [post-doctoral fellow], Division of Pain Medicine, ACCM, Johns Hopkins University, currently attending anesthesiologist, Assistant Professor, Wonkwang University Hospital, Iksan, South Korea. Co-authored articles OR 37,39,42-44.
- 2012-2016 Zhe Li, PhD, [graduate student], Program in Biochemistry, Cellular and Molecular Biology (BCMB), Johns Hopkins University, Maryland, currently clinical staff, Johns Hopkins University. Co-authored articles OR 35,40,41,46,55,68.
- 2012-2013 Andrei D. Sdrulla, MD, PhD, [post-doctoral fellow], Division of Pain Medicine, ACCM, Johns Hopkins University, currently faculty at Assistant Professor rank, Department of Anesthesiology, Portland, Oregon Health and Science University. Co-authored articles OR 37,42,50,53.
- 2013-2016 Vinod Tiwari, PhD, [post-doctoral fellow], Division of Pain Medicine, ACCM, Johns Hopkins University. Currently Assistant Professor, Department of Pharmaceutical Engineering & Technology Indian Institute of Technology (B.H.U.), Varanasi-221005 (U.P.) India. Co-authored articles OR 40-44, 46-48,50,55,56,61, 65, 68; RA 4,5; BC 1.
- 2014-2015 Chen Zhang, MD, PhD, [visiting scientist], Division of Pain Medicine, ACCM, Johns Hopkins University, currently attending anesthesiologist, Chao Yang Hospital, Beijing, China. Co-authored articles OR 47,50,56,61.
- 2014-2016 Bin Shu, MD, [graduate student/trainee], Joint-Training Program, currently resident, Tongji Medical College, China. Co-authored articles OR 55,56,61,65.
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- 2015-2016 Tong Zhang, MD, PhD, [visiting scientist], Division of Pain Medicine, ACCM, Johns Hopkins University, currently attending neurologist, Tian Tan Hospital, Beijing, China. Co-authored articles OR 55,56,61; RA 5; BC 1.
- 2015-2016 Vineeta Tiwari, MS, [research scholar], Currently Department of Pharmaceutical Engineering & Technology Indian Institute of Technology (B.H.U.), Varanasi-221005 (U.P.) India. Co-authored articles. OR 61,68; RA 5; BC 1.
- 2015-2017 Michael Anderson, MS [technician, research specialist], Division of Pain Medicine, ACCM, Johns Hopkins University, Maryland. Co-authored articles OR 66.
- 2016-2018 Ya Yang, Ph.D [technician, research specialist], Division of Pain Medicine, ACCM, Johns Hopkins University, currently clinical staff at JHU.
- 2017-2019 Shaness Grenald, PhD [T32 post-doctoral fellow], Division of Pain Medicine, ACCM, Johns Hopkins University, currently senior scientist at Johnson & Johnson.
- 2017-2018 Cong cong [Research Volunteer, Trainee], Master of Health Science, School of Public Health, Johns Hopkins University.
- 2017-2018 Shuguang Liu, MD, [doctoral candidate of Orthopaedics/trainee], Joint-Training Program. Currently attending physician, Assistant Professor, Department of Orthopaedics, Hong Hui Hospital, Affiliated Hospital of Medical School, Xi'an Jiaotong University, Xi'an, Shaanxi, China.
- 2018-2019 Wanru Duan, MD, Ph.D, [visiting scientist], currently attending physician, Assistant Professor, Department of Neurosurgery, Xuan Wu Hospital, Capital Medical University, Beijing, China.
- 2017-2019 Eellan Sivanesan, MD [T32 post-doctoral fellow], currently attending physician, Assistant Professor, Division of Pain Medicine, ACCM, Johns Hopkins University.
- 2013-2019 Kimberly E. Stephens, PhD, MHP, [T32 post-doctoral fellow], Pharmacology and Molecular Sciences, Johns Hopkins University, currently Assistant Professor, Department of Pediatrics Center for Applied and Research Evaluation, University of Arkansas for Medical Sciences.
- 2016-2019 Christopher Lin [Research Volunteer], Bachelors of Science in Chemical and Biomolecular Engineering, Johns Hopkins University, currently medical student and University of South California.
- 2018-2019 Danxu, Ma, MD, Ph.D, [visiting scientist], visiting scientist at Division of Pain Medicine, ACCM, Johns Hopkins University. Currently Department of Anesthesiology, Chao Yang Hospital, Capital Medical University, Beijing, China.
- 2018-2020 Xinyan Gao, MD, Ph.D, [visiting scientist/ post-doctoral fellow], visiting scientist at Division of Pain Medicine, ACCM, Johns Hopkins University. Currently Professor, Department of Physiology, Institute of Acupuncture, China Academy of Chinese Medical Sciences, China.
- 2019-2020 Ruijuan Guo, MD, Ph.D, [visiting scientist], visiting scientist at Division of Pain Medicine, ACCM, Johns Hopkins University. Currently Department of Anesthesiology, Friendship Hospital, Capital Medical University, Beijing, China.
- 2016-2020 Christine Beauchene, PhD [post-doctoral fellow], Department of Biomedical Engineering, Johns Hopkins University, Baltimore, MD.
- 2016-2020 Zhiyong Chen, MD, PhD [post-doctoral fellow], Division of Pain Medicine, ACCM, Johns Hopkins University.
- 2017-2020 Eellan Sivanesan, MD, [T32 post-doctoral fellow, Assistant professor], Division of Pain Medicine, ACCM, Johns Hopkins University, Maryland, currently faculty at Assistant Professor rank, ACCM, Johns Hopkins University.
- 2017-2021 Qian Huang, PhD [post-doctoral fellow], Division of Pain Medicine, ACCM, Johns Hopkins University.
- 2011-present Shao-Qiu He, PhD, [Instructor], Division of Pain Medicine, ACCM, Johns Hopkins University, Maryland, currently faculty at Instructor rank, ACCM, Johns Hopkins University. Co-authored articles OR 35,37,39,40-42,44,46,47,50,55,61,65,68; RA 5; BC 1.
- 2012-present Qian Xu, PhD, [Instructor], ACCM, Johns Hopkins University, currently faculty at Instructor rank at HHMI. Co-authored articles OR 37,40,46,47,50,53,55,65,68.
- 2018-present Neil Ford, PhD [post-doctoral fellow], Division of Pain Medicine, ACCM, Johns Hopkins University.
- 2019-present Chi Zhang, PhD [post-doctoral fellow], Division of Pain Medicine, ACCM, Johns Hopkins University.
- 2021-present Irina Duff, PhD [post-doctoral fellow], Division of Pain Medicine, ACCM, Johns Hopkins University.
- 2021-present Xiang Cui, MD, Ph.D, [visiting scientist], Assistant Professor, Department of Physiology, Institute of Acupuncture, China Academy of Chinese Medical Sciences, China.
- 2021-present Jing Liu, PhD [post-doctoral fellow], Division of Pain Medicine, ACCM, Johns Hopkins University.
- 2021-present QinChao Wu, MD [visiting scientist], Division of Pain Medicine, ACCM, Johns Hopkins University.

