

Curriculum Vitae

Michael J. Caterina MD PhD

DEMOGRAPHIC AND PERSONAL INFORMATION

CURRENT APPOINTMENTS

9/1/13 to date Professor, Department of Neurosurgery, Johns Hopkins School of Medicine

5/1/10-date Professor, Department of Biological Chemistry, Johns Hopkins University School of Medicine

5/1/10-date Professor, Department of Neuroscience, Johns Hopkins University School of Medicine (Secondary Appointment)

12/06-date Member, Center for Sensory Biology, Johns Hopkins University School of Medicine

9/1/13 – date Director, Neurosurgery Pain Research Institute, Johns Hopkins University School of Medicine

PERSONAL DATA

Address: 408 Biophysics Building
Department of Neurosurgery
725 North Wolfe St.
Baltimore, MD 21205

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EDUCATION AND TRAINING

1983-1987 **B.S. in Biology with Honors** (Vertebrate Physiology)
Pennsylvania State University, University Park, PA (Dr. Theodore Hollis, advisor) Thesis title: Thoracic aortic albumin concentrations increase linearly with plasma histamine concentrations in the rat.

1987-1995 **M.D.**, Johns Hopkins University School of Medicine

1987-1995 **Ph.D., Biochemistry, Cellular and Molecular Biology**

Dept. Biological Chemistry, Johns Hopkins University School of Medicine (Dr. Peter Devreotes, advisor) Thesis title: Activation and desensitization of the cyclic AMP receptor, cAR1, from *Dictyostelium*

1995-1999 **Postdoctoral Fellow**, Department of Cellular and Molecular Pharmacology, University of California San Francisco (Dr. David Julius, advisor)

PROFESSIONAL EXPERIENCE

9/99 – 3/04 **Assistant Professor**, Department of Biological Chemistry, Johns Hopkins University School of Medicine

9/99 – 3/04 **Assistant Professor**, Department of Neuroscience, Johns Hopkins University School of Medicine (Secondary Appointment)

3/04-5/10 **Associate Professor**, Department of Biological Chemistry, Johns Hopkins University School of Medicine

3/04-5/10 **Associate Professor**, Department of Neuroscience, Johns Hopkins University School of Medicine (Secondary Appointment)

RESEARCH ACTIVITIES

PUBLICATIONS

Peer-Reviewed Original Research Articles

1. Johnson, R.L., Vaughan, R.A., **Caterina, M.J.**, Van Haastert, P.J.M., and Devreotes, P.N. (1991) Overexpression of the cAMP Receptor cAR1 in *Dictyostelium*. *Biochemistry* **30**, 6982-6986.
2. **Caterina, M.J.**, Milne, J.L.S. and Devreotes, P.N. (1994) Mutation of the third intracellular loop of the cAMP receptor, cAR1 of *Dictyostelium* yields mutants impaired in multiple processes. *J.Biol. Chem.*, **269**, 1523-1532.
3. **Caterina, M.J.**, Hereld, D., and Devreotes, P.N. (1995) Occupancy of the cAMP Receptor, cAR1 of *Dictyostelium* Induces a Reduction in Affinity which Depends upon C-terminal serine Residues. *J. Biol Chem*, **279**, 4418-4423.
4. Milne, J.L.S., Wu, L., **Caterina, M.J.**, and Devreotes, P.N. (1995) Seven Helix cAMP Receptors Stimulate Ca²⁺ Entry in the Absence of Functional G Proteins in Dictystelium *J. Biol. Chem.*, **270**, 5926-5931.
5. **Caterina, M.J.**, Devreotes, P.N., Borleis, J. and Hereld, D. (1995) Agonist-induced loss of ligand binding is correlated with phosphorylation of cAR1, a G protein-coupled chemoattractant receptor from *Dictyostelium*. *J. Biol. Chem.*, **270**, 8667-8672.

6. #Kim J.Y. , #**Caterina, M.J.**, Milne, J.L.S., Lin, K.C., Borleis, J.A. and Devreotes, P.N. (1997) Random Mutagenesis of the cAMP Chemoattractant Receptor, cAR1, of Dictyostelium: Mutant Classes that Cause Discrete Shifts in Agonist Affinity and Lock the Receptor in a Novel Activational Intermediate. *J.Biol. Chem.*, **272**, 2060-2068. (# denotes equal contribution)
7. Milne, J.L.S., **Caterina, M.J.**, and Devreotes, P.N. (1997) Random Mutagenesis of the cAMP Chemoattractant Receptor, cAR1, of Dictyostelium:: Evidence for Multiple Activation States *J.Biol. Chem.*, **272**, 2069-2076.
8. **Caterina, M.J.**, Schumacher, M., Tominaga, M., Rosen, T.A., Levine, J.D. and Julius, D. (1997) The capsaicin receptor, a heat-activated ion channel in the pain pathway *Nature*, **389**, 816-824. (Research article, cover article)
9. Tominaga, M., **Caterina, M.J.**, Malmberg, A.B., Rosen, T.A., Gilbert, H., Skinner, K., Raumann, B.E., Basbaum, A.I. and Julius, D. (1998) The cloned capsaicin receptor integrates multiple pain-producing stimuli. *Neuron*, **21**, 531-543. (cover article)
10. **Caterina, M.J.**, Rosen, T.A., Tominaga, M., Brake, A.J., and Julius, D. (1999) A capsaicin receptor homologue with a threshold for noxious heat. *Nature*, **398**, 436-441.
11. **Caterina, M.J.**, Leffler, A., Malmberg, A., Martin, W., Trafton, J., Petersen-Zeitz, K.R., Koltzenberg, M., Basbaum, A. and Julius, D. (2000) Impaired nociception and pain sensation in mice lacking the capsaicin receptor. *Science* **288**, 306-313. (Research article, cover article)
12. McNamara, N., Khong, A., McKemy, D., **Caterina, M.**, Boyer, J., Julius, D. and Basbaum, C. (2001) ATP transduces signals from ASGM1, a glycolipid that functions as a bacterial receptor *Proc. Natl. Acad. Sci., U.S.A.*, **98**, 9086-9091 .
13. Birder, L.A., Kanai, A.J., de Groat, W.C., Kiss, S., Nealen, M.L., Burke, N.E., Dineley, K.E., Watkins, S., Reynolds, I.J. and **Caterina, M.J.** Vanilloid Receptor Expression Suggests a Sensory Role for Urinary Bladder Epithelial Cells (2001) *Proc. Natl. Acad. Sci., U.S.A.*, **98**, 13396-13401.
14. Guler, A., Lee, H., Iida, T., Shimizu, I. Tominaga, M., and **Caterina, M.** Heat-evoked activation of the ion channel, TRPV4 (2002) *J. Neurosci.* **22**, 6408-6414.
15. Birder LA, Nakamura Y, Kiss S, Nealen ML, Barrick S, Kanai AJ, Wang E, Ruiz G, De Groat WC, Apodaca G, Watkins S, **Caterina M.J.** Altered urinary bladder function in mice lacking the vanilloid receptor TRPV1. (2002) *Nature Neurosci.* **5**, 856-860.
16. Birder, L.A., Nealen, M.L., Kiss, S., de Groat, W.C., **Caterina, M.J.**, Wang, E., Apodaca, G. and Kanai, A.J. (2002) β -Adrenoceptor Agonists Stimulate Endothelial Nitric Oxide Synthase in Rat Urinary Bladder Urothelial Cells *J. Neurosci.* **22**, 8063-8070.

