

SHIN NAGAYAMA, PH.D.**ASSISTANT PROFESSOR**

Department of Neurobiology and Anatomy
 The University of Texas Medical School at Houston
 McGovern Medical School
 6431 Fannin Street, MSB 7.046, Houston, TX 77030 USA
 Tel: 713-500-5862
 E-mail: shin.nagayama@uth.tmc.edu

EDUCATION

1992-1996	B.S. in Zoology	University of Hokkaido, Japan
1996-1998	M.S. in Biology	University of Hokkaido, Japan
2000-2004	Ph.D. in Neuroscience	University of Tokyo, Japan

PROFESSIONAL / TEACHING EXPERIENCE

1998-2000	Technician, Department of Pharmacology and Neurobiology, Graduate School of Medicine, Tokyo Medical and Dental University, Tokyo, Japan
2002-2004	Research assistant, Department of Physiology, Graduate School of Medicine, University of Tokyo, Tokyo, Japan

POSTGRADUATE TRAINING

2004-2008	Postdoctoral Associate/Fellow, Yale University, CT, USA
2009-2012	Research track Assistant Professor, The University of Texas Medical School at Houston, TX, USA
2012-Present	Tenure track Assistant Professor, The University of Texas Medical School at Houston, TX, USA

RESEARCH INTERESTS

Olfactory system
 Dendritic processing and Axonal spike propagation
 Individual neuronal contribution to the function of brain circuit

PROFESSIONAL SOCIETIES

Society for Neuroscience
 The Association for Chemoreception Science

HONORS AND AWARDS

2000-2003	Junior Research Associate (predoctoral fellowship) RIKEN, Brain Science Institute
2007-2009	The Robert Leet and Clara Guthrie Patterson Trust Fellowship

CURRENT RESEARCH FUNDING

Grant Type:	R01 Research Grant (NIH/NIDCD)
Project Title:	<i>"Neuronal and Network Dynamics in the Olfactory System"</i> (R01DC013802)
My Role:	Principal Investigator
Total Cost:	\$1,900,000
Funding Period:	4/1/2014 – 3/31/2019

Grant Type:	Seed Grant (University of Texas System / Neuroscience & Neurotechnology Research Institute)
Project Title:	<i>"Developing Integrated Methods for Analyzing Brain Circuits"</i> (362804)
My Role:	Co-Investigator (PI: Byrne)
Total Cost:	\$100,000
Funding Period:	9/1/2015 – 8/31/2017

PAST RESEARCH FUNDING

- Grant Type: R01 Research Grant (NIH/NIDCD)
 Project Title: “*Optical Imaging of Olfactory Sensory Code Transformation*” (R01DC009666)
 My Role: Principal Investigator
 Total Cost: \$1,416,025
 Funding Period: 7/1/2008 – 6/30/2014
- Grant Type: R03 Research Grant (NIH/NIDCD)
 Project Title: “*Differential odor-response and central-projection patterns of mitral and tufted cells*” (R03DC010057)
 My Role: Principal Investigator
 Total Cost: \$442,248
 Funding Period: 7/1/2009 – 6/31/2013
- Grant Type: Postdoctoral Fellowship (The Robert Leet and Clara Guthrie Patterson Trust)
 Project Title: “*Individual Neuronal Contributions to the Function of a Cortical Network Module*”
 My Role: Awardee
 Total Costs: \$96,000
 Funding Period: 2/1/2007 – 1/31/2009