Thesis committees:

- 2016 Zhe Li, PhD candidate, [graduate student], Program in Biochemistry, Cellular and Molecular Biology (BCMB), Johns Hopkins University, Baltimore, MD, currently clinical staff, Johns Hopkins University. Co-authored articles OR 35,40,41,46,55,68.
Title: Mrg receptor ligands for pain inhibition.
Mentor: Xinzhong Dong
- 2017 Vijay Sadashivaiah, MS candidate in Engineering, [graduate student], Department of Biomedical Engineering, Johns Hopkins University, Baltimore, MD. Co-authored articles OR 79.
Title: Towards pain control by modeling the interactions in a mammalian nerve fiber.
Mentor: Mentor: Sridevi Sarma
- 2018 Ankitha Rajagopalan Nair, MS Candidate in Engineering, [graduate student], Department of Biomedical Engineering, Johns Hopkins University, Baltimore, MD.
Title: Microfluidics and neural interfaces development for the safe direct current stimulator.
Mentor: Gene Fridman
- 2020 Claire Zurn, Ph.D candidate in Engineering, [graduate student], Department of Biomedical Engineering, Johns Hopkins University, Baltimore, MD.
Title: A model-based closed-loop peripheral nerve stimulation paradigm for the restoration of a healthy pain system.
Mentor: Sridevi Sarma
- 2022 Grace Foxworthy, Ph.D candidate in Biomedical Engineering, [graduate student], Department of Biomedical Engineering, Johns Hopkins University, Baltimore, MD.
Title: Effect of non-pulsatile arbitrary stimulation waveforms in the peripheral nervous system as a new technique for neuromodulation.
Mentor: Gene Fridman, Ph.D.
- 2022 Patrick Myers, Ph.D candidate in Engineering, [graduate student], Department of Biomedical Engineering, Johns Hopkins University, Baltimore, MD.
Title: Closed-loop peripheral nerve stimulation for pain control.
Mentor: Sridevi Sarma

Educational Program Building / Leadership: none

Educational Demonstration Activities to external audiences, on or off campus: none

RESEARCH ACTIVITIES

Research Focus

Treatment of chronic pain continues to be a challenge and represents a large unmet medical need. The long-term goal of my research is to elucidate neuronal mechanisms of chronic pain and develop better strategies for treatment of chronic pain. My research is multidisciplinary in nature and encompasses electrophysiological, molecular biological, imaging, immunocytochemical, and behavioral pharmacological approaches. Major areas of my current research include:

- 1) Mechanistic study of neurostimulation for pain treatment;
- 2) Developing novel analgesics for chronic pain;
- 3) New strategies to improve peripheral opioid analgesia and endogenous pain inhibitory mechanisms.

Research Program Building / Leadership

2015-present

Director, Pain Research Core (PRC) at the Johns Hopkins University, Baltimore, MD.

