

**(1) Personal and Contact Information**

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RIKEN Center for Brain Science  
 Lab for Circuit & Behavioral Physiology  
 2-1 Hirosawa  
 Wako-shi, Saitama, 351-0198, JAPAN

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**(2) Present Appointments**

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RIKEN Center for Brain Science, Lab for Circuit & Behavioral Physiology Team Leader	Wako-shi, JAPAN 2018-present
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The University of Tokyo Graduate School of Arts & Sciences, Department of Life Sciences Adjunct Associate Professor	Tokyo, JAPAN 2015-present
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**(3) Previous Appointments**

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RIKEN Brain Science Institute, Lab for Circuit & Behavioral Physiology Senior Team Leader	Wako-shi, JAPAN 2016-2018
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RIKEN Brain Science Institute, Lab for Circuit & Behavioral Physiology Team Leader	Wako-shi, JAPAN 2009-2016
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Massachusetts Institute of Technology, The Picower Institute for Learning and Memory Research Scientist HHMI Postdoctoral Research Associate	Cambridge, MA 2004-2009 2001-2004
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**(4) Academic Qualifications**

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Massachusetts Institute of Technology Department of Biology Ph.D. in Biology	Cambridge, MA 1994-2001
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University of California, Berkeley B.A. in Molecular and Cell Biology	Berkeley, CA 1990-1994
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**(5) Awards, Honours and Distinctions**

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MIT School of Science Infinite Mile Award, 2002  
 MIT School of Science Dean's Educational Advising Award, 2005

**(6) Other Professional Activities**

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- Invited referee (journals): Nature, Science, Cell, Neuron, Nature Neuroscience, eLife, Current Biology, Journal of Neuroscience, Hippocampus, Nature Neuroscience Reviews, Journal of Cell Biology, Neuropsychopharmacology, Neurobiology of Learning & Memory, PLoS, European Journal of Neuroscience, Neuroscience Research, Journal of Comparative Neurology, Scientific Reports, Journal of Neuroscience Methods, Molecular Brain, eNeuro
- Invited referee (grants): Israel Science Foundation, French Agence Nationale de la Recherche, Austrian Science Fund, Netherlands Organisation for Scientific Research, Deutsche Forschungsgemeinschaft
- Member Society for Neuroscience, Japan Neuroscience Society, Molecular & Cellular Cognition Society
- Editorial Board Molecular Brain
- Reviewing Editor eNeuro

## (7) Journal Articles

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1. Tanaka KZ, He H, Tomar A, Niisato K, Huang AJY, McHugh TJ (2018) The hippocampal engram maps experience but not place. **Science**, 361(6400):392-397.
2. Luo R, Uematsu A, Weitemier A, Aquili L, Koivumaa J, McHugh TJ, Johansen JP (2018) A dopaminergic switch for fear to safety transitions. **Nature Communications**, 9(1): 2483, doi:10.1038/s41467-018-04784-7.
3. Middleton SJ, Kneller EM, Chen S, Ogiwara I, Montal M, Yamakawa K, McHugh TJ (2018) Altered hippocampal replay is associated with memory impairment in mice heterozygous for the SCN2A gene. **Nature Neuroscience**, 21(7):996-1003.
4. Kamiki E, Boehringer R, Polygalov D, Ohshima T, McHugh TJ (2018) Inducible knockout of the Cyclin-dependent kinase 5 activator p35 alters hippocampal spatial coding and neuronal excitability. **Frontiers in Cellular Neuroscience**, 2018 May 17, <https://doi.org/10.3389/fncel.2018.00138>.
5. Raveau M, Polygalov D, Boehringer R, Amano K, Yamakawa K, McHugh TJ (2018) Alterations of in vivo CA1 network activity in Dp(16)1Yey Down syndrome model mice. **eLife**, 2018 Feb 27;7. doi: 10.7554/eLife.31543.
6. Iwano S, Sugiyama M, Hama H, Watakabe A, Hasegawa N, Kuchimaru T, Tanaka KZ, Takahashi M, Ishida Y, Hata J, Shimozono S, Namiki K, Fukano T, Kiyama M, Okano H, Kizaka-Kondoh S, McHugh TJ, Yamamori T, Hioki H, Maki S, Miyawaki A (2018) Single cell bioluminescence imaging of deep tissue in freely moving animals. **Science**, 359(6378):935-939.
7. Chen S, Weitemier AZ, Zeng X, He L, Wang X, Tao Y, Huang AJY, Hashimoto-dani Y, Kano M, Iwasaki H, Parajuli LK, Okabe S, Loong Teh DB, All AH, Tsutsui-Kitamura I, Tanaka KF, Liu X, McHugh TJ (2018). Near-infrared Deep Brain Stimulation via Upconversion Nanoparticle-mediated Optogenetics. **Science**, 359(6376):679-684.
8. Chiang MC, Huang AJY, Wintzer ME, Ohshima T, McHugh TJ (2018). A role for CA3 in social recognition memory. **Behavioural Brain Research**, 2018 Feb 2. pii: S0166-4328(17)31896-X. doi: 10.1016/j.bbr.2018.01.019.
9. Soya S, Takahashi TM, McHugh TJ, Maejima T, Herlitze S, Abe M, Sakimura K, Sakurai T (2017). Orexin modulates behavioral fear expression through the locus coeruleus. **Nature Communications**, 8(1):1606.
10. Boehringer R, Polygalov D, Huang AJY, Middleton SJ, Robert V, Wintzer ME, Piskorowski RA, Chevaleyre V, McHugh TJ. (2017) Chronic loss of CA2 transmission leads to hippocampal hyperexcitability. **Neuron**, 94(3):642-655.
11. Yasuda K, Hayashi Y, Nakagawa N, Tanaka M, Kashiwagi M, Ando R, Huang A, Hosoya T, McHugh TJ, Kuwahara M, Itohara S (2017). Schizophrenia-like phenotypes in mice with NMDA receptor ablation in intralaminar thalamic nucleus cells and gene therapy-based reversal in adults. **Translational Psychiatry**, 7(2):e1047.
12. Weitemier AZ and McHugh TJ. (2016) Noradrenergic modulation of dopamine release and pH shift in the mouse dorsal hippocampus and ventral striatum. **Brain Research**, 1657:74-86.
13. Middleton SJ and McHugh TJ. (2016) Silencing CA3 disrupts temporal coding in the CA1 Ensemble. **Nature Neuroscience**, 19(7): 945-951.