PUBLICATIONS**PEER REVIEWED RESEARCH ARTICLES**

1. **Nagayama, S.**, Morimoto, M., Kawabata, K., Fujito, Y., Ogura, S., Abe, K., Ushiki, T. & Ito, E. (1996). AFM observation of three-dimensional fine structural changes in living neurons. *Bioimages*, 4: 111-116.
2. Kojima, S., Nakamura, H., **Nagayama, S.**, Fujito, Y. & Ito, E. (1997). Enhancement of an inhibitory input to the feeding central pattern generator in *Lymnaea stagnalis* during conditioned taste-aversion learning. *Neuroscience Letter*, 230: 179-182.
3. **Nagayama, S.**, Tojima, T., Morimoto, M., Sasaki, S., Kawabata, K., Ushiki, T., Abe, K. & Ito, E. (1997). Practical scan speed in atomic force microscopy for live neurons in a physiological solution. *Japanese Journal of Applied Physics*, 1 36(6B): 3877-3880.
4. Yamamoto, M., Takahashi, H., Nakamura, T., Hioki, T., **Nagayama, S.**, Ooashi, N., Sun, X.F., Ishii, T., Kudo, Y., Nakajima-Iijima, S. Kimchi, A. & Uchino, S. (1999). Developmental changes in distribution of death-associated protein kinase mRNAs. *Journal of Neuroscience Researches*, 58: 674-783.
5. Sadamoto, H., Yamanaka, M., Hatakeyama, D., **Nagayama, S.**, Kojima, S., Yamashita, M. and Ito, E. (2000). Developmental study of anatomical substrate for conditioned taste aversion in *Lymnaea stagnalis*. *Zoological Science*, 17: 141-148.
6. Toru, S., Murakoshi, T., Ishikawa, K., Saegusa, H., Fujigasaki, H., Uchihara, T., **Nagayama, S.**, Osanai, M., Mizusawa, H. & Tanabe, T. (2000). Spinocerebellar ataxia type 6 mutation alters P-type calcium channel function. *Journal of Biological Chemistry*, 275: 10893-10898.
7. Tsunemi, T., Saegusa, H., Ishikawa, K., **Nagayama, S.**, Murakoshi, T., Mizusawa, H. & Tanabe, T. (2002). Novel Ca(v)_{2.1} splice variants isolated from Purkinje cells do not generate P-type Ca²⁺ current. *Journal of Biological Chemistry*, 277: 7214-7221.
8. Inaki, K., Takahashi, Y.K., **Nagayama, S.** & Mori, K. (2002). Molecular-feature domains with posterodorsal-anteroventral polarity in the symmetrical sensory maps of the mouse olfactory bulb: mapping of odourant-induced Zif268 expression. *European Journal of Neuroscience*, 15: 1563-1574.

9. **Nagayama, S.**, Takahashi, Y.K., Yoshihara, Y. & Mori, K. (2004). Mitral and tufted cells differ in the decoding manner of odor maps in the rat olfactory bulb. *Journal of Neurophysiology*, 91: 2532-2540.
10. Takahashi, Y.K., **Nagayama, S.** & Mori, K. (2004). Detection and masking of spoiled food smells by odor maps in the olfactory bulb. *Journal of Neuroscience*, 24(40): 8690-8694.
11. Mori, K., Takahashi, Y.K., Igarashi, K. & **Nagayama, S.** (2005). Odor maps in the dorsal and lateral surfaces of the rat olfactory bulb. *Chemical Senses*, 30 SUPPL. 1: i103-i104.
12. Osanai, M., Saegusa, H., Kazuno, A.A., **Nagayama, S.**, Hu, Q., Zong, S., Murakoshi, T. & Tanabe, T. (2006). Altered cerebellar function in mice lacking CaV2.3 Ca²⁺ channel. *Biochemical and Biophysical Research Communications*, 344: 920-925.
13. **Nagayama, S.**, Shaoqun, Z., Xiong, W., Fletcher, M.L., Masurkar, A.V., Davis, D.J., Pieribone, V.A. & Chen, W.R. (2007). *In vivo* simultaneous tracing and Ca²⁺ imaging of local neuronal circuits. *Neuron*, 53: 789-803.
14. Fletcher, M.L., Masurkar, A.V., Xing, J.-L., Xiong, W., **Nagayama, S.**, Mutoh, H., Knöpfel, T. & Chen, W.R. (2009). Optical imaging of postsynaptic odor representation in the glomerular layer of the mouse olfactory bulb. *J. Neurophysiology*, 102(2): 817-30.
15. **Nagayama, S.**, Enerva, A., Fletcher, M.L., Masurkar, A.V., Igarashi, K.M., Mori, K. & Chen, W.R. (2010). Differential axon projections of mitral and tufted cells in the mouse main olfactory system. *Frontier in Neural Circuits*, 4: 120
16. Igarashi, K.M., Ieki, N., An, M., Yamaguchi, Y., **Nagayama, S.**, Kobayakawa, K., Kobayakawa, R., Tanifuji, M., Sakano, H., Chen, W.R. & Mori, K. (2012). Parallel Mitral and Tufted Cell Pathways Route Distinct Odor Information to Different Targets in the Olfactory Cortex. *Journal of Neurosciences*, 32(23): 7970-7985
17. Kikuta, S., Fletcher, M.L., Homma, R., Yamasoba, T. & **Nagayama, S.** (2013). Odorant response properties of individual neurons in an olfactory glomerular module. *Neuron*, 77:1122-1135
18. Kikuta, S., Sakamoto, T., **Nagayama, S.**, Kanaya, K., Kinoshita, M., Kondo, K., Tsunoda, K., Mori, M. and Yamasoba, T. (2015). Sensory deprivation disrupts homeostatic regeneration of newly generated olfactory sensory neurons following injury in adult mice. *Journal of Neurosciences*, 35(6): 2657-2673.