In 2015, I established the Pain Research Core (PRC) at the Johns Hopkins University, and successfully acquired funds from the Blaustein Pain Fund and Neurosurgery Pain Research Institute (an award of \$160,000/year in direct costs). I have been serving as the director to operate, facilitate, and expand multidisciplinary preclinical pain research at JHU aimed at improving our understanding of pain mechanisms, identifying novel drug targets, developing new analgesics, and crafting innovative strategies for pain treatment. Since 2015, PRC has conducted 18 Behavioral Core Projects, and 15 Imaging Core projects with multiple JHU investigators from different departments (Biophysics, Gastroenterology, Neuroscience, Neurosurgery, Anesthesiology).

2017-present

Director, Pain Neuromodulation Research, the Johns Hopkins University, Baltimore, MD.

In 2017, I was appointed as Director of Pain Neuromodulation Research by Neurosurgery Pain Research Institute at the Johns Hopkins University. I have been facilitating and organizing collaborative research about neurostimulation pain therapies with investigators across multiple departments and institutions of JHU.

Research Demonstration Activities to external audience, on or off campus: none

Inventions, Patents, Copyrights

Date: August 5, 2010

Role: Co-applicant. (David Anderson, Qin Liu, Xinzhong Dong, Yun Guan)

Title: IDENTIFICATION AND USE OF COMPOUNDS FOR TREATING PERSISTENT PAIN

U.S. Provisional Application(s) No(s):12/851,436 Reference: CIT 5420

Date: June 24, 2020

Role: Co-applicant. (Srideve V. Sarma, Christine Beauchene, and Yun Guan)

Title: CLOSED-LOOP PERIPHERAL NERVE STIMULATION FOR RESTORATION IN CHRONIC PAIN

U.S. Provisional Application(s) No(s). 63/043,431

Date: August 24, 2021

Role: Co-applicant. (Takashi Tukamoto, Xinzhong Dong, and Yun Guan)

Title: HUMAN MRGX1 PAM FOR PAIN TREATMENT

U.S. Provisional Application(s) No(s). to be submitted.

Technology Transfer Activities

SYSTEM INNOVATION AND QUALITY IMPROVEMENT ACTIVITIES: none

ORGANIZATIONAL ACTIVITIES

Institutional Administrative Appointments

2013-present Member, Research and Grant Review Committee, ACCM, Johns Hopkins University.

2018-present Member, Department mentoring and promotions committee, ACCM, Johns Hopkins University.

Editorial Activities

2014 Guest Editor, Neural Plasticity. Maladaptive plasticity and Neuropathic pain.

Editorial Board appointments

Executive/Section Editor

2020-present Executive Editor, Regional Anesthesia and Pain Medicine,
Impact factor 7.01 (2019/2020), Q1
<https://rapm.bmj.com/>

Associate Editor

2015-present Editorial board member, Neuromodulation: Technology at the Neural Interface.
The journal of the International Neuromodulation Society (INS).

Impact factor 4.03 (2019/2020), Q1

<http://www.neuromodulation.com/ins-journal>

2017-present Editorial board member, Molecular Pain.

Impact factor 2.69 (2019/2020), Q1

<http://journals.sagepub.com/home/mpx>

2018-present Editorial board member, Pain Practice.

Impact factor 2.26 (2019/2020), Q1

<https://onlinelibrary.wiley.com/journal/15332500>

2012-present Editorial board member, Analgesia & Resuscitation: Current Research.

Journal peer review activities

2005-present Pain

2008-present Neuroscience Letters

2009-present Neuroscience

2009-present Journal of Neurochemistry

2010-present Molecular Pain

2010-present Journal of Pain

2010-present Journal of Neuroscience Research

2011-present Journal of Neuroscience
 2011-present Neurochemistry International
 2012-present Amino Acid
 2012-present Anesthesia and Analgesia
 2012-present European Journal of Pain
 2012-present Journal of NeuroEngineering and Rehabilitation
 2012-present Journal of Neural Engineering
 2012-present Journal of Pain Research
 2012-present Life Science
 2012-present Neuromodulation: Technology at the Neural Interface
 2012-present Pharmacology, Biochemistry and Behavior
 2013-present Brain Research
 2013-present Experimental Neurology
 2014-present Anesthesiology
 2016-present Scientific Reports
 2018-present J. Neurosci. Method

Other peer review activities

Advisory Committees

2016-present Member, Research and Scientific Oversight. International Neuromodulation Society's (INS).
 2016-present Member, Clinical Research Committee Member. National Pain Foundation (NPF).
 2017-present Member, Scientific Program Committee, International Neuromodulation Society's (INS).

Review Groups/Study Sections

Regular/Permanent

2020-2026 Surgery, Anesthesiology and Trauma Study Section (SAT), NIH.