17. Nealen, M., Thut, P., Gold, M. and **Caterina, M.** TRPM8 is expressed in a subset of cold-responsive trigeminal neurons from rat. (2003) *J. Neurophysiology* **90**, 515-520.
18. Chung, M.K., Lee, H. and **Caterina, M.J.** Warm Temperatures Activate TRPV4 in Mouse 308 Keratinocytes (2003) *J. Biol. Chem.* **278**, 32037-32046
19. Chung M.K., Lee H., Mizuno A., Suzuki M., **Caterina M.J.** TRPV3 and TRPV4 mediate warmth-evoked currents in primary mouse keratinocytes. (2004) *J Biol. Chem.* **279**, 21569-21575.
20. Chung M.K., Lee H., Mizuno A., Suzuki M., **Caterina M.J.** 2-aminonethoxydiphenyl borate activates and sensitizes the heat-gated ion channel, TRPV3 (2004) *J. Neurosci.* **24**, 5177-5182.
21. Zhang N., Rogers T.J., **Caterina, M.** and Oppenheim J.J. Pro-inflammatory Chemokines, such as CCL3, Desensitizes m-opioid Receptors on Dorsal Root Ganglia Neurons (2004) *J. Immunology* **173**, 594-599.
22. Woodbury CJ, Zwick M, Wang S, Lawson JJ, **Caterina MJ**, Koltzenburg M, Albers KM, Koerber HR, and Davis BM. Nociceptors lacking TRPV1 and TRPV2 have normal heat responses (2004) *J Neurosci.* **24**, 6410-6415
23. Iida, T., Shimizu, I., Nealen, M.L., Campbell, A., and **Caterina M.** Attenuated fever response in mice lacking TRPV1 (2005) *Neurosci. Lett.* **378**, 28-33.
24. Lee, H., Iida, T., Mizuno, A., Suzuki, M., **Caterina M.J.** Altered thermal preference in mice lacking TRPV4 (2005) *J. Neurosci.* **25** 1304-1310.
25. Zhang N., Inan S., Cowan A., Sun R., Wang J., Rogers T.J., **Caterina M.**, and Oppenheim, J.J. A Pro-inflammatory chemokine, CCL3, sensitizes the heat- and capsaicin-gated ion channel, TRPV1 (2005) *Proc. Natl. Acad. Sci., USA* 102,4536-4541.
26. Chung M.K., Guler A.D., and **Caterina M.J.** (2005) Biphasic currents evoked by chemical or thermal activation of the heat-gated ion channel, TRPV3. *J. Biol Chem.* 280, 15928-15941.
27. Pogatzki-Zahn E., Shimizu I., **Caterina, M.**, and Raja S.N. (2005) Heat hyperalgesia after incision requires TRPV1 and is distinct from pure inflammatory pain. *Pain*, 115, 296-307.
28. Shimizu I., Iida T., Guan Y., Zhao C., Raja SN, Jarvis M.F., Cockayne D.A., and **Caterina M.J.** (2005) Enhanced thermal avoidance in mice lacking the ATP receptor P2X3 *Pain*, 116, 96-108.
29. Shimizu I., Iida T., Horiuchi N. and **Caterina M.J.** (2005) 5-Iodoresiniferatoxin

evokes hypothermia in mice and is a partial TRPV1 agonist *in vitro* *J. Pharm. Exp. Ther.*, 314:1378-1385.

30. Sidhaye V.K., Guler A.D., Schweitzer K.S., D'Alessio F., **Caterina M.J.** and King L.S. (2006) Transient receptor potential vanilloid 4 regulates aquaporin-5 abundance under hypotonic conditions. *Proc. Natl. Acad. Sci., USA* 103(12):4747-4752.

31. Birder L., Negoita F., Lee H., de Groat W., Kanai A., Barrick S., Meyers S., and **Caterina, M.** (2007) Activation of Urothelial-TRPV4 by 4a-PDD contributes to altered bladder reflexes in the rat *J Pharmacol Exp Ther.* 323(1):227-235.

32. Tan PL, Barr T, Inglis PN, Mitsuma N, Huang SM, Garcia-Gonzalez MA, Bradley BA, Coforio S, Albrecht PJ, Watnick T, Germino GG, Beales PL, **Caterina MJ**, Leroux MR, Rice FL, Katsanis N. (2007) Loss of Bardet Biedl syndrome proteins causes defects in peripheral sensory innervation and function. *Proc Natl Acad Sci U S A.* 104:17524-17529. (cover article)

33. Moussaieff A., Rimmerman N., Bregman T., Straiker A., Felder C.C., Shoham S., Kashman Y., Huang S.M., Lee H., Shohami E., Mackie K., **Caterina M.J.**, Walker J.M., Fride E. and Mechoulam R. (2008) Incensole acetate, an incense component, elicits psychoactivity by activating TRPV3 channels in the brain *FASEB J* 22(8):3024-3034.

34. Chung M.K., Guler A.D. and **Caterina M.J.** (2008) TRPV1 exhibits dynamic ionic selectivity during agonist stimulation *Nature Neuroscience* 11, 555-564. (Highlighted in *Nat Neurosci.* 2008 May;11(5):528-9)

35. Sidhaye V.K., Schweitzer K.S., **Caterina M.J.**, Shimoda L., King L.S. (2008) Shear-induced regulates AQP5 and airway epithelial barrier function. *Proc. Natl. Acad. Sci. (USA)* Mar 4;105(9):3345-3350.

36. Huang S.M., Lee H., Chung M.K., Park, U., Yu Y.Y., Bradshaw H., Coulombe P.A., Walker J.M., and **Caterina M.J.** (2008) Skin keratinocyte TRPV3 ion channels modulate pain sensitivity via prostaglandin E2. *J. Neurosci.* 28, 13727-13737.

37. Landouré G, Zdebik AA, Martinez TL, Burnett BG, Stanescu HC, Inada H, Shi Y, Taye AA, Kong L, Munns CH, Choo SS, Phelps CB, Paudel R, Houlden H, Ludlow CL, **Caterina MJ**, Gaudet R, Kleta R, Fischbeck KH, Sumner CJ. Mutations in TRPV4 cause Charcot-Marie-Tooth disease type 2C *Nature Genet.* (2010) Feb;42(2):170-4. PMID: 20037586

38. Link TM, Park U, Vonakis BM, Raben DM, Soloski MJ, **Caterina MJ.** TRPV2 has a pivotal role in macrophage particle binding and phagocytosis *Nature Immunology* (2010) 11, 232-239. PMID: 20118928

39. Cheng X, Jin, J, Hu L, Shen D, Dong X, Samie MA, Knoff J, Eisinger B, Liu M, Huang SM, **Caterina MJ**, Dempsey P, Michael E, Dlugosz A, Andrews NC, Clapham

DE, and Xu H. A Keratinocyte TRP Channel Controls Hair Morphogenesis and Skin Barrier Formation via EGFR signaling and Transglutaminase Activity. *Cell* (2010) 141, 331-343.