REVIEWS

19. **Nagayama, S.**, Homma, R. & Imamura, F. (2014). Neuronal organization of olfactory bulb circuits. "Neuronal Circuits Revealed": *Research Topic*, edited by Arenkiel B.R., Saggau P. & Soiza-Reilly M. *Frontier in Neural Circuits*, 8:98

BOOK CHAPTERS

20. **Nagayama, S.**, Fletcher M.L., Wenhui, X., Lu X., Shaoqun, Z. & Chen, W.R. (2011). *In Vivo* Local Dye Electroporation for Ca²⁺ Imaging and Neuronal-Circuit Tracing. "Imaging In Neuroscience": *A Laboratory Manual*, edited by Yuste R., Konnerth A. & Helmchen F. *Cold Spring Harbor laboratory Press*, Chapter 50, pp501-510
21. **Nagayama, S.**, Igarashi, K.M., Manabe, H. & Mori, K. (2014). Parallel Tufted Cell and Mitral Cell Pathways from the Olfactory Bulb to the Olfactory Cortex. "The Olfactory System": *From Odor Molecules to Motivational Behaviors*, edited by Mori K. *Springer Japan*, Chapter 7: 133-160
22. **Nagayama, S.** (2014). *In vivo* functional imaging of the olfactory bulb. "The Frontier in Life Science"; *The Frontier in Bioimaging Researches*, edited by Ishii M. *Nanzando*, Chapter 16: 135-144

PRESENTATION**INVITED SYMPOSIUM**

1. Optical Imaging of Functioning Olfactory Bulb Network. (2013). *The 11th International Symposium on Molecular and Neural Mechanisms of Taste and Olfactory Perception (ISMNTOP)*, Fukuoka, Japan
2. Optical imaging of multiple types of neurons in the glomerular module. (2014). *Pre-Symposium Workshop "Olfaction beyond boundaries: Towards general principles of olfaction."* Cold Spring Harbor Symposium, New York, USA
3. Spatial and temporal odor representation in the olfactory bulb. (2015). *Olfaction Symposium. University of Tokyo*, Tokyo, Japan

INVITED SEMINAR

4. Two-photon imaging of the olfactory parallel pathways. (2009). *BSI Forum*, RIKEN, Japan
5. Neurons in the Olfactory Bulb Network. (2013). *University of Tokyo*, Tokyo, Japan
6. Structural and Functional Study of the Olfactory Glomerular Module. (2013). *University of Tokyo*, Tokyo, Japan
7. Mouse Olfactory Glomerular Network. (2016). *Hokkaido University*, Hokkaido, Japan

CONFERENCE

8. **Nagayama, S.**, Morimoto, M., Kawabata, K., Fujito, Y., Abe, K., Ushiki, T. & Ito, E. (1995). Atomic force microscopic observation of synaptic forming process among neurons cultured from the pond snail, *Lymnaea stagnalis*. *The 65th annual meeting of the Zoological Society of Japan*, Tokyo, Japan
9. Kojima, S., Yamanaka, M., **Nagayama, S.**, Fujito, Y & Ito, E. (1995). Neuromodulation models for associative learning with central pattern generator in the pond snail, *Lymnaea stagnalis*. *Nervous Systems and Behavior. Proceedings of the 4th International Congress of Neuroethology*, Cambridge, England
10. **Nagayama, S.**, Kojima, S., Morimoto, M., Kawabata, K., Fujito, Y., Abe, K., Ushiki, T., & Ito, E. (1995). In vitro learning and atomic-force-microscopic observation of synaptic forming process in cultured neurons of *Lymnaea stagnalis*. *Annual meeting for Japanese Biophysics*, Sapporo, Japan
11. **Nagayama, S.**, Kojima, S., Morimoto, M., Kawabata, K., Fujito, Y., Ogura, S., Abe, K., Ushiki, T. & Ito, E. (1995). AFM observation of synapses in primary cultured neurons from the pond snail. *The 5th International Symposium on Bioelectronic and Molecular Electronic Devices and the 6th International Conference on Molecular Electronics and Biocomputing*, Okinawa, Japan
12. Morimoto, M., **Nagayama, S.**, Kawabata, K., Fujito, Y., Ogura, S., Abe, K., Ushiki, T. & Ito, E. (1996). Imaging nerve-terminal structure by atomic force microscopy. *Acta Histochemistry and Cytochemistry*, Kobe, Japan
13. Kojima, S., Nakamura, H., **Nagayama, S.**, Fujito, Y. and Ito, E. (1996). Modification of central nervous system in *Lymnaea stagnalis* by its taste-aversion learning. *67th Annual Meeting of Zoological Society of Japan*, Hokkaido, Japan
14. Kojima, S., **Nagayama, S.**, Fujito, Y. and Ito, E. (1996). Inhibitory mechanism of central pattern generator in the pond snail's taste-aversion learning. *19th Annual Meeting of Japan Neuroscience Society*, Kyoto, Japan
15. Kojima, S., Yamanaka, M., **Nagayama, S.**, Sadamoto, H., Nakamura, H., Fujito, Y., Yamashita, M. & Ito, E. (1996). Developmental analysis of taste-aversion learning in the pond snail, *Lymnaea stagnalis*. *Progress in Biophysics and Molecular Biology*, Japan

