
BIOGRAPHICAL SKETCH

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NAME Chen, Zhou-Feng	POSITION TITLE Professor		
eRA COMMONS USER NAME (credential, e.g., agency login) chenzf			
EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)			
INSTITUTION AND LOCATION	DEGREE (if applicable)	MM/YY	FIELD OF STUDY
Wuhan University, China	B.S.	1983	Virology
University of Texas Health Science Center, Houston, TX	Ph.D.	1994	Genetics

A. Personal Statement

My long-term interest is to understanding the molecular and cellular mechanisms of itch and pain sensations. Chronic itch is a major intractable clinical problem that is associated with a wide spectrum of skin diseases including atopic dermatitis, a very prevalent problem in children. My laboratory has identified the first itch-specific receptor, gastrin-releasing peptide receptor (GRPR), and neural circuits dedicated to the transmission of itch in the spinal cord. These findings have opened a new frontier for elucidating mechanisms of itch transmission from the skin to the brain as well as the relation between itch and pain. Our goal is to uncover novel targets for designing anti-itch therapy in the future.

B. Positions and Honors

Professional Experience:

1983 – 1985 Practice Research Fellow, National Vaccine & Serum Institute, Beijing, China
1987 – 1990 Assistant Research Fellow, National Vaccine & Serum Institute, Beijing, China
1994 – 2000 Research Associate, Howard Hughes Medical Institute, California Institute of Technology, Pasadena, California
2000 – 2006 Assistant Professor, Departments of Anesthesiology, Psychiatry and Developmental Biology, Washington University, St. Louis, Missouri
2006 – 2009 Associate Professor, Departments of Anesthesiology, Psychiatry and Developmental Biology, Washington University, St. Louis, Missouri
2009 – present Professor, Departments of Anesthesiology, Psychiatry and Developmental Biology, Washington University, St. Louis, Missouri
2011 – present Director, Center for the Study of Itch, Washington University, St. Louis, Missouri

Honors and Awards:

1986 State Education Committee Fellowship, China (to study abroad)
1993 John P. McGovern Award and First Place Winner, 11th Annual Graduate Student Research Symposium, GSBS, University of Texas Health Science Center at Houston
1994 Best Poster Award, Gordon Research Conference: Neural Development, Salve Regina University, and Newport, RI.
2010 Keynote speaker, Japanese biannual meeting on itch
2011 Founder and Director, Center for the Study of Itch

Other experience and Professional memberships

2001- Member, The Society of Neuroscience
2001- Member, American Association for the Advancement of Science (AAAS)

Ad Hoc reviewer for NIH study section ZRG1 IFCN-E, 2008; The NDPR study section, 2009.

Ad Hoc reviewer for J. Clin Inv, Cell, Nature, Pain, Brain Res, Genesis, Development, Dev Dynam, Dev Biol, J. Neurosci, Trends Neurosci, Gene Dev, Eur J Neurosci, PNAS, ACTA Derm-Venereol, Exp Cell Res etc; Neuron, Nat Neurosci etc.

International Reviewers for faculty performance, promotion and recruitment for various institutes including Institute of Neuroscience (China) and Peking-Tsinghua Center for life science (China) etc.