40. Huang SM, Li X, Yu Y, Wang J, **Caterina MJ**. (2011) TRPV3 and TRPV4 ion channels are not major contributors to mouse heat sensation. *Mol Pain*. 2011 May 17;7(1):37 PMID: 21586160

41. Park U, Vastani N, Guan Y, Raja S, Koltzenberg M. and **Caterina MJ** (2011) TRPV2 knockout mice are susceptible to perinatal lethality but display normal thermal and mechanical nociception *J Neurosci*. 31(32):11425-36. PMID: 21832173

42. Nedungadi TP, Dutta M, Bathina CS, **Caterina MJ**, Cunningham JT. (2012) Expression and distribution of TRPV2 in rat brain. *Exp Neurol*. 237(1):223-37. PMID: 22750329

43. Kim YS, Chu Y, Han L, Li M, Li Z, LaVinka PC, Sun S, Tang Z, Park K, **Caterina MJ**, Ren K, Dubner R, Wei F and Dong X. Central Terminal Sensitization of TRPV1 by Descending Serotonergic Facilitation Modulates Chronic Pain. *Neuron* (In Press)

Invited Reviews

1. **Caterina, M.J.** and Devreotes, P.N. (1991) Molecular Insights into Eukaryotic Chemotaxis. *FASEB J.*, **5**, 3078-3085.
2. **Caterina, M.J.** and Julius, D. (1999) Sense and specificity: a molecular identity for nociceptors. *Curr. Opin. Neurobiol.* **9**, 525-530.
3. **Caterina, M.J.**, Julius, D. The vanilloid receptor: a molecular gateway to the pain pathway. (2001) *Ann. Rev. Neurosci.* **24**, 487-517.
4. **Caterina, M.** Quenching fire with fat: phosphatidylinositides as putative regulators of pain (2001) *Trends Pharm. Sci.* **22**, 602-604 (cover article)
5. **Caterina, M.J.** Vanilloid receptors take a TRP beyond the sensory neuron, *Pain* (2003) **105**, 5-9.
6. Tominaga M. and **Caterina M.J.** Thermosensation and Pain (2004) *J. Neurobiology* **61**, 3-12.
7. **Caterina MJ**, Montell C. Take a TRP to beat the heat. (2005) *Genes Dev.* **19**, 415-418.
8. Lee H, **Caterina MJ**. TRPV channels as thermosensory receptors in epithelial cells. (2005) *Pflugers Arch.* 451:160-167.
9. **Caterina MJ**. (2007) Transient Receptor Potential Ion Channels as Participants in

Thermosensation and Thermoregulation. *Am J Physiol Regul Integr Comp Physiol*. 292(1):R64-76.

10. **Caterina M.J.** (2007) Sticky Spices. *Nature* 445(7127):491-492.
11. Lumpkin, E.A. and **Caterina M.J.** (2007) Mechanisms of Sensory Transduction in the Skin. *Nature* 445(7130):858-865.
12. Chung M.K. and **Caterina M.J.** TRP channel knockout mice lose their cool. *Neuron* (2007) May 3;54(3):345-347.
13. Montell C and **Caterina M.J.** (2007) Thermoregulation: Channels that Are Cool to the Core. *Curr Biol*. 17(20):R885-R887.
14. **Caterina M.J.** (2008) On the Thermoregulatory Perils of TRPV1 Antagonists. *Pain*, 136:3-4.
15. Munns C.H. and **Caterina M.J.** (2011) Tune in to KCNQ. *Nat Neurosci* 15(1):8-10
16. Coulombe PA and **Caterina M.J.** (2013) The incidental pore: CaV1.2 and stem cell activation in quiescent hair follicles. *Genes Dev*. 27(12):1315-7 PMID: 23788620
17. **Caterina M.J.** (2013) Boosting that tan with a bit of voltage. *Channels* Oct 2;7(6). PMID: 24088950

Book Chapters:

1. Johnson, R.L., Vaughan, R.A., **Caterina, M.J.** and Devreotes, P.N. (1989) Adaptation of chemoattractant elicited responses in Dictyostelium discoideum. In *Activation and Desensitization of Transducing Pathways, NATO ASI Series*, **44**, 22-36.
2. **Caterina M.J.** (2004) Ion Channels and Thermotransduction in Transduction in Sensory Cells, wiley-VCH Verlag Gmb H& Co. KgaA, Weinheim, Germany, Stefan Frings, Jon Bradley, Eds. 2004 pp. 335-249.
3. **Caterina, M.J.**, Gold, M. S. and Meyer, R.A. (2005) Molecular Biology of Nociceptors in *The Neurobiology of Pain*, Oxford University Press, Stephen Hunt and Martin Koltzenburg, Eds. pp. 1-33.
4. **Caterina M.J.** (2005) Pathological Changes in the Nociceptor: Alterations in TRPV1 Activity and Expression, in: *Handbook of Clinical Neurology*, Elsevier, Edinburgh, Fernando Cervero and Troels Jensen, Eds., pp. 221-230.
5. **Caterina M.J.** and Park U. (2006) TRPV1, A Polymodal Sensor in the Nociceptor Terminal, in: *The Nociceptor Membrane*, Academic Press, San Diego, Uhtaek Oh, Ed., pp 114 – 150.

8. Gold MS, **Caterina MJ**. Molecular biology of nociceptor transduction. In: Basbaum AI, Bushnell MC (eds). Handbook of the Senses, vol. 5. Academic Press: San Diego, 2008, pp 43–74.

Other

1. Montell, C., Birnbaumer, L., Flockerzi, V., Bindels, R.J., Bruford, E.S., **Caterina, M.J.**, Clapham, D.E., Hartneck, C., Heller, S., Julius, D., Kojima, I., Mori, Y., Penner, R., Prawitt, D., Sharenberg, A.M., Schultz, G., Shimizu, N., and Zhu, M.X. (2002) A unified nomenclature for the superfamily of TRP cation channels. *Mol. Cell* **9**, 229-231.