16. **Nagayama, S.**, Morimoto, M., Tojima, T., Kawabata, K., Fujito, Y. Ogura, S., Abe, K., Ushiki, T. & Ito, E. (1996). 3D-structural observation of synaptic formation with AFM. *Progress in Biophysics and Molecular Biology*, Japan
17. **Nagayama, S.**, Tojima, T., Kawabata, K., Ushiki, T., Abe, K. & Ito, E. (1997). Application of a biological AFM to live neurons. *Annual Meeting of the Physical Society of Japan*, Tokyo, Japan
18. **Nagayama, S.**, Nakamura, T., Nakamura, K., Hirata, M., Ooashi, N., Ito, E. Kudo, Y. (1998). Relationship between increase in intracellular Ca²⁺ concentration during global ischemia and delayed ischemic death. *Annual meeting for Japanese Neuroscience*, Tokyo, Japan
19. Inaki, K., Tkahashi, Y., **Nagayama, S.** & Mori, K. (2001). Spatial distribution of the odorant-induced activity on the mirror-image sensory maps of the mouse olfactory bulb. *Annual meeting for Japanese Neuroscience*, Kyoto, Japan
20. **Nagayama, S.**, Takahashi, Y.K., Inaki, K., Yoshihara, Y. & Mori, K. (2001). Tufted cell axon collaterals connect equivalent domains in the medial and lateral maps of the olfactory bulb. *Annual meeting for Japanese Neuroscience*, Kyoto, Japan
21. **Nagayama, S.**, Yoshihara, Y. & Mori, K. (2003). Functional differences between mitral and tufted cells in the rat olfactory bulb. *Annual meeting for Japanese Neuroscience*, Kyoto, Japan
22. **Nagayama, S.**, Takahashi, Y.K., Yoshihara, Y. & Mori, K. (2003). Mitral cells and tufted cells are distinct in their odorant-response properties. *33rd Society for Neuroscience*, New Orleans, USA
23. Mori, K., Takahashi, Y.K., Igarashi, K., & **Nagayama, S.** (2004). Odor maps in the dorsal and lateral surfaces of the rat olfactory bulb. *14th International Symposium on Olfaction and Taste & 38th Japanese Association for Taste and Smell*, Kyoto, Japan
24. **Nagayama, S.**, Takahashi, Y.K., Yoshihara, Y. & Mori, K. (2004). Differences between mitral and middle tufted cells in the manner of decoding the odor maps. *14th International Symposium on Olfaction and Taste & 38th Japanese Association for Taste and Smell*, Kyoto, Japan
25. Takahashi, Y.K., **Nagayama, S.** & Mori, K. (2004). Encoding of spoiled food smells in the odor maps of the olfactory bulb. *34th Society for Neuroscience*, San Diego, USA
26. **Nagayama, S.**, Zeng S., Fletcher, M.L., Xiong, W. & Chen, W.R. (2006). *In vivo* two-photon imaging of mitral cell odor responsiveness. *28th Association for Chemoreception Sciences*, Sarasota, USA
27. **Nagayama, S.**, Zeng, S., Fletcher, M.L., Xiong, W., Davis D.J., Pieribone, V.A. & Chen, W.R. (2006). *In vivo* two-photon imaging of structure and function of neuronal circuits. *36th Society for Neuroscience*, Atlanta, USA
28. Fletcher, M., Masurkar, A., Xiong, W., **Nagayama, S.**, Mutoh, H., Cohen, L., Knöpfel, T. & Chen, W. (2006). *In vivo* imaging of postsynaptic olfactory bulb odor representation. *36th Society for Neuroscience*, Atlanta, USA
29. Nien, L., **Nagayama, S.**, Wang, R., Fletcher, M., Masurkar, A., Xiong, W. & Chen, W. (2007). High-throughput imaging data archiving and retrieval in neurosciences. *29th Association for Chemoreception Sciences*, Sarasota, USA
30. Fletcher, M., Masurkar, A., Xing, J., Xiong, W., **Nagayama, S.**, Mutoh, H., Riota, H., Cohen, L., Knöpfel, T. & Chen, W. (2007). Optical imaging of postsynaptic odorant representations in the olfactory bulb. *29th Association for Chemoreception Sciences*, Sarasota, USA
31. Xing, J., Xiong, W., Fletcher, M., **Nagayama, S.**, Xeng, X., Masurkar, A., Knöpfel, T. & Chen, W. (2007). *In vivo* block of dendrodendritic inhibition unleashes widely spread lateral propagation of odor-evoked calcium signals. *37th Society for Neuroscience*, San Diego, USA
32. **Nagayama, S.** & Chen, W. (2008). Differential projection patterns of Mitral/tufted cells to olfactory cortex versus tubercle. *10th International Symposium on Olfaction and Taste*, San Francisco, USA