C. Selected Peer-reviewed Publications (from more than 50 papers)

1. **Chen ZF**, Behringer RR: *twist* is required in head mesenchyme for cranial neural tube morphogenesis. **Genes Dev.** 1995; 9:686-699
2. Ma Q, **Chen ZF**, del Barc Barrantes I, de la Pompa JL, Anderson DJ: neurogenin1 is essential for the determination of neuronal precursors for proximal cranial sensory ganglia. **Neuron** 1998; 20:469-482
3. Wang HU, **Chen ZF**, Anderson DJ: Molecular distinction and angiogenic interaction between embryonic arteries and veins revealed by ephrin-B2 and its receptor Eph-B4. **Cell** 1998; 93:741-753
4. **Chen ZF**, Paquette AJ, Anderson DJ. NRSF/REST is required *in vivo* for repression of multiple neuronal target genes in both neural and non-neuronal tissues during embryogenesis. **Nat. Genet.** 1998; 20:136-142
5. Kin J, Jones BW, Zock C, **Chen ZF**, Wang H, Goodman CS, Anderson DJ: Isolation and characterization of mammalian homologs of the Drosophila gene, glial cells missing. **Proc. Natl. Acad. Sci. USA** 1998; 95:12364-12369
6. Gerety SS, Wang HU, **Chen ZF**, Anderson DJ: Symmetrical mutant phenotype of the receptor EphB4 and its specific transmembrane ligand ephrin-B2 in cardiovascular development. **Mol. Cell** 1999; 4:403-414
7. **Chen ZF**, Guenther T, Kin J, Prieme M, Rueger JM, Amling M, Moseley JM, Martin TJ, Anderson DJ, Kensley G: Genetic ablation of parathyroid glands by targeted mutation of *Glial cells missing2* reveals an auxiliary source of parathyroid hormone secretion. **Nature** 2000; 406:199-203
8. Wei F, Wang GD, Kerchner GA, Kim SJ, Xu HM, **Chen ZF**, Zhuo M: Genetic enhancement of inflammatory pain by forebrain NR2B overexpression. **Nat. Neurosci.** 2001; 2:164-169
9. Labarca C, Schwarz J, Deshpande P, Schwarz S, Nowak MW, Fonck C, Nashmi R, Kofuji P, Dang H, Shi W, Fidan M, Khakh BS, **Chen ZF**, Bowers BJ, Boulter J, Wehner JM, Lester HA: Point mutant mice with hypersensitive [alpha] 4 nicotinic receptors show dopaminergic deficits and increased anxiety **Proc. Natl. Acad. Sci. USA** 2001; 98:2786-2791
10. **Chen ZF**, Rebelo S, White F, Malmberg A, Baba B, Lima L, Woolf CJ, Basbaum AI, Anderson DJ: The paired homeodomain protein DRG11 controls the projection of nociceptive sensory afferent fibers to the dorsal spinal cord. **Neuron** 2001; 31:59-73
11. Wei F, Kim, SJ, Muglia, L, Maas, L, Pineda, VV, Xu, HM, **Chen ZF**, Storm DR, Muglia LJ and Zhuo M: Elimination of inflammation related allodynia but not acute pain in mice lacking calmodulin stimulated adenylyl cyclases. **Neuron** 2002; 36:713-726
12. Ding YQ, Yin J, Jacquin MF, and **Chen ZF**. Formation of whisker-related PrV-based lemniscal pathway requires a paired homeodomain transcription factor, *Drg11*. **J. Neurosci**, 2003; 23:7426-7437
13. Ding YQ, Marklund U, Yuan W, Wegman L, Ericson J, Deneris E, Johnson RL, and **Chen ZF**. *Lmx1b* is essential for the development of serotonergic neurons. **Nat. Neurosci**, 2003; 6:933-938
14. Ding YQ, Yin J, Artur K, Johnson RL, and **Chen ZF**. *Lmx1b* controls the differentiation and migration of the superficial dorsal horn neurons of the spinal cord. **Development** 2004; 131:3693-703.