Non-permanent (Ad hoc)

2012 Reviewer, ANIH, CSR program of Early Career Reviewer, USA. Surgery, Anesthesiology and Trauma Study Section (SAT), Bethesda, MD.
 2013 Reviewer, NIH, Ad-hoc, USA. Surgery, Anesthesiology and Trauma Study Section (SAT), Chicago, IL.
 2014 Reviewer, NIH, Ad-hoc, Special Emphasis Panel (SEP) USA. Sensorimotor Integration Study Section (SMI). Internet Assisted Meeting (IAM).
 2014 Reviewer, Department of Defense (DoD), USA. Congressionally Directed Medical Research Programs (CDMRP). FY13 Pain Management Defense Medical Research and Development Program (DMRDP), Baltimore, MD.
 2014 Chair, Department of Defense (DoD), USA. Congressionally Directed Medical Research Programs (CDMRP). FY14 Spinal Cord Injury Research Program (SCIRP), Reston, VA.
 2015 Reviewer, Department of Defense (DoD), USA. Congressionally Directed Medical Research Programs (CDMRP). FY15 Spinal Cord Injury Research Program (SCIRP), Reston, VA.
 2015 Reviewer, Department of Defense (DoD), USA. Congressionally Directed Medical Research Programs (CDMRP). PRMRP- PRE-ART
 2015 Reviewer, National Medical Research Council (NMRC), Singapore. Clinical Trial Grant Co-Development Scheme (CTGCoD).
 2016 Chair, Department of Defense (DoD), USA. Congressionally Directed Medical Research Programs (CDMRP). FY16. Spinal Cord Injury Research Program (SCIRP), Reston, VA.
 2016 Reviewer, NIH, NCCIH, Ad-hoc, USA. Training and Research Grant, Internet Assisted Meeting (IAM).
 2016 Reviewer, NIH, Ad-hoc, USA. Somatosensory and Chemosensory Systems Study Section (SCS), Washington, DC.
 2016 Reviewer, NIH, Ad-hoc, USA. Surgery, Anesthesiology and Trauma Study Section (SAT), Austin, TX.
 2017 Reviewer, NIH, NCCIH, Ad-hoc, USA. Training and Research Grant, Internet Assisted Meeting (IAM).
 2017 Reviewer, NIH, Ad-hoc, USA. Surgery, Anesthesiology and Trauma Study Section (SAT), Special Emphasis Panel/Scientific Review Group **2017/05 SAT**, San Francisco, CA.
 2017 Reviewer, National Medical Research Council (NMRC), Singapore. Clinical Trial Grant Co-Development Scheme (CTGCoD).
 2017 Reviewer, NIH, NCCIH, Ad-hoc, USA. Training and Research Grant, Internet Assisted Meeting (IAM).

- 2017 Reviewer, NIH, Ad-hoc, USA. BRAIN Initiative: Targeted BRAIN Circuits Projects. Neurobiology of Motivated Behavior (NMB) Study Section and Mechanisms of Sensory, Perceptual and Cognitive Processes (SPC) Study Section. Bethesda, MD.
- 2017 Reviewer, NIH, NCCIH, Ad-hoc, USA. NIH-DoD-VA Pain Management Collaboratory –Pragmatic Clinical Trials Demonstration Projects (UG3/UH3) – RFA-AT-17-001. Bethesda, MD.
- 2017 Reviewer, NIH, Ad-hoc, USA. Surgery, Anesthesiology and Trauma Study Section (SAT), Bethesda, MD.
- 2017 Reviewer, NIH, Ad-hoc, USA. Somatosensory and Pain Study Section (SPS), Washington DC, MD.
- 2018 Chair, Department of Defense (DoD), USA. Congressionally Directed Medical Research Programs (CDMRP). FY18. Spinal Cord Injury Research Program (SCIRP), Reston, VA.
- 2018 Reviewer, NCCIH, Ad-hoc, USA. 2018/05 ZAT1 YW (05) P, Center of Excellence for Research on Complementary and Integrative Health (P01) Special Emphasis Panel. Bethesda, MD.
- 2018 Reviewer, NIH, Ad-hoc, USA. Surgery, Anesthesiology and Trauma Study Section (SAT), Bethesda, MD.
- 2018 Chair, Department of Defense (DoD), USA. Congressionally Directed Medical Research Programs (CDMRP). FY18. JWMP.
- 2018 Reviewer, NCCIH, Ad-hoc, USA. 2018/11 ZAT1 YW (05) P, Center of Excellence for Research on Complementary and Integrative Health (P01) Special Emphasis Panel. Bethesda, MD.
- 2018 Chair, Department of Defense (DoD), USA. Congressionally Directed Medical Research Programs (CDMRP). FY18 Spinal Cord Injury Research Program (SCIRP), Baltimore, MD.
- 2019 Reviewer, NIH, Ad-hoc, USA. Special Emphasis Panel/Scientific Review Group, 2019/05 ZRG1 IFCN-B(03). Bethesda, MD.
- 2019 Reviewer, NIH, Ad-hoc, USA. Special Emphasis Panel/Scientific Review Group 2019/08 ZTR1 TC-7 (01) R. Bethesda, MD.
- 2019 Chair, 2019.6, Department of Defense (DoD), USA. Congressionally Directed Medical Research Programs (CDMRP). 2019 Joint Warfighter Medical Research Program on the Clinical Rehabilitative Medicine (CRM) 2019 JWMP.
- 2020 Chair, 2020. 10, Department of Defense (DoD), USA. Congressionally Directed Medical Research Programs (CDMRP). FY 20 Peer Reviewed Medical Research Program (PRMRP).
- 2020 Reviewer, 2020. 10, Regular member, NIH, USA. Surgery, Anesthesiology and Trauma Study Section (SAT), Bethesda, MD.
- 2021 Chair, 2021.01, Department of Defense (DoD), USA. Congressionally Directed Medical Research Programs (CDMRP). Investigator Initiated Research - 2020 Chronic Pain Management Research Program (CPMRP).
- 2021 Reviewer, 2021. 2, Regular member, NIH, USA. Surgery, Anesthesiology and Trauma Study Section (SAT), Bethesda, MD.
- 2021 Reviewer, 2021. 6, Regular member, NIH, USA. Surgery, Anesthesiology and Trauma Study Section (SAT), Bethesda, MD.
- 2021 Reviewer, 2021. 10, Regular member, NIH, USA. Surgery, Anesthesiology and Trauma Study Section (SAT), Bethesda, MD.
- 2021 Reviewer, 2021.10, Department of Defense (DoD), USA. Congressionally Directed Medical Research Programs (CDMRP). 2021 PRMRP Focused Program Award Pain Management (FPA-PM)
- 2022 Reviewer, 2022. 3.3, NINDS, USA. ZNS1 SRB-C 14. HEAL Initiative: Interdisciplinary Teams to Elucidate the Mechanisms of Device-Based Pain Relief, Bethesda, MD.
- 2022 Reviewer, 2022. 2, Regular member, NIH, USA. Surgery, Anesthesiology and Trauma Study Section (SAT), Bethesda, MD.
- 2022 Reviewer, 2022. 6, Regular member, NIH, USA. Surgery, Anesthesiology and Trauma Study Section (SAT), Bethesda, MD.
- 2022 Reviewer, 2022. 10, Regular member, NIH, USA. Surgery, Anesthesiology and Trauma Study Section (SAT), Bethesda, MD.

