

## **Shigeyoshi Itohara, DVM, PhD**

### Position

Team Leader

Laboratory for Behavioral Genetics, RIKEN Center for Brain Science (CBS)  
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### Education

B. Sci., 1976. Department of Veterinary Science, Faculty of Agriculture,  
Yamaguchi University (Veterinary Medicine)  
M. Sci., 1978. Graduate School of Agriculture,  
Yamaguchi University (Veterinary Medicine)

### Degree

D.V.M., 1976.  
Ph.D., 1987. The University of Tokyo (Veterinary Science, by dissertation)

### Appointments

1978.4-1988.3 Researcher, National Institute for Animal Health (NIAH)  
1988.4-1991.3 Postdoctoral fellow, Howard Hughes Medical Institute,  
Center for Cancer Research, MIT  
1991.4-1992.3 Senior Researcher, Laboratory of Biophysics, NIAH  
1992.4-1993.3 Laboratory head, Laboratory of Immunogenetics, NIAH  
1993.4-1997.11 Associate Professor, Institute for Virus Research, Kyoto University  
1997.12-2010.3 Team Leader, Laboratory for Behavioral Genetics,  
RIKEN Brain Science Institute (BSI)  
2010.4-2018.3 Senior Team Leader, Laboratory for Behavioral Genetics,  
RIKEN BSI  
2004.4-2007.3 Visiting Professor, Graduate School of Agricultural and Life  
Sciences, University of Tokyo  
2007.4-2017.3 Adjunctive Professor, Graduate School of Agricultural and Life  
Sciences, University of Tokyo  
2007.4-2018.3 Visiting Professor, Department of Life Science and Medical  
Bio-Science, Waseda University  
2018.4-present Team Leader, Laboratory for Behavioral Genetics,  
RIKEN Center for Brain Science (CBS)

### **Current Professional Society Memberships**

Molecular and Cellular Cognition Society (MCCS: International Council member  
2002-2015)  
International Behavioural and Neural Genetics Society (IBANGS)  
Society for Neuroscience  
The Japan Neuroscience Society  
The Molecular Biology Society of Japan

The Japanese Society for Neurochemistry  
The Japanese Society of Veterinary Science (Council member since 1992)  
Japanese Association for Laboratory Animal Science

## PUBLICATIONS

1. Miyamoto H, Shimohata A, Abe M, Abe T, Mazaki E, Amano K, Suzuki T, Tatsukawa T, Itohara S, Sakimura K, and Yamakawa K\*. Potentiation of excitatory synaptic transmission ameliorates aggression in mice with *Stxbp1* haploinsufficiency. *Hum. Mol. Genet.*, 26(24):4961-4974, 2017.
2. Shiihashi G, Ito D\*, Arai I, Kobayashi Y, Hayashi K, Otsuka S, Nakajima K, Yuzaki M, Itohara S, and Suzuki N. Dendritic homeostasis disruption in a novel frontotemporal dementia mouse model expressing cytoplasmic fused in sarcoma. *EBioMedicine* 24:102-115, 2017.
3. Sawai M, Uchida Y, Ohno Y, Miyamoto M, Nishioka C, Itohara S, Sassa T, and Kihara A\*, The 3-hydroxyacyl-CoA dehydratases HACD1 and HACD2 exhibit functional redundancy and are active in a wide range of fatty acid elongation pathways. *J. Biol. Chem.*, 292(37):15538-15551, 2017.
4. Katori S, Noguchi-Katori Y, Itohara S, and Iwasato T\*. Spinal RacGAP  $\alpha$ -chimaerin is required to establish the midline barrier for proper corticospinal axon guidance. *J. Neurosci.*, 37(32):7682-7699, 2017.
5. Hayashi Y\*, and Itohara S. Cutting-edge approaches to unwrapping the mysteries of sleep. *Neurosci Res.*, 118:1-2, 2017.
6. Yasuda K, Hayashi Y, Yoshida T, Kashiwagi M, Nakagawa N, Michikawa T, Tanaka M, Ando R, Huang A, Hosoya T, McHugh TJ, Kuwahara M, Itohara S\*. Schizophrenia-like phenotypes in mice with NMDA receptor ablation in intralaminar thalamic nucleus cells and gene therapy-based reversal in adults. *Transl. Psychiatry* 7(2):e1047, 2017.
7. Yoshikawa F, Sato Y, Tohyama K, Akagi T, Furuse T, Sadakata T, Tanaka M, Shinoda Y, Hashikawa T, Itohara S, Sano Y, Ghandour MS, Wakana S, and Furuichi T\*. Mammalian-Specific Central Myelin Protein Opalin Is Redundant for Normal Myelination: Structural and Behavioral Assessments. *PLoS One* 11(11):e0166732, 2016.
8. Kim J, Pignatelli M, Xu S, Itohara S, and Tonegawa S\*. Antagonistic negative and positive neurons of the basolateral amygdala. *Nat. Neurosci.*, 19(12):1636-1646, 2016.
9. Luo W, Mizuno H, Iwata R, Nakazawa S, Yasuda K, Itohara S, and Iwasato T\*. Supernova: A Versatile Vector System for Single-Cell Labeling and Gene Function Studies in vivo. *Sci Rep.* 6:35747, 2016.
10. Okuyama T, Kitamura T, Roy DS, Itohara S, Tonegawa S. Ventral CA1 neurons store social memory. *Science* 353(6307):1536-1541, 2016.
11. Yamaguchi K, Itohara S and Masaso Ito\*. Reassessment of long-term depression in cerebellar Purkinje cells in mice carrying mutated GluA2 - C terminus. *Proc. Natl. Acad. Sci. USA* 113(36):10192-7, 2016.
12. Shinoda Y, Ishii C, Fukazawa Y, Sadakata T, Ishii Y, Sano Y, Iwasato T, Itohara S, and Furuichi T\*. CAPS1 stabilizes the state of readily releasable synaptic vesicles to fusion competence at CA3-CA1 synapses in adult hippocampus. *Sci. Rep.*, 6:31540, 2016.
13. Prosser P\*, Hashimoto R, Polygalov D, Ohi K, Zhang Q, McHugh TJ, Takeda M and Itohara S\*. Cognitive endophenotypes of modern and extinct hominins associated with *NTNG* gene paralogs. *Biomed. Genet. Genomics* 1(1):5-13, 2016.
14. Prosser P\*, Polygalov D, Zhang Q, McHugh TJ and Itohara S\*. Cognitive domains function complementation by *NTNG* gene paralogs. *Biomed. Genet. Genomics* 1(1):24-33, 2016.