15. Ren XR, Ming GL, Xie Y, Hong Y, Sun DM, Zhao ZQ, Wang Q, Shim S, **Chen ZF**, Song HJ, Mei L and Xiong WC. Focal adhesion kinase in netrin-1 signaling. *Nat Neurosci*. 2004. 7:1204-12.
16. Ding YQ, Kim JY, Rao Y, and **Chen ZF**. Ventral migration of early-born neurons requires Dcc and is essential for the projections of primary afferents in the spinal cord. *Development*. 2005. 132: 2047-2056.
17. Wu LJ, Toyoda H, Zhao MG, Lee YS, Rang J, KO SW, Jia YH, Shum FWF, Zerbinatti CV, Bu G, Wei F, Xu TL, Muglia LJ, **Chen ZF**, Auberson YP, Kaang BK and Zhuo M. Upregulation of forebrain NMDA NR2B receptors contributes to behavioral sensitization after inflammation. *J. Neurosci*. 2005, 25(48):11107-16.
18. Zhao ZQ, Scott M., Chiechio S, Wang JS, Renner K, Gereau R., Johnson R., Deneris E., and **Chen ZF** Lmx1b is required for maintenance of central serotonergic neurons and mice lacking central serotonergic system exhibit normal locomotor activity. *J. Neurosci*. 2006, 26: 12781-88.
19. Zhao ZQ, Chiechio S, Sun YG, Zhang KH, Zhao CS, Scott M, Johnson R., Deneris E., Renner K., Gereau RW. and **Chen ZF** Mice lacking central serotonergic neurons show enhanced inflammatory pain and an impaired analgesic response to antidepressant drugs. *J. Neurosci*. 2007 27: 6045-6053
20. Sun YG, and **Chen ZF**. Gastrin-releasing peptide receptor mediates the itch sensation in the spinal cord. *Nature* 2007 448: 700-703 (*This paper has received numerous international media coverage and highlighted by Faculty of 1000, Nature and Science*)
21. Zhao ZQ, Gao YJ, Sun YG, Zhao CS, Gereau RW. and **Chen ZF**. Central serotonergic neurons are differentially required for opioid analgesia but not for morphine tolerance or morphine reward. *Proc. Natl. Acad. Sci. USA*. 2007 104(36): 14519-24.
22. Jacquin MF, Joop JA. Xiang C, Shapiro LA, Ribak CE and **Chen ZF**. In *Drg11* knockout mice, trigeminal cell death is extensive, apoptotic and does not account for failed brainstem patterning. *J. Neurosci*. 2008 28: 3577-3585.
23. Hodges MR, Tattersall, GJ, Harris MB, McEvoy S, Richerson DN, Deneris ES, Johnson RL, **Chen ZF**, Richerson GB. Defects in breathing and thermoregulation after genetic deletion of central serotonin neurons. *J. Neurosci*. 2008 28: 2495-2505.
24. Sun YG, Gracias NG, Drobish J, Vasko MR, Gereau RW and **Chen ZF**. The c-kit signaling pathway is required for the development of persistent pain. *Pain*, 144:178-186, 2009.
25. Sun YG, Zhao ZQ, Meng XL, Yin J and **Chen ZF**. Cellular basis of itch sensation. *Science* 325: 1531-1534, 2009. (*This paper has received numerous international media coverage and highlighted by Faculty of 1000, Science and Nature*)
26. Liu Q, Tang ZX, Surdenikova L, Kim SI, Patel KN, Kim A, Ru F, Guan Y, Weng H-J, Geng YX, Udem BJ, Kollarik M, **Chen ZF**, Anderson DJ and Dong XZ. Sensory neuron-specific GPCRs Mrgprs are itch receptors mediating chloroquine-induced pruritus. *Cell*, 139(7): 1353-1365, 2009.
27. Lagerström MC, Rogoz K, Abrahamsen B, Persson E, Reinius B, Nordenankar K, Ölund C, Smith C, Mendez JA, **Chen ZF**, Wood, JN, Mackenzie AW and Kullander K. VGLUT2 dependent sensory neurons in the TRPV1 population regulate pain and itch. *Neuron* 68(3): 529-542, 2010.
28. Liu Y, Jiang Y-A, Si YX, Kim JY, **Chen ZF** and Rao Y. Molecular Regulation of Sexual Preference Revealed by Genetic Studies of 5-HT in the Brain of Male Mice. *Nature* 472(7341): 95-99, 2011.
29. Liu XY, Liu ZC, Sun YG, Ross M, Kim SI, Tsai FF, Li QF, Jeffry J, Kim JY, Loh HH and **Chen ZF**. Unidirectional cross activation of GRPR by MOR1D uncouples itch and analgesia-induced by opioids. *Cell*

147(2): 447-458, 2011 (*This paper was highlighted by Cell with a preview, and by Nature's research highlight and Science's editor choice, and has been featured by Faculty of 1000*)