Patents

United States Patent #6,335,180 Nucleic acid sequences encoding capsaicin receptor and uses thereof. Awarded January 1, 2002 Inventors: David Julius, Michael Caterina and Anthony Brake

RESEARCH SUPPORT

Ongoing

8/1/12 – 6/30/17

NIDCR 1R01DE022750-01

Neuronal subtype-specific plasticity in the acute to chronic pain transition

Role: Principal Investigator (Multi-PI Caterina, Dong, Ginty)

Annual Direct Costs: \$392,910

The goal of this proposal is to develop novel imaging, transgenic, and behavioral tools to examine what changes account for the transition from acute to chronic pain in mice

4/1/12-3/31/14

NIAMS 1 R21 AR-62826-01

Transgenic Regulation of Keratinocyte to Nociceptor Signaling

Role: Principal Investigator

Annual Direct Costs: \$123,750

This proposal aims to examine the ability of keratinocytes to signal the presence of noxious stimuli to the peripheral nervous system

2/1/12-1/31/17 RO1 DK 54824 NIDDK (PI Lori Birder)

Nitric oxide in bladder neural-epithelial signaling

Annual Direct Costs: \$10,492 to Caterina lab

Role: Co-Investigator (0.36 months effort)

This proposal aims to determine the contribution of TRPV ion channels to the sensory function of epithelial cells in the urinary bladder lumen

4/1/12-3/31/14 Patrick C. Walsh Cancer Research Fund

Contribution of TRPV2 to Prostate Cancer Progression

Role: Principal Investigator

Annual Direct Costs: \$75,000

This proposal aims to dissect the contribution of TRPV2 to the progression of prostate cancer in mice and humans.

NIDDK DK071085 (PI Kanai) 4/1/13 – 3/31/17

Roles of Nitric Oxide and Superoxide in Cystitis

Role: Co-Investigator (0.48 mos effort)

Annual Direct Costs: \$15,429 to Caterina lab

This proposal aims to dissect the role of TRPV channels in radiation induced cystitis

Completed

9/9/11-9/8/13 Johns Hopkins Brain Sciences Institute (PI's Caterina, Dong, Fuchs, Guan, Mankowski, Polydefkis, Raja, Ringkamp)

Annual Direct Costs: \$400,000

Seeing Pain More Clearly

Role: Coordinating Principal Investigator

This is an interdisciplinary program to utilize murine, nonhuman primate, and human tissues and model systems to examine the events that underlie peripheral mechanisms of pain sensation

12/1/06 – 11/31/11 (no cost extension to 11/31/12)

Agonist-evoked changes in TRPV ion channel selectivity

RO1 NS054902

NINDS

Annual Direct Costs: \$153,125

Role: Principal Investigator

This proposal is aimed at exploring the mechanistic basis behind a novel form of ion channel regulation that involves dynamic conformational changes at the channel pore

7/1/07-1/31/12

Nitric oxide in bladder neural-epithelial signaling

RO1 DK 54824

NIDDK

(PI Lori Birder)

Role: Co-Investigator

This proposal aims to determine the contribution of TRPV ion channels to the sensory function of epithelial cells in the urinary bladder lumen

7/1/2008 to 6/30/2014

Title: Johns Hopkins Ion Channel Center

Grant #: 1U54MH084691-01

Direct Costs: \$10,000,000

(PI: Min Li)

Role: Co-Investigator

This grant will establish a high-throughput ion channel screening center for User-Driven and Center-Driven projects.

5/15/05-5/14/10 (no-cost extension until 5/14/11)

Role of TRPV channels in pain and temperature sensation

RO1 1 NS051551

NINDS

\$1,040,625 direct costs

Role: Principal Investigator

This proposal is aimed at examining the contribution of heat-gated TRPV ion channels TRPV1, TRPV2, TRPV3 and TRPV4 to the perception of environmental temperatures by sensory neurons and skin keratinocytes.

7/1/01-6/30/04

Title: Molecular Mechanisms Underlying Mammalian Thermosensation

Searle Scholars Program

\$220,800 total direct costs

Role: Principal Investigator

7/1/01-6/30/04

Title: Molecular Mechanisms Underlying Mammalian Thermosensation

Beckman Young Investigators Program

\$240,000 total direct costs

Role: Principal Investigator

1/1/01-12/31/09

Title: Vanilloid Receptor Contributions to Pain and Growth-Factor-Evoked Responses

RSG-01-063-01-CSM

American Cancer Society Research Scholar Grant

\$791,606 total direct costs

Role: Principal Investigator

Terminated to allow replacement with 1 RO1 NS051551-01

7/1/00-12/31/00

Analysis of differential gene expression in mice lacking the capsaicin receptor, VR1

Blaustein Pain Research Fund (Johns Hopkins)

Total direct costs: \$37,400

Role: P.I.

7/1/01-6/30/06

Title: Molecular Mechanisms Underlying Mammalian Thermosensation

W.M. Keck Foundation Distinguished Young Scholar In Medical Research

\$1,000,000 total direct costs

Role: Principal Investigator

1/1/06-12/31/06

Agonist evoked ionic selectivity changes in TRPV ion channels

Blaustein Pain Research Fund (Johns Hopkins)

Total direct costs: \$27,540

Role: P.I.

1/1/06-12/31/06

Title: TRPV ion channels in Sensation and Homeostasis

Johnson & Johnson PRD

Total Direct Costs: \$15,202

Role: Principal Investigator

6/1/07-5/31/08

Development of a non-invasive model of dental pain in mouse

Blaustein Pain Research Fund (Johns Hopkins)

Direct Costs: \$45,000

Role: P.I.

04/01/10-03/31/11 The Johns Hopkins NIEHS Center in Urban Environmental Health
Pilot Grant

\$25,000 direct costs

Role: Principal Investigator (no effort specified)

Title: TRPV2 as a mediator of pathophysiological effects of airborne particulate matter

1/1/06-12/31/06

Agonist evoked ionic selectivity changes in TRPV ion channels

Blaustein Pain Research Fund (Johns Hopkins)

Total direct costs: \$27,540

Role: P.I.

7/1/11-6/30/12 Blaustein Pain Research Fund

Mutagenic Analysis of TRPV1 Ionic Selectivity

Total Direct Costs: \$32,000

Role: Principal Investigator

This proposal aims to dissect the mechanistic basis of dynamic ionic selectivity in the ion channel TRPV1

Unrestricted Gifts

Merck Research Laboratories 6/00

Unrestricted gift to laboratory of Michael Caterina \$20,000

Dainippon Pharmaceutical Company 9/01

Unrestricted gift to laboratory of Michael Caterina \$20,000 total

Guilford Pharmaceutical Company 7/03
Unrestricted gift to laboratory of Michael Caterina \$1500

Kao Corporation 5/11
Unrestricted gift to laboratory of Michael Caterina \$24,000

RESEARCH PROGRAM BUILDING, LEADERSHIP

Founding Member (One of 8)

Center for Sensory Biology, Johns Hopkins Medicine Institute for Basic Biomedical Sciences 2006-date

Leader, Pain Working Group

Organized faculty from six basic science and clinical departments at Johns Hopkins focused on defining problems in pain biology that can be uniquely tackled by interdisciplinary efforts, and seeking intramural and extramural support for doing so. Coordinate monthly meetings featuring in-house speakers. 2008-date