33. **Nagayama, S.**, Enerva, A., Fletcher, M, Masurker, A. & Chen, W. (2008). Differential axon projection pattern of mitral and tufted cell in the mammalian olfactory system. *38th Society for Neuroscience*, Washington D.C., USA
34. Igarashi, K., Yamaguchi, Y., An, M., Ieki, N., **Nagayama, S.**, Liu, N., Kobayakawa, K., Kobayakawa, R., Yoshihara, Y., Tanifuji, M., Sakano, H., Chen, W.R. & Mori, K. (2009). Axon projection maps of fox-odor-responsive mitral/tufted cells in the mouse olfactory cortex. *Keystone Symposia on Molecular and Cellular Biology, Chemical Sense: Receptors and Circuits (C7)*, Tahoe City, USA
35. Igarashi, K., Yamaguchi, Y., An, M., Ieki, N., **Nagayama, S.**, Liu, N., Kobayakawa, K., Kobayakawa, R., Yoshihara, Y., Tanifuji, M., Sakano, H., Chen, W.R. & Mori, K. (2009). Axon projection maps of fox-odor-responsive mitral/tufted cells in the mouse olfactory cortex. *37th International Congress of Physiological Sciences*, Kyoto, Japan
36. Igarashi, K., Yamaguchi, Y., An, M., Ieki, N., **Nagayama, S.**, Kobayakawa, K., Kobayakawa, R., Tanifuji, M., Sakano, H., Chen, W., & Mori, K. (2009). Segregation of olfactory information into mitral- and tufted-cell streams in olfactory cortex. *39th Society for Neuroscience*, Chicago, USA
37. Kikuta, S., **Nagayama, S.** & Chen, W.R. (2011). *In vivo* functional imaging of individual neurons of the same glomerular module in the mouse main olfactory bulb. *33th Association for Chemoreception Sciences*, St. Petersburg, USA
38. Kikuta, S., **Nagayama, S.**, Fletcher, L.M. & Chen, W.R. (2011). Distinct odor representation of individual neurons within a single glomerulus module in the mouse main olfactory bulb. *34th Annual Meeting of the Japan Neuroscience Society*, Yokohama, Japan
39. **Nagayama, S.**, Kikuta, S., Fletcher, L.M. & Chen, W.R. (2011). Odor representation of individual neurons within a single olfactory glomerular module. *41st Society for Neuroscience*, Washington DC., USA
40. Homma, R., Lv, X., Zeng, S. & **Nagayama, S.** (2014). High-speed recording of odor-evoked calcium transient in the olfactory bulb neurons using an AOD-based two-photon microscope. *44th Society for Neuroscience*, Washington DC., USA
41. Neveu, C., Costa, R., Homma, R., **Nagayama, S.** and Byrne, J. (2016). Combining voltage-sensitive dye (VSD) imaging with extracellular nerve recordings aid in the identification of neurons. *46th Society for Neuroscience*, San Diego, USA
42. Homma, R., Lv, X., Zeng, S. and **Nagayama, S.** (2016). Onset latency analysis of odor-evoked calcium response in the juxtglomerular cells of mouse olfactory bulb. *46th Society for Neuroscience*, San Diego, USA