30. Zhao ZQ, Huo FQ, Jeffry J, Hapmton L, Demehri S, Kim S, Liu XY, Barry DM, Wan L, Liu ZC, Li H, Turkoz A, Ma K, Cornelius LA, Kopan R, Battey JF, Zhong J and **Chen ZF**. Chronic itch development in sensory neurons requires BRAF signaling pathways. **J. Clin Invest.** 123 (11), 4769-4780, 2013.
31. Liu ZX, Zhou JF, Li Y, Hu F, Lu Y, Ma M, Feng QR, Zhang J, Wang DQ, Zeng JW, Bao JH, Kim JY, **Chen ZF**, Mestikawy S and L MM. Dorsal Raphe Neurons Signal Reward through 5-HT and Glutamate. **Neuron.** 81(6): 1360-74, 2014
32. Zhao ZQ, Wan L, Liu XY, Huo FQ, Li H, Barry DM, Krieger S, Kim S, Liu ZC, Xu J, Rogers BE, Li YQ, **Chen ZF**. Cross-Inhibition of NMBR and GRPR Signaling Maintains Normal Histaminergic Itch Transmission. **J Neurosci.** 2014 Sep 10;34(37):12402-14.
33. Zhao ZQ, Liu XY, Jeffry J, Karunarathne WK, Li JL, Munanairi A, Zhou XY, Li H, Sun YG, Wan L, Wu ZY, Kim S, Huo FQ, Mo P, Barry DM, Zhang CK, Kim JY, Gautam N, Renner KJ, Li YQ and **Chen ZF**. Descending Control of Itch Transmission by the Serotonergic System via 5-HT_{1A}-Facilitated GRP-GRPR Signaling. **Neuron.** 2014 Nov 19 84(4):821-834. (*This paper has received numerous world-wide media coverage, including NBC nightly news, highlighted by Neuron as a video abstract and ABC etc.*)
34. Barry DMD, Li H, Liu XY, Shen KF, Liu XT, Wu ZY, Munanairi A, Chen XJ, Yin J, Sun YG, Li YQ, **Chen ZF**. Critical Evaluation of the Expression of Gastrin Releasing Peptide in Dorsal Root Ganglia and Spinal Cord **Mol Pain** 2016
35. Kim S, Barry, DM, Liu XY, Yin SJ, Karunarathne, WK, Munanairi A, Meng QT, Cheng W, Mo P, Wan L, Yin J, Liu SB, Zhao ZQ, Gautam N., Zheng J, **Chen, ZF**. Facilitation of TRPV4 by TRPV1 is required for itch transmission in sensory neurons. **Science Signaling** 2016 (in revision)

D. Research Support

Ongoing Research Support

RO1 1R01AR056318-06 4/01/14-3/31/19
NIH/NIAMS Molecular mechanisms of the itch sensation in the spinal cord
Role: PI

R56 AR064294-01A1 9/15/14-6/30/16
NIH/NIAMS A novel approach to identify the mediators in chronic itch
Role: PI

R21 NS088861-01A1 2/1/2015 - 2/28/2017
NIH/NINDS The role of PKA in GRPR desensitization
Role: PI

R01NS094344 9/01/2015 - 06/30/2020
NIH/NINDS Understanding mechanisms that block GRPR-mediated chronic itch
Role: PI

R01 DA037261-01A1 10/01/2015 – 9/30/2020
NIH/NIDA Mechanism of desensitization of MOR1D-GRPR crosstalk
Role: PI

F. U.S. PATENT

US patent 7,939,071. 2011, "Artery- and vein-specific proteins and uses therefor", Inventors: Hai Wang, Zhou-Feng Chen, and David.J. Anderson.

US patent 082267, 2008, "Compositions and methods for treating pruritus", Inventors: Zhou-Feng Chen and Yan-Gang Sun

US patent 560,620, 2013 "composition and methods for reducing opioid-induced pruritis", Inventors: Zhou-Feng Chen and Xianyu Liu