Inaugural Director, Neurosurgery Pain Research Institute at Johns Hopkins

2013-date

EDUCATIONAL ACTIVITIES

Teaching – Classroom Instruction

Lecturer - Graduate Biochemistry and Cell Biology Course (2 lectures/year) 2000-2003

Lecturer – Pathways and Regulation Course (2 lectures/yr) 2004-date

Lecturer – Medical Neuroscience Course (1-2 lecture/year) 2001-date

Lecturer – Graduate Neuroscience and Cognition Course (2 lectures/year) 2000-date

Lecturer – Medical School Molecules and Cells Course (2 lectures/year) 2003-date

Group Leader – Medical School Molecules and Cells Course (5 sessions/year) 2001-date

Lecturer – Topics in Cellular and Molecular Medicine Course (1 lecture/year) 2000

Course Coordinator - Cellular and Molecular Medicine Core Discussion Course 2001-2005

Lecturer – The Neuroscience of Pain Course (Homewood Campus) (1 lecture/year) 2003-2004

Lecturer – Interdisciplinary Training Grant in Pain (Johns Hopkins School of Nursing) (1 lecture per year, 2012)

Lecturer - Cellular and Molecular Basis of Sensation (Homewood Campus) (1 lecture/yr) 2011-date

Instructor – Cellular and Molecular Medicine Core Discussion (1 session/yr) 2006, 2007, 2012

Instructor – Topics in Biological Chemistry (1 session/year) 2000-date

Instructor – BCMB Core Discussion Course (2 sessions/year) 2002, 2008-2010

Instructor – Neuroscience Core Discussion Course (1 session/year) 2002, 2004-2008

Visiting Instructor – Topics in Neuroscience (Homewood Campus) (1 session/year)
2001-2005

Visiting Instructor – GPILS (Graduate Program in Life Sciences) 601. Mechanisms in Biomedical Sciences (University of Maryland, School of Medicine) – 1 Lecture Nov, 2012, November 2013

Mentoring – Advisees

Michele Nealen

Ph.D. candidate, Cellular and Molecular Medicine Graduate Program 1999-2003
Currently: Homemaker, Portland, OR

Hyosang Lee

Ph.D. candidate, Biological Chemistry Graduate Program 2000-2006
Currently: Postdoctoral fellow, California Institute of Technology, Laboratory of David Anderson

Una Park

Ph.D. Candidate, Neuroscience Graduate Program 2002-2008
Postdoctoral Fellow, 2008
Currently: Postdoctoral Fellow, National Institute of Neurological Disease and Stroke, Laboratory of Leo Belluscio

Ali Guler

Ph.D. candidate, Biological Chemistry, Cellular and Molecular Biology Graduate Program 2000-2005
Currently: Assistant Professor, University of Virginia

Tiffany Link

M.D. Ph.D. Candidate (MSTP Award), Cellular and Molecular Medicine Graduate Program
2006- 2012 Dermatology Resident, UCLA
Received Michael A. Shannoff Young Investigator Award 2010

Zixuan Pang

Ph.D. Candidate, Graduate Program in Biological Chemistry
2012-date Currently in lab

Man Kyo Chung, D.D.S., Ph.D.

Postdoctoral Fellow 2002-2008
Currently: Assistant Professor, University of MD School of Dentistry

Isao Shimizu Ph.D.

Postdoctoral Fellow 2001-2003

Currently: Senior Research Scientist
Neuroscience Group I Discovery
Pharmacology I
Pharmacology Research Laboratories
Dainippon Sumitomo Pharma Co., Ltd.

Tohko Iida Ph.D.

Postdoctoral Fellow 2002-2004

Currently: Translator, Hyogo, Japan

Susan M. Huang, Ph.D.

Postdoctoral Fellow 2004-2011

Research Scientist, Abbott Laboratories

Received Life Sciences Research Foundation Award

Jill-Desiree Brederson Ph.D.

Postdoctoral Fellow 2005-2006

Currently: Research Scientist, Abbott Laboratories.

Received NIH Interdisciplinary Biobehavioral Pain Fellowship

Clare Munns Ph.D.

Postdoctoral Fellow 2008-2012

Presently job hunting in Europe

Received John J. Bonica Fellowship, International Association for the Study of Pain

Bin Wang, M.D.

Presently in lab

Postdoctoral Fellow 2012-date

Sangmin Jeon, Ph.D.

Presently in lab

Postdoctoral Fellow 2013-date

Ramana Sidhaye M.D.

Assistant Professor, Johns Hopkins Department of Medicine, Pulmonary Division

Dr. Caterina was Co-Mentor for her K award K08 HL085763 2008-2011

Visiting Scientists

Takashi Sakamoto

2011-2012

Visiting Research Scientist, Kao Corporation

Rotation Students - Former

Byoung Il Bae

David Wasserman

Guo Huang

Jun Zhong

Bae Gyo Jung

Erin Golden

Hao-Jui Weng

Joseph Bedont
Erin Golden
Elizabeth Hwang
Sonia Chin
Bipasha Mukherjee
Salman Hassan

Undergraduates - Former

Richard Evans JHU
Paul Capestany JHU
Ashley Campbell Yale
Zachary Epstein-Peterson JHU
Yin Yin Yu UPENN
John Barrett JHU
Alexander Blood JHU
Sara Li JHU
Raouf Algomai JHU
Christine Lee JHU
Wafa Khadraoui JHU
Queenie Qiu JHU
Beata Durcanova JHU
Hayley Richter JHU
Joseph Nugent JHU

Undergraduates – Current

Tyler Bryant JHU

Mentoring - Thesis Committee Member

Daniel Warren, Human Genetics Graduate Program 2000
Katie Sackstedler, Human Genetics Graduate Program 2000
Christie Turtzo, Biochemistry, Cellular and Molecular Biology, 2001
Stacy Mazzalupo, Cellular and Molecular Medicine Graduate Program 2001-2002
David Kozono, Biochemistry, Cellular and Molecular Biology, 2001-2002
Min-Gyu Li, Biological Chemistry Graduate Program 2002-2003
Marcel Estevez, Cellular and Molecular Medicine Graduate Program 2002-2006
Seung-Jae Lee, Biological Chemistry Graduate Program 2002-2003
Jaime Cheah, Biochemistry, Cellular and Molecular Biology 2002-2005
Sean O’Hearn, Biochemistry, Cellular and Molecular Biology, 2002-2004
Shawn Motyka, Biochemistry, Cellular and Molecular Biology 2003-2005
Xuemei Tong, Biological Chemistry Graduate Program 2003, 2004, 2005
Chih-ying Su, Neuroscience Graduate Program 2003-2005
David Wasserman, Biochemistry, Cellular and Molecular Biology 2004-2008
Katherine Sixt, Neuroscience Graduate Program 2003-2008
Carey Connely, Neuroscience Graduate Program 2004-2008
Mosi Bennet, Neuroscience Graduate Program 2003-2006
Julie Law, Biochemistry Cellular and Molecular Biology 2004-2006