Professional Societies

- 2000-present Society for Neuroscience (SFN), member.
- 2008-present American Pain Society (APS), member.
- 2010-present International Association for the Study of Pain (IASP), member.
- 2012-present North American Neuromodulation Society (NANS), member.

Conference Organizer (separate into JHMI/Regional - National - International activities)

Session Chair

National

2012. 5.17-19. Chair and Moderator. Current Perspectives on the Mode of Action of Spinal Cord Stimulation-induced Analgesia. The American Pain Society's 31st Annual Scientific Meeting, Honolulu, Hawaii, USA.
2017. 1.19-22. Chair and Moderator. The Scientific Foundations of Neuromodulation. North American Neuromodulation Society (NANS) 20th Annual Scientific Meeting. Las Vegas, NV, USA.
2018. 11.4-6. Chair. Spinal Cord Stimulation: Mechanisms of Action. Neuromodulation: The Science. NTS Conference. Cleveland, OH, USA. S
2019. 10.4-6. Chair. Spinal Cord Stimulation: Mechanisms of Action. Neuromodulation: The Science. NTS Conference. Napa, CA, USA. (Invited)

International

2014. 6.21-22. Chair and Moderator. From Bench to Bedside: Translational Research of Pain and Itch. 2014 China-US Translational Research Forum on Pain and Itch. Peking Union Medical College (PUMC), Beijing, China.

Consultantships:

2015. 2 Medtronic inc, Dublin, Ireland.
2016. 5 National Pain Foundation. Denver, CO, USA.
2017. 5 Tissue Tech, Inc. Miami, FL, USA.

RECOGNITION

Awards, Honors

- 2002 First prize winner of the Poster session in Cell Biology, University of Maryland, Baltimore, MD.
- 2011 Gold Medal award of The 13th ACCM Research Day, Johns Hopkins University, Baltimore, MD.
- 2012 Gold Medal award of The 14th ACCM Research Day, Johns Hopkins University, Baltimore, MD.
- 2013 Gold Medal award of The 15th ACCM Research Day, Johns Hopkins University, Baltimore, MD.
- 2016 1st Price Award of the Neuromodulation: The Science. 2016. 5, NTS Conference, San Francisco, CA.