14. Miyamoto D, Hirai D, Fung CCA, Inutsuka A, Odagawa M, Suzuki T, Boehringer R, Adaikkan C, Matsubara C, Matsuki N, Fukai T, McHugh TJ, Yamanaka A, Murayama M. (2016) Top-Down Cortical Input during NREM Sleep Consolidates Perceptual Memory. **Science**, 352(6291): 1315-1318.
15. Prosselkov P, Hashimoto R, Polygalov D, Ohi K, Zhang Q, McHugh TJ, Takeda M, Itohara S. (2016) Cognitive endophenotypes of modern and extinct hominins associated with NTNG gene paralogs. **Biomed Genet Genomics**, 1(1): 5-13.
16. Prosselkov P, Polygalov D, Zhang Q, McHugh TJ, Itohara S. (2016) Cognitive domains function complementation by NTNG gene paralogs. **Biomed Genet Genomics**, 1(1): 24-33.
17. Yu LMY, Polygalov D, Wintzer ME, Chiang MC, McHugh TJ. (2016) CA3 synaptic silencing attenuates kainic acid induced seizures and hippocampal network oscillations. **eNeuro**, 3(1), <http://dx.doi.org/10.1523/ENEURO.0003-16.2016>
18. Roh M, McHugh TJ, Lee K. (2015) A video based feedback system for control of an active commutator during behavioral physiology. **Molecular Brain**, 2015 Oct 12; 8(1):61. doi: 10.1186/s13041-015-0152-8.
19. Tsuneoka Y, Tokita K, Yoshihara C, Amano T, Esposito G, Huang AJ, Yu LM, Odaka Y, Shinozuka K, McHugh TJ, Kuroda KO. (2015) Distinct preoptic-BST nuclei dissociate paternal and infanticidal behavior in mice. **EMBO J**. 2015 Nov 3; 34(21):2652-70. doi: 10.15252/embj.201591942.
20. Sakaguchi M, Kim K, Yu LM, Hashikawa Y, Sekine Y, Okumura Y, Kawano M, Hayashi M, Kumar D, Boyden ES, McHugh TJ, Hayashi Y. (2015) Inhibiting the Activity of CA1 Hippocampal Neurons Prevents the Recall of Contextual Fear Memory in Inducible ArchT Transgenic Mice. **PLoS One**, 2015 Jun 15; 10(6):e0130163. doi: 10.1371/journal.pone.0130163
21. Tomar A, Polygalov D, Chattarji S, McHugh TJ. (2015) The dynamic impact of repeated stress on the hippocampal spatial map. **Hippocampus**, 25(1): 38-50.
22. Chinnakkaruppan A, Wintzer ME, McHugh TJ<sup>\*</sup>, Rosenblum K<sup>\*</sup>. (2014) Differential contribution of hippocampal subfields to components of associative taste learning. **J. Neurosci.**, 2014 August 13; 34(33):11007-15.
23. Wintzer ME, Boehringer R, Polygalov D, McHugh TJ. (2014) The Hippocampal CA2 Ensemble is Sensitive to Contextual Change. **J. Neurosci.**, 34(8): 3056-66.
24. Shih PY, Savtchenko LP, Kamasawa N, Dembitskaya Y, McHugh TJ, Rusakov DA, Shigemoto R, Semyanov A. (2013) Retrograde synaptic signaling mediated by K<sup>+</sup> efflux through postsynaptic NMDA receptors. **Cell Reports**, 5(4): 941-51.
25. Aizawa H, Yanagihara S, Kobayashi M, Niisato K, Takekawa T, Harukuni R, McHugh TJ, Fukai T, Isomura Y, Okamoto H. (2013) The synchronous activity of lateral habenular neurons is essential for regulating hippocampal theta oscillation. **J. Neurosci.**, 33(20): 8909-21.
26. Wu, Y-W, Grebenyuk, S., McHugh TJ, Rusakov, DA, Semyanov, A. (2012) Backpropagating action potentials enable detection of extrasynaptic glutamate by NMDA receptors. **Cell Reports**, 1(5): 495-505.
27. Place R, Lykken C, Beer Z, Suh J, McHugh TJ, Tonegawa S, Eichenbaum H, Sauvage MM. (2012) NMDA signaling in CA1 mediates selectively the spatial component of episodic memory. **Learning & Memory**, 19(4):164-9.