George Huang, Biochemistry, Cellular and Molecular Biology 2004-2005
Yi Fang, Biological Chemistry Graduate Program 2004-2006
Jee-Hyun Kong, Biomedical Engineering Graduate Program 2005-2009
Chen Chen, Biological Chemistry Graduate Program 2005, 2006
Hsie Wen (Rock) Liao, Neuroscience Graduate Program 2005-2006
Seouk Jun Moon, Biological Chemistry Graduate Program 2005-2008
Young Kwan, Biological Chemistry Graduate Program 2005-2008
Rasika Wickramasinghe, Neuroscience Graduate Program 2006-2008
Matthew Boersma, Neuroscience Graduate Program 2006-
Ming (Michelle) Tang, Biochemistry Cellular and Molecular Biology 2006-
Qiaojie Xiong, Physiology Graduate Program, 2007-2008
Qiuting Ren, Biological Chemistry Graduate Program, 2006-
Michael Rutlin, Neuroscience Graduate Program 2006-
Matthew Miskimmon, Neuroscience, 2006-2008
Anca Mihalas, Biological Chemistry, 2007-
Andrew Kim, Neuroscience, 2007- 2009
Xiaoyue Wang, Biological Chemistry Graduate Program 2007-
Richard Ren, Pharmacology Graduate Program 2007-2008
Cara Altimus, Biology Graduate Program, Homewood 2007- 2009
Beiyi Shen, Biological Chemistry, 2008-2011
Han Gil Lee, Biological Chemistry, 2008-
Kaoru Sakabe, BCMB Graduate Program, 2008-
Phillip Yang, CMM Graduate Program, 2009-
Andrea Benedict, Pharmacology Graduate Program, 2009-2011
Melissa Miller, Biomedical Engineering, Graduate Program 2010-2011
Hao-Jui Weng, Neuroscience, 2010-
Xin Gan, Biological Chemistry, 2011
JrMing Yang, Biological Chemistry, 2011
Lishi Li, Neuroscience, 2011-
Wei Shen, Biological Chemistry, 2010-
Juliane Lessard, Biochemistry, Cellular and Molecular Biology, 2011- 2012
Cassandra Patenaude, BCMB, 2011-
Jinfei Ni, Biological Chemistry, 2011-
Wendy Yue, Biochemistry Cellular and Molecular Biology, 2011-
Ling Bai, Neuroscience, 2012-
Shuohao Sun, Neuroscience 2012-
Chang Liu, Neuroscience 2012-
Paul Scherer, Neuroscience 2012-
Zhou Yu, Biochemistry Cellular and Molecular Biology, 2013-
Laurel Oldach – Biochemistry, Cellular and Molecular Biology, 2013-

Mentoring – Other

M.D. PhD. Student – Faculty Advisor (3 new students/yr) – 2004-2007
School of Medicine College Advisory System – Sabin College advisor (same students as for MD-PhD program) – 2006-2007
Neuroscience Graduate Program Steering Committee – 1-2 new students/yr 2004-2013

Training Grant Participation

Biological Chemistry, Cellular and Molecular Biology Graduate Program 1999-date
Cellular and Molecular Medicine Graduate Program 1999-date
Neuroscience Graduate Program 1999-date
Anesthesiology and Critical Care Medicine Training Grant (Allan Gottschalk PI, T32 GM075774 7/1/2006-6/30/2011
Interdisciplinary Biobehavioral Pain Fellowship Program (Page and Haythornthwaite PIs, T32 MH 75884) 2006-date
Biochemistry and Molecular Biology Training Grant, Johns Hopkins School of Public Health, 2009-date

CLINICAL ACTIVITIES

None

ORGANIZATIONAL ACTIVITIES

Institutional Administrative Appointments

Co-Director, Graduate Program in Biological Chemistry 2003-date
Admissions Committee – Biological Chemistry Graduate Program 2000-date
Admissions Committee – Biological Chemistry, Cellular and Molecular Biology Graduate Program 2002
Admissions Committee, M.D., Ph.D. Program 2004-date
Steering Committee, Neuroscience Graduate Program, 2004-date
Medical School Council 2003-2007
Building Design Committee, Institute for Basic Biomedical Sciences 2004-2005
Seminar Coordinator, Department of Biological Chemistry 2003-2005
M.A., Ph.D. Committee 2003-date
Medical Curriculum Review Mind/Brain Subcommittee – 2005
Member, Center for Sensory Biology (one of 8 founding members) – 2006-date
Graduate Education Committee – 2008
Biomedical Scholars Award Programs Selection Committee – 2008-date
Coordinator, Johns Hopkins Brain Sciences Institute Pain Working Group – 2011-date
BCMB Graduate Education Vision Committee – 2011
Johns Hopkins University Strategic Research – Basic Discovery Subcommittee – 2012
Advisory Committee, Johns Hopkins Neurosurgical Pain Institute, 2012-date
Faculty Search Committee for Center for Chemoprevention Director – 2011
Faculty Search Committee for Center for Cell Dynamics Director – 2013
Director, Neurosurgery Pain Research Institute – 2013

Editorial Activities

Deputy Editor – *Molecular Pain* (2005-date)
Associate Editor, *Journal of Neuroscience* (2007-date)
Ad hoc Editor *Proceedings of the National Academy of Sciences* (2013)

Ad hoc reviewer - Nature, Science, Cell, Nature Chemical Biology, Neuron, Nature Neuroscience, Journal of Neuroscience, Journal of Biological Chemistry, Pain, Journal of Pharmacology and Experimental Therapeutics, Journal of Neurobiology, Proceedings of the National Academy of Sciences, European Journal of Neuroscience, Neuroscience, Neuropharmacology, Biochemical Pharmacology, Lancet, Molecular Pain.

Review Groups

Ad hoc reviewer, National Institutes of Health Center for Scientific Review Special Emphasis Panel ZRG1 IFCN-5 (03) 2001

Ad hoc reviewer, National Cancer Institutes Subcommittee C, RPRB (R2) PO1 review committee (Michael Small SRA) October, 2004

Ad hoc reviewer, National Institutes of Health Center for Scientific Review Special Emphasis Panel 2005/01 ZRG1 IFCN-K (02) (M) (Joseph Rudolf SRA) November, 2004

Ad hoc reviewer, National Institute of Neurological Disease and Stroke NSDC Study Section (Andrea Sawczuk SRA) June 2005

Ad hoc reviewer, National Institutes of Health Neurogenesis and Cell Fate Study Section (Lawrence Baizer SRA) June 2005, Aug 2006, Feb 2007, March 2007, March 2008

Ad hoc reviewer, National Institutes of Health Special Emphasis Panel (Joseph Rudolph SRA) December 2005

Ad hoc reviewer, National Institutes of Health Special Emphasis Panel (Lawrence Baizer SRA) December 2005

Ad hoc reviewer, National Institutes of Health , Neurogenesis and Cell Fate Study Section (Mary Custer SRA) August 2006