Invited Talks

JHMI/Regional

- 10/02 Speaker. "Changes in AMPA receptor expression and phosphorylation in the rostral ventromedial medulla (RVM) after inflammation". The Blaustein Pain Conference. Johns Hopkins University, Baltimore, MD, USA.
- 5/04 Speaker. Research Workshop. University of Maryland, Baltimore, MD, USA. "Involvement of mu-opioid receptor in the development of spinal sensitization in mice".
- 4/05 Speaker. The Blaustein Pain Conference. Johns Hopkins University, Baltimore, MD, USA. "Role of mu-opioid receptor in the development of spinal sensitization in mice."
- 10/07 Speaker. University of Maryland, Baltimore, MD, USA. "Activation of peripheral mu-opioid receptor is effective in attenuating mechanical allodynia in rat after L5 spinal nerve injury."
- 12/07 Speaker. ACCM Research Talk, Johns Hopkins University, Baltimore, MD, USA. "Roles for spinal mu-opioid receptors in the process of central neuronal sensitization."
- 12/11/10 Speaker. The Blaustein Pain Conference. Johns Hopkins University, Baltimore, MD, USA. "An animal model to study spinal cord stimulation-induced analgesia."
- 10/11/11 Speaker. Pain Interest Group, Department of Neural and Pain Sciences, Dental School, University of Maryland, Baltimore, MD, USA. "The mode of action of spinal cord stimulation in the treatment of neuropathic pain."
- 3/12/12 Speaker. Laboratory of Physiologic Studies, National Institute on Alcohol Abuse and Alcoholism, National Institutes of Health, Rockville, MD, USA. "Mas-related G-protein-coupled receptor subtype C (MrgC) may represent a novel target for pain treatment."
- 10/11/12 Speaker. The 2012 Annual Meeting of Chinese American Society of Anesthesiology (CASA), Washington DC, USA. "Basic science studies for improving chronic pain treatment."
- 11/19/12 Speaker. The Blaustein Pain Conference. Johns Hopkins University, Baltimore, MD, USA. "Spinal cord stimulation: Evidence from mechanistic studies of a widely used therapy for pain."
- 02/17/17 Speaker. The Blaustein Pain Conference. Johns Hopkins University, Baltimore, MD, USA. "Towards Pain Control: Synergizing Computational and Biological Approaches to Develop an Integrated Model of the Closed-Loop Pain System."

National

- 5/20/12 Speaker. 31st Annual Scientific Meeting, The American Pain Society, Honolulu, Hawai'i. USA. "Study the spinal mechanisms of spinal cord stimulation-induced analgesia in nerve-injured rats."
- 3/28/14 Speaker, Faculty, Mechanisms of Action Conference. Electrical Stimulation of the Nervous System. Orlando, FL, USA. "SCS Mechanisms: WDR Neuronal Effects."
- 3/29/14 Speaker. Mechanisms of Action Conference. Electrical Stimulation of the Nervous System. Orlando, FL, USA. "Electrical Stimulation of the PNS Affects Targets Up and Downstream to Stimulation."
- 5/16/15 Speaker, Faculty, 34th Annual Scientific Meeting, The American Pain Society, Palm Springs, CA, USA. "Spinal neuronal plasticity induced by electrical stimulation of A β -fibers: Implications to the carryover pain inhibitory effect of spinal cord stimulation."
- 10/17/15 Speaker. Neuro Nexus. Dallas, TX. USA. "The science of paresthesia free spinal cord stimulation."
- 5/29/16 Speaker, Faculty, Neuromodulation: The Science. NTS Conference. San Francisco, USA. "Conventional SCS versus high-frequency SCS for pain inhibition: Insight from preclinical studies."
- 6/29/16 Speaker, Faculty, Plenary Session, 2016 Joint Meeting of North American Neuromodulation Society (NANS) and Neural Interfaces Conference (NIC). Baltimore, MD, USA. "Neuromodulation at the cellular level."
- 7/30/16 Speaker, Faculty, 24th Annual Scientific Meeting, Spine Intervention Society (SIS). New Orleans, LA, USA. "Spinal cord stimulation: Update on mechanisms of action".
- 8/28/16 Speaker. National Pain Foundation. Denver, CO, USA. "Global pain initiative: Consensus group on pain and breakthrough pain concept and scope of project."
- 1/22/17 Speaker, Faculty, 20th Annual Scientific Meeting, The Scientific Foundations of Neuromodulation. North American Neuromodulation Society (NANS). Las Vegas, NV, USA. "Basic Science of Spinal Cord Stimulation."
- 5/20/17 Speaker, Faculty, Amniox Medical's Roundtable Meeting. Miami, FL, USA. "AM/UC for Chronic Post Surgical Pain and Neuropathic Pain Treatment."
- 11/16/17 Speaker, Faculty, 16th Annual Pain Medicine Meeting, American Society of Regional Anesthesia and Pain Medicine (ASRA). Orlando, FL, USA. "Neuromodulation: Waveforms to Satisfy Your Patient/Waveforms and Mechanism of Analgesic Actions."
- 11/06/18 Scientific Committee Member, Speaker, Neuromodulation: The Science. NTS Conference. Cleveland, Ohio, USA.
- 10/06/19 Scientific Committee Member, Speaker, Neuromodulation: The Science. NTS Conference. Napa, CA, USA.
- 08/15/20 Speaker, Faculty, 2020 Napa Pain Conference Online, Neuronal and Non-neuronal Modulations by Spinal Cord Stimulation in Pain Control. Zoom.
- 11/12/20 Speaker, Faculty, 2020 North American Neuromodulation Society (NANS) webinar: Pre-Clinical Studies of Genetic Role in Pain Control. Modeling a Glial-Neuronal Interaction. Zoom.

