

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

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**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)<sub>2.1</sub> splice variants isolated from Purkinje cells do not generate P-type Ca<sup>2+</sup> 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 Ca<sup>2+</sup> 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 Ca<sup>2+</sup> 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 Ca<sup>2+</sup> 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 11<sup>th</sup> 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 65<sup>th</sup> 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 4<sup>th</sup> 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 5<sup>th</sup> International Symposium on Bioelectronic and Molecular Electronic Devices and the 6<sup>th</sup> 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. *67<sup>th</sup> 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. *19<sup>th</sup> 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 Ca<sup>2+</sup> 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. *33<sup>rd</sup> 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. *14<sup>th</sup> International Symposium on Olfaction and Taste & 38<sup>th</sup> 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. *14<sup>th</sup> International Symposium on Olfaction and Taste & 38<sup>th</sup> 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. *34<sup>th</sup> 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. *28<sup>th</sup> 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. *36<sup>th</sup> 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. *36<sup>th</sup> 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. *29<sup>th</sup> 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. *29<sup>th</sup> 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. *37<sup>th</sup> Society for Neuroscience*, San Diego, USA
32. **Nagayama, S.** & Chen, W. (2008). Differential projection patterns of Mitral/tufted cells to olfactory cortex versus tubercle. *10<sup>th</sup> 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. *38<sup>th</sup> 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. *37<sup>th</sup> 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. *39<sup>th</sup> 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. *33<sup>th</sup> 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. *34<sup>th</sup> 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. *41<sup>st</sup> 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. *44<sup>th</sup> 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. *46<sup>th</sup> 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. *46<sup>th</sup> Society for Neuroscience*, San Diego, USA