28. Nakashiba T, Cushman JD, Pelkey KA, Renaudineau S, Buhl DL, McHugh TJ, Barrera VR, Chittajallu R, Iwamoto KS, McBain CJ, Fanselow MS, Tonegawa S. (2012) Young Dentate Granule Cells Mediate Pattern Separation, whereas Old Granule Cells Facilitate Pattern Completion. **Cell**, 149(1): 188-201.
29. Yoshimi K, Naya Y, Mitani N, Kato T, Inoue M, Natori S, Takahashi T, Weitemier A, Nishikawa N, McHugh T, Einaga Y, Kitazawa S. (2011) Phasic reward responses in the monkey striatum as detected by voltammetry with diamond microelectrodes. **Neurosci. Res.**, 71(1): 49-62.
30. Kamsler A, McHugh TJ, Gerber D, Huang S-Y and Tonegawa S. (2010) Presynaptic m1 muscarinic receptors are necessary for mGluR long-term depression in the hippocampus. **Proc. Nat. Acad. Sci.**, 107(4):1618-23, 2010. doi:10.1073/pnas.0912540107
31. McHugh TJ and Tonegawa S. (2009) CA3 NMDA Receptors are required for the rapid formation of a salient contextual representation. **Hippocampus**, 19(12): 1153-8, 2009. doi:10.1002/hipo.20684
32. Nakashiba T\*, Buhl DL\*, McHugh TJ \*, Tonegawa S. (2009) Hippocampal CA3 Output is Crucial for Ripple-Associated Reactivation and Consolidation of Memory. **Neuron**, 62, 781-787, 2009. \* These authors contributed equally doi: 10.1016/j.neuron.2009.05.013.
33. Nakashiba T, Young JZ, McHugh TJ, Buhl DL, Tonegawa S. (2008) Transgenic Inhibition of Synaptic Transmission Reveals the Role of CA3 Output in Hippocampal Learning and Memory. **Science**, 319(5876): 1260-4, 2008. DOI: 10.1126/science.1151120
34. McHugh TJ \*, Jones MW\*, Quinn JJ, Balthasar N, Coppari R, Elmquist JK, Lowell BB, Fanselow MS, Wilson MA, Tonegawa S. (2007) Dentate gyrus NMDA receptors mediate rapid pattern separation in the hippocampal network. **Science**, 317(5834):94-9. \* These authors contributed equally
35. McHugh TJ and Tonegawa S. (2007) Spatial exploration is required for the formation of contextual fear memory. **Behav. Neurosci.** 121(2):335-9.
36. McHugh T.J., Blum K.I., Tsien J.Z., Tonegawa S., and Wilson M.A. (1996) Impaired Hippocampal Representation of Space in CA-1 Specific NMDAR1 Knockout Mice. **Cell**, 87:1339-1349.