15. Kida S\* and Itohara S\*. Editorial. *Neurobiol. Learn. Mem.*, 135:1-2, 2016.
16. Masuda A, Kobayashi Y, Kogo N, Saito T, Saido TC, and Itohara S\*. Cognitive deficits in single App knock-in mouse models. *Neurobiol. Learn. Mem.*, 135:73-82, 2016.
17. Zhang Q, Sano C, Masuda A, Ando R, Tanaka M, and Itohara S\*. Netrin-G1 regulates fear-like and anxiety-like behaviors in dissociable neural circuits. *Sci. Rep.*, 6:28750, 2016.
18. Monai H, Ohkura M, Tanaka M, Oe Y, Konno A, Hirai H, Mikoshiba K, Itohara S, Nakai J, Iwai Y, and Hirase H\*. Calcium imaging reveals glial involvement in transcranial direct current stimulation-induced plasticity in mouse brain. *Nat. Commun.*, 7:11100, 2016.
19. Zhang Q, Gao X, Li C, Feliciano C, Wang D, Mei Y, Monteiro P, Anand M, Itohara S, Dong X-W, Fu Z, Feng G, and Zhou D\*. Impaired dendritic development and memory in Sorbs2 knockout mice. *J. Neurosci.*, 36(7):2247-60, 2016.
20. Zhang Q, Goto H, Akiyoshi-Nishimura S, Prosser P, Sano C, Matsukawa H, Yaguchi K, Nakashiba T, and Itohara S\*. Diversification of behavior and postsynaptic properties by netrin-G presynaptic adhesion family proteins. *Mol. Brain* 9(1):6, 2016.
21. Hayashi Y\*, Kashiwagi M, Yasuda K, Ando R, Kanuka M, Sakai K, and Itohara S\*. Cells of a common developmental origin regulate REM/non-REM sleep and wakefulness in mice. *Science* 350(6263):957-61, 2015.
22. Iwata R\*, Matsukawa H, Yasuda K, Mizuno H, Itohara S, and Iwasato T\*. Developmental RacGAP  $\alpha$ 2-chimaerin signaling is a determinant of the morphological features of dendritic spines in adulthood. *J. Neurosci.*, 35(40):13728-44, 2015.
23. Sato T\*, Kobayakawa R, Kobayakawa K, Emura M, Itohara S, Kizumi M, Hamana H, Tsuboi A, and Hirono J. Supersensitive detection and discrimination of enantiomers by dorsal olfactory receptors: evidence for hierarchical odour coding. *Sci. Rep.*, 5:14073, 2015.
24. Niven J, Hoare J, McGowan D, Devarajan G, Itohara S, Gannagé M, Teismann P, and Crane I\*. S100B Up-Regulates Macrophage Production of IL1 $\beta$  and CCL22 and Influences Severity of Retinal Inflammation. *PLoS One