Ad hoc reviewer, National Institutes of Health, Limited Competition for Dietary Supplement Research Centers: Botanicals, (Martina Schmidt SRA) November 2006

Ad hoc reviewer, National Institutes of Health, Neurogenesis and Cell Fate (Lawrence Baizer SRA) February 2007

Ad hoc reviewer, National Institutes of Health ZRG1 MDCN-D 02 M, Regulation of Axonal Growth and Synaptic Plasticity MDCN-D (02) (Lawrence Baizer SRA), March 2007

Ad hoc reviewer, National Institutes of Health, Special Emphasis Panel ZRG1 MDCN-N (03) Carol Hamelink, SRA) July 2007

Ad hoc reviewer, National Institutes of Health Special Emphasis Panel ZRG1 MDCN-D 02 M (Lawrence Baizer SRA) March, 2008

Ad hoc reviewer, National Cancer Institutes Special Emphasis Panel, SEP Cluster Review Pane, October 2008

Ad hoc reviewer, National Institutes of Health, Molecular, Cellular and Developmental Neurosciences IRG (Carol Hamelink SRO), April 2009

Ad hoc reviewer, National Institutes of Health, Cellular and Tissue Oncology Special Emphasis Panel (Ahmad Shakeel, SRO), October, 2009

Ad hoc reviewer, National Institutes of Health, Neurotoxicology and Alcohol (NAL) Study Section 3/10

Ad hoc reviewer, National Institutes of Health, NIDCD, 2011/05 Council ZDC1 SRB-Y 51, (Shiguang Yang, SRO) 03/01/2011

Ad hoc reviewer, National Institutes of Health, NTRC study section (Peter Guthrie SRO) Sept 2011

Ad hoc reviewer, National Institutes of Health, IAM meeting 2012/05 ZRG1 IFCN-L (02) M (Ed Clayton, SRO) 2/29/12

Ad hoc reviewer, National Institutes of Health, Transformative Research Award Program, 139 TRA 2013_IRG (M. Catherine Bennett SRO) 1/28/13

Ad hoc reviewer, National Institutes of Dental and Craniofacial Research, Board of Scientific Counselors, Intramural tenure review, 5/28/13

Review Committee – Blaustein Pain Research Program, Johns Hopkins School of Medicine 2004-date

Reviewer, Wellcome Foundation Postdoctoral Fellowships 2003-2008

Reviewer, American Pain Society Small Grants Program 2006-date

Member, International Association for the Study of Pain Junior Investigator Grants Program 2006

Reviewer, Beckman Young Investigators Program, 2006-2007

Reviewer, Johns Hopkins University Biomedical Scholars Award Programs Selection Committee – 2008-date

Professional Societies

Society for Neuroscience –Member 2001-date

Annual Meeting Program Committee 2008, 2009

Continuing Medical Education Subcommittee 2008, 2009

International Association for Pain Research – Member 2002-date

Biennial Meeting Program Committee 2009

Junior Investigator Grants Program Committee 2006-date

American Pain Society – Member 2002-date

Small Grants Program Committee – 2006-date

Conference Organizer

Session Chair, American Pain Society Annual Meeting, 2001, Atlanta

Session Chair, American Pain Society Annual Meeting, 2003, Chicago

Session Chair Society for Neuroscience Annual Meeting Washington, DC 11/05

Co-Chairman, FASEB Meeting on Calcium and Cell Function, (2006, 2008)

Program Committee, Society for Neuroscience Annual Meeting – 2008, 2009

Program Committee, International Association for the Study of Pain Meeting, 2010

Advisory Boards/Consulting

Hydra Biosciences, 2005-date

Merck Research Laboratories, 2007

ENDO Pharmaceuticals, 2008

RECOGNITION

Awards, Honors

Evan Pugh Scholar, The Pennsylvania State University, 1987

NIH Medical Scientist Training Program Grant, 1987-1995

McGraw Hill Publishing Medical Student Award, 1988

Lange Publishing Medical Student Award, 1988
Franklin Paine Mall Award in Anatomy and Cell Biology, 1988
Alpha Omega Alpha Medical Honor Society, 1995
Gate Pharmaceuticals Medical Student Award, 1995
Postdoctoral Fellowship, U.C.S.F. Cardiovascular Research Institute, 1995-1996
Postdoctoral Fellowship, American Cancer Society, 1996-1999
Young Investigator Award, National Alliance For Research on Schizophrenia and Depression, 1996-1998
Keith Killam Memorial Award in Receptor Pharmacology, Western Pharmacology Society 2000
Searle Scholars Program, 2001
Beckman Young Investigator, 2001
W. M. Keck Foundation Distinguished Young Scholar in Medical Research, 2001
NARSAD Freedman Award Honorable Mention 2001
Patrick D. Wall Young Investigator Award, International Association for the Study of Pain, 2005
Professor's Award for Excellence in Teaching, Johns Hopkins School of Medicine, 2008
Donlin M. Long Pain Service Award, Blaustein Pain Treatment Center, Johns Hopkins School of Medicine, 2013

Invited Talks, Panels

As Graduate Student

Dictyostelium International Conference, Vancouver, Canada 1994

As Postdoctoral Fellow

European Neuroscience Association Satellite Meeting on Peripheral Mechanisms of Pain Sensation, Berlin, Germany, 7/98

Japanese Biochemical Society Annual Meeting, Nagoya, Japan, 10/98

American Pain Society Annual Meeting, San Diego, CA 11/98

Ion channels in Nociception Meeting, San Francisco, CA 1999

Duke University Department of Cell Biology, Durham, NC 1999

University of Wisconsin Department of Physiology, Madison, WI 1999

Harvard Medical School Department of Biological Chemistry and Molecular Pharmacology. Boston, MA 1999

Harvard University Department of Molecular and Cellular Biology, Cambridge, MA 1999

University of Chicago Department of Pharmacological and Physiological Sciences, Chicago, IL 1999

Johns Hopkins School of Medicine Department of Biological Chemistry, Baltimore, MD 1999