International

- 10/9/10 Speaker. The 7th East-West Pain Conference, Beijing, China. "Tuning pain circuits using SCS: From phenomenology to mechanisms."
- 8/12/12 Speaker. The 14th World Congress on Pain, International Association for the Study of Pain (IASP), Milan, Italy. "Spinal cord stimulation-induced analgesia in the context of peripheral neuropathic pain: from phenomenology to mechanisms."
- 5/25/13 Speaker. The 4th International Congress on Neuropathic Pain, Toronto, Ontario, Canada. "Intensity and frequency-dependent features of spinal cord stimulation-induced analgesia: Behavioral and electrophysiological evidence in neuropathic rats."
- 4/25/14 Speaker. 2nd Joint Symposium, International Headache Society (IHS) & International Association for the Study of Pain (IASP). Siena, Italy "Neurostimulation for chronic pain: potential targets, parameters and mechanisms."
- 6/22/14 Speaker. China-US Translational Research Forum on Pain and Itch. Peking Union Medical College, Beijing, China. "Presynaptic inhibition of noxious inputs by MrgC agonism in rodent models of neuropathic pain."
- 6/7/15 Speaker. International Neuromodulation Society's (INS) 12th World Congress, Montreal, Canada. "The segmental neurophysiological mechanisms for pain inhibition from SCS."
- 11/14/15 Speaker. Beijing Tiantan Functional Neurosurgery Summit Forum, Beijing, China. "Spinal cord stimulation for pain treatment: mechanisms of action and future research."
- 11/15/15 Speaker. Beijing Tiantan Functional Neurosurgery Summit Forum, Beijing, China. "Preclinical study of MrgC, the ortholog of human MrgX1, in pain modulation".