#### **(8) Review Articles, Book Chapters, Invited Comments**

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1. Kazumasa Z. Tanaka and Thomas J. McHugh (2018) The hippocampal engram as a memory index. **Journal of Experimental Neuroscience**, *in press*.
2. Thomas J. McHugh (2012) Memory Circuits in the Hippocampus. In *Memory Mechanisms in Health and Disease*. K.P Giese Ed., World Scientific Publishing, London.
3. Matthew W. Jones and Thomas J. McHugh (2011) Updating hippocampal representations: CA2 joins the circuit. **Trends in Neuroscience**, 34(10):526-35.
4. Susumu Tonegawa and Thomas J. McHugh (2008) The ins and outs of the hippocampal circuit. **Neuron**, 57(2):175-177.
5. Susumu Tonegawa and Thomas J. McHugh (2007) Molecular and circuit mechanisms for hippocampal learning. In *Retrotransposition Diversity and the Brain*, F.H. Gage & Y. Christen Eds., Springer-Verlag Press, New York.
6. Nakazawa, K, McHugh, T.J., Wilson, M.A., and Tonegawa, S., and Wilson, M.A. (2004) NMDA receptors, place cells and hippocampal spatial memory. **Nature Reviews Neuroscience**. 5(5):361-372.

7. McHugh, T.J. and Nakazawa, K. Multiple Electrode-Recording on the Genetically Engineered Mouse Brain (In Japanese). (1998) **Genes & Medicine**, 2(4): 47-53.

### **(9) Selected Talks and Symposia**

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- Invited Speaker. MCCS Meeting. San Diego, CA, November 1-2, 2018.  
Symposium Speaker, The Korean Society for Brain and Neural Sciences, Seoul, Korea, August 30-31, 2018.  
Symposium Speaker, Japan Neuroscience Annual Meeting, Kobe, Japan, July 26-29, 2018.  
Invited Speaker, Functional Architecture of Memory Conference, Magdeberg, Germany, May 23-25, 2018.  
Invited Speaker. Department of Chemistry, National University of Singapore, January 23, 2018.  
Symposium Speaker, Society for Neuroscience Meeting, Washington D.C, November 12, 2017.  
Invited Seminar. UCSF Neuroscience Program, September 18, 2017.  
Invited Speaker. MCB BrainPlast Conference, Magdeberg, Germany, September 4-6, 2017.  
Invited Seminar. KIST Center for Functional Connectomics, Seoul, Korea, April 19, 2017.  
Invited Seminar. Seoul National University, Department of Biological Sciences, Seoul, Korea April 18, 2017.  
Invited Speaker. NIPS International Workshop, Okazaki, Japan, December 5-7, 2016.  
Session Organizer and Speaker. Japan Neuroscience Annual Meeting, Yokohama, Japan. July 20-22, 2016.  
Invited Speaker. NYU Frontiers in Memory Research, Florence, Italy. June 27-29, 2016.  
Invited Speaker. GDR NeuroMem Meeting, Bordeaux, France. May 17-20, 2016.  
Invited Seminar. Champalimaud Neuroscience Institute, Lisbon, Portugal. March 31, 2016.  
Invited Speaker. Memory and Mind Meeting, Tohoku, Japan. September 28-29, 2015.  
Session Organizer and Speaker. Japan Society for Neurochemistry, Saitama City, Japan. September 11-13, 2015.  
Invited Seminar. University of Tokyo Department of Neurochemistry, Tokyo, Japan. May 26, 2015.  
Invited Speaker. Weizmann-BSI Joint Symposium, Rehovot, Israel. January 21-22, 2015.  
Invited Seminar. Haifa University Department of Neurobiology & Ethology, Haifa, Israel. January 20, 2015.  
Invited Speaker. Genetic Approaches to Study the Neurobiology of Memory, London, UK. November 27-28, 2014.  
Invited Seminar. Oxford University Cortex Club, Oxford, UK. November 25<sup>th</sup>, 2014.  
Session Organizer and Speaker. FENS, Milan, Italy. July 5-9, 2014.  
Invited Speaker. MCCS-Europe Meeting. Milan, Italy. July 3-4, 2014.  
Invited Speaker. The 2<sup>nd</sup> Annual IIS Symposium, Tsukuba, Japan. Jan 19-21, 2014.  
Invited Seminar. Center for Functional Connectomics, KIST, Seoul, Korea. December 4<sup>th</sup>, 2013.  
Session Organizer and Speaker. Japan Neuroscience Annual Meeting, Kyoto, Japan. June 20-23, 2013.  
Invited Speaker. Functional Architecture of Memory Meeting, Madenburg, Germany. May 23-25, 2012.  
Invited Speaker. KSBNS/MCCS-Asia Memory Meeting, Seoul, Korea. September 19, 2011.  
Invited Speaker. Learning about Memory, Bangalore, India. February 14-17, 2010  
Invited Speaker. Winter Workshop on Mechanisms of Brain and Mind, Rusutsu, Japan. January 12-14, 2010.