Ohio State University Department of Neuroscience, Columbus, OH 1999

As Assistant Professor

Pulmonary Research Service, Johns Hopkins Univ. School of Medicine 2/00

Blaustein Pain Research Center, Johns Hopkins Univ. School of Medicine 2/00

Department of Neurology and Neurosurgery, Johns Hopkins Univ. School of Medicine 4/00, 11/00
Department of Cell Biology and Anatomy, Johns Hopkins Univ. School of Medicine 4/00
Spring Pain Research Conference, Cayman Islands 5/00
Merck Research Laboratories, Rahway, NJ 7/00
American Pain Society Annual Meeting, Atlanta, GA (Session Chair) 10/00
Laboratory of Cellular and Molecular Biology, National Cancer Institute, Bethesda, MD 11/00
Department of Pharmacology, Univ. of Pittsburgh School of Medicine 12/00
Carnegie Institute of Embryology, Johns Hopkins University 12/00
Johns Hopkins University Hearing Center 12/00
University of Alabama, Birmingham Dept. of Physiology 1/01
Western Pharmacology Society Meeting, (Killiam Award Lecture) Vancouver, Canada 3/01
Johns Hopkins Board of Advisors 4/01
Johnson and Johnson Meeting on Visceral Pain Mechanisms, New Brunswick, NJ 5/01
National Institutes of Drug Abuse, Baltimore, MD 10/01
Baylor University School of Medicine, Dept. Neuroscience, Houston, TX 2/02
BCMB Recruitment Weekend, Johns Hopkins Sch. Medicine 2/02
Endo Pharmaceuticals Round Table Discussion on Analgesic Drugs, Baltimore, MD 3/02
Johns Hopkins School of Medicine Department of Neurology and Neurosurgery 3/02
Uniformed Health Services University, Bethesda, MD 5/02
Johns Hopkins University Department of Biology 10/02
3Dimensional Pharmaceuticals, Exton, PA 11/02
Johns Hopkins School of Medicine, Renal Division, Department of Medicine 12/02
BCMB Recruitment Weekend, Johns Hopkins Sch. Medicine 2/03
Symposium Keynote Speaker, Society of Toxicology Annual Meeting, Salt Lake City, UT 3/03
American Pain Society Annual Meeting, Chicago, IL (Session chair) 3/03
Federated Association of Societies for Experimental Biology Annual Meeting, San Diego CA (presented by graduate student Michele Nealen) 4/03
Albany Medical College, Albany, NY 6/03
Merck Research Laboratories, Rahway, NJ 1/03
Japanese Society for Neuroscience Annual Meeting (presented by graduate student Hyosang Lee) 7/03
American Chemical Society Annual Meeting, New York, NY 9/03
Peter E. Dresel Memorial Lecture in Pharmacology, Dalhousie University, Halifax, Nova Scotia, Canada 10/03
Emory University, Department of Pharmacology, 12/03

As Associate Professor

University of Oregon Health Sciences Center, Vollum Institute, 5/04
FASEB Conference on Calcium Signaling, Snowmass, CO 6/04
London Pain Consortium Seminar Series, London UK 6/04
KU Leuven, Leuven, Belgium 6/04
Hydra Biosciences, Cambridge, MA 7/04

State University of New York, Stony Brook, Dept. of Neurobiology Stony Brook, NY 10/04
Society for Neuroscience Annual Meeting Minisymposium, San Diego, CA 10/04
Johnson and Johnson Pain Research Division, La Jolla, CA 10/04
Center for Mol. Medicine, University of Cologne Meeting on Homeostasis and the Hypothalamus, Cologne, Germany 11/04
Indiana University School of Medicine, Indianapolis IN 2/05
Medical College of Wisconsin, Milwaukee, WI 2/05
University of Southern California, Los Angeles, CA 2/05
Duke University School of Medicine, Durham, NC 3/05
University of North Carolina School of Medicine, Chapel Hill, NC 3/05
Neuroscience Student Invited Speaker, University of Virginia Sch. Medicine, Charlottesville, VA 3/05
35th International Congress of Physiological Sciences, Symposium, San Diego, CA 4/05
Northwestern University Chicago, IL 5/05
Gordon Conference on Calcium Signaling, Oxford, UK 7/05
University of Washington, Dept. of Pharmacology, Seattle WA 11/05
Johns Hopkins Sch. Medicine Dept. Anesthesiology and Critical Care Medicine 11/05
2nd International Meeting on Physiology and Pharmacology of Temperature Regulation, Phoenix AZ 3/06
Columbia University School of Medicine, New York, NY 4/06
University of Minnesota, Minneapolis MN 4/06
Johns Hopkins Sch. Medicine Dept. Medicine Pulmonary Division 4/06
Woods Hole Neurobiology Course, Woods Hole, MA 6/06
National Cancer Institute, Bethesda MD 6/06
FASEB Meeting on Calcium and Cell Function, Snowmass CO 7/06
McGill University, Montreal Canada, 12/06
Astra-Zeneca Pharmaceuticals, Montreal Canada 12/06
Biophysical Society Annual Meeting, Baltimore, MD 3/07
Monell Chemical Senses Center, Philadelphia, PA 3/07
Georgetown University, Washington, DC 5/07
Yale University, New Haven, CT 5/07
University of California, Irvine 6/07
Merck Research Labs, West Point, PA 8/07
Keystone Meeting on TRP Channels, Keystone, CO 9/07
Principle Speaker, Keratinocyte Study Group of Japan, Kyoto, Japan 12/07
Johns Hopkins Asthma and Allergy Center, Baltimore, MD 1/08
ENDO Pharmaceuticals Neuropathic Pain Conference, Philadelphia, PA 4/08
Johns Hopkins Clinical Neurology Seminar Series, Baltimore, MD 5/08
St. Louis University, St. Louis, MO, 11/08
St. Joseph's Hospital/Barrow Neurological Institute, Phoenix AZ, 2/09
Washington University School of Medicine, St. Louis, MO, 4/09
Virginia Commonwealth University, Richmond, VA 5/09
Gordon Research Conference on Epithelial Differentiation and Keratinization, Les Diablerets, Switzerland, 6/09
Nobel forum, Karolinska Institute, Stockholm, Sweden. 9/09

Johns Hopkins University Department of Biology, 12/9
Student-Invited Speaker, Medical College of Wisconsin, 3/10
University of Pennsylvania, Philadelphia, PA, 4/10

As Professor

University of Miami, Miami, FL 4/11
University of Michigan, Ann Arbor, MI, 4/11
Institut de Biologie du Développement de Marseille-Luminy (IBDML), Marseilles,
France, 3/12
Johns Hopkins Brain Sciences Institute, Baltimore MD 5/12
International Pachyonychia Congenita Consortium, Raleigh, NC 5/12
FASEB Meeting on Calcium and Cell Function, Snowmass CO 6/12
2012 International Ion Channel Conference, Jeju Island, Korea 8/12
International Workshop on Transient Receptor Potential Channels, Valencia, Spain 9/12
Duke University Ion Channel Center, Durham, NC 11/13
University of Pennsylvania Interdisciplinary Pain Program, Philadelphia, PA 11/13
Harvard Neurobiology/Children's Hospital, Boston, MA 12/12
International Pachyonychia Congenita Consortium, Park City, UT 2/13
Dean's Lecture/Donlin M. Long Award Presentation, Johns Hopkins, Baltimore, MD
3/13
Gulf Coast Consortium for Translational Pain Research, Houston, TX 3/13
Janelia Farms Research Campus, Sensory Signaling in Model Organisms Symposium
4/13
Johns Hopkins Blaustein Pain Research Seminar Series, Baltimore, MD 4/13
NIH Membrane Protein Interest Group, Bethesda MD 6/13
National Institute of Drug Abuse, Bethesda MD 7/13
University of Iowa, Iowa City, IA 2/14
University of Texas Medical Branch, Galveston, TX 3/14