- 6/2/16 Speaker. XIII National Congress of Spanish Pain Society. Pamplona, Spain. "Conventional SCS and high-Frequency SCS: Preclinical studies to compare efficacy and mechanism for pain inhibition."
- 4/17/17 Speaker. Acupuncture Research Forum, China Academy of Chinese Medical Sciences, Beijing, China. "Progress in Studying the Mechanisms of Neurostimulation Pain Therapies."
- 8/20/17 Speaker. The 5th International Biomedical Forum of China, Shihezi, Xinjiang, China. "Developing Pharmacotherapies with Limited Central Adverse Effects in Chronic Pain Treatment."
- 10/12/17 Speaker. The 12th Biennial Conference of Chinese Neuroscience Society. Tianjin, China. "Pain: Neural Circuit Mechanisms and Neuromodulation."
- 4/03/18 Lecture. Chinese Academy of Medical Sciences, Peking Union Medical College, Beijing, China. "Targeting MrgC/X1 on Central Terminals of Primary Sensory Neurons for Pain-specific Pharmacotherapy".
- 11/03/18 Speaker. The 15th Asian Australasian Congress of Anesthesiologists & The 26th Annual Meeting of Chinese Society of Anesthesiology. Beijing, China. "Spinal Cord Stimulation for Pain Treatment: Translational Study from Bench-side to Bed-side."
- 5/29/19 Speaker. The 14th World Congress of International Neuromodulation Society (INS). Sydney, Australia. "Spinal Cord Stimulation for Pain Inhibition: New Paradigms and Mechanisms Beyond the Gate."
- 10/12/19 Speaker. The 13th Biennial Conference of Chinese Neuroscience Society. Suzhou, China. "Developing Non-opioid Pain Therapies that Target Peripheral Sensitization."
- 8/1/20 Speaker, Faculty, 2020 Forum of Translation Research of Major Brain Disorders. China. "Spinal Cord Stimulation for Pain Control." Webinar.
- 12/17/21 Speaker, "SAHZU GUANGJI ACADEMIC WEEK, Neuroscience and Pain Symposium". China. "Mechanistic and Translational Research of Spinal Cord Stimulation for Pain Treatment". Webinar.
- Visiting Professorships
- 10/4/10 Neuroscience Research Institute, Peking University, Beijing, China. "Spinal Cord Stimulation for the Treatment of Neuropathic Pain."
- 8/5/11 Chandler Medical Center, School of Medicine, University of Kentucky, Lexington, KY, USA. "Spinal Cord Stimulation-induced Analgesia: Mechanistic Studies in Pre-clinical Models of Neuropathic Pain."
- 9/9/11 Neuroscience Seminar Series, School of Medicine, University of Cincinnati, Cincinnati, OH, USA. "Spinal Cord Stimulation: Revealing its Therapeutic Action and the Underlying Mechanisms Through Studies in Animal Models of Neuropathic Pain."
- 11/5/11 Department of Anesthesiology, School of Medicine, Yale University, New Haven, CT, USA. "The Behavioral and in vivo Electrophysiological Approaches to the Mechanistic Understanding of Spinal Cord Stimulation-induced Pain Relief."
- 11/24/11 Department of Anesthesiology and Perioperative Medicine, The University of Texas, MD Anderson Cancer Center, Houston, TX, USA. "Current Perspectives on the Feature and Mechanisms of Spinal Cord Stimulation-induced Analgesia from Studies in Animal Models of Neuropathic Pain."
- 1/15/13 Department of Anesthesiology, University of Florida, Gainesville, FL, USA. "Mechanistic Studies of Neuromodulation and Pharmacological Interventions of Neuropathic Pain."
- 5/4/13 Medtronic Inc. Minneapolis, MN, USA. "Spinal Cord Stimulation for Neuropathic Pain: Advances and Opportunities from the Clinical Perspective and Pre-clinical Findings."
- 6/20/14 Chao Yang Hospital, Capital University of Medical Sciences, Beijing, China. "Preclinical Study of Spinal Cord Stimulation Induced Analgesia."
- 6/25/14 Nanjing Medical University, Nanjing, China. "Roles of MrgC Receptor in Pain."
- 6/26/14 Nanjing University of Traditional Medicine, Nanjing, China. "Mechanisms of Intrathecal MrgC Agonist-induced Analgesia."
- 3/14/16 Dalhousie University, Halifax, Canada. "Electroceuticals for Pain Treatment: Pre-clinical Study of the Underlying Mechanisms."
- 8/24/16 Department of Pharmacology and Biomedical Sciences, University of Georgia, GA, USA. "Pharmaceutical and Electroceutical Interventions of Neuropathic Pain."
- 10/30/16 Chinese Academy of Medical Sciences. Peking Union Medical College, Beijing, China. "Electroceutical Intervention of Chronic Pain."
- 12/8/16 University of Maryland, School of Medicine, MD, USA. "Battling Chronic Pain with New Pharmaceutical Targets and Electroceutical Interventions."
- 3/28/17 Department of Integrative Biology and Pharmacology, University of Texas Medical School, TX, USA. "A Primary Sensory Neuron-Specific Target for Inhibiting Chronic Pain and Improving Morphine Analgesia."
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- 4/14/17 Nanjing University of Traditional Medicine, Nanjing, China. “Preclinical Approaches for Translational Study of Chronic Pain.”
- 4/19/17 Lu He Hospital, Capital University of Medical Sciences, Beijing, China. “Regenerative Medicine for Inhibiting the Transition to Chronic Pain after Nerve Injury.”
- 4/26/17 Dept. of Physiology, University of Kentucky, Lexington, KY, USA. “Exploring New Pharmaceutical Targets and Electroceutical Interventions for Chronic Pain Treatment.”
- 10/16/17 Dept. of Physiology, College of Medicine of University of Oklahoma, Oklahoma City, OK, USA. “Developing Pain Therapies with Limited Adverse Effects.”
- 10/10/18 College of Dentistry, TX A&M Health Science Center, Dallas, TX, USA “MrgC/X1, A Target for Both Pain Inhibition and Enhancement of Morphine Analgesia.”
- 11/03/18 Dept. of Anesthesiology, Duke University School of Medicine, Durham, North Carolina, USA. “Neuromodulation for Pain Treatment: the Gate Control Theory and Beyond.”
- 03/08/19 Dept. of Anesthesiology, Medical College of Wisconsin, Milwaukee, WI, USA. “Spinal Cord Stimulation for Pain Control: the Theories and Translational Research.”
- 04/23/19 Department of Anesthesiology and Perioperative Medicine, University of Alabama at Birmingham, AL, USA. “Preclinical Development of Non-Opioid Pain Treatment: Sensory Neuron Specific Drug Target and Neurostimulation.”
- 09/03/19 Chinese Academy of Medical Sciences. Peking Union Medical College, Beijing, China. “Neuromodulation for Pain Treatment: Translational Study from Bench-side to Bed-side.”
- 01/27/20 Department of Anesthesiology Rutgers - New Jersey Medical School, NJ, USA. “Human MrgX1 Receptor Agonist and Positive-Allosteric Modulation for Non-Opioid Pain Treatment.”
- 2/20/20 Department of Pharmaceutical Sciences, University of Buffalo, NY, USA. “A New Target on the Primary Sensory Neurons for Pain Treatment: Translation from Rodent Evidence to Potential Human Benefit.”
- 3/3/20 Department of Neurobiology, University of Pittsburgh School of Medicine, PA, USA. “Potential Sensory Neuron Specific Drug Target and Neurostimulation Therapy for Non-Opioid Pain Treatment.”
- 9/1/20 Department of Anesthesia & Perioperative Care, University of California, San Francisco (UCSF) CA, USA. Virtual meeting. “Targeting MrgX1 Receptor for Pain Treatment - translation from animal study to human benefit.” Webinar.
- 10/24/22 Department of Anesthesiology, Washington University School of Medicine, St. Louis, MO, USA. “The Pathway of Developing Human MrgprX1 Receptor Agonist and Positive Allosteric Modulators for Pain Treatment.”

OTHER PROFESSIONAL ACCOMPLISHMENTS (*Optional*)

Posters

Oral/Podium Presentations [abstracts that were both presented orally and published]

Military Service

Community Services

Humanitarian Activities

Philanthropic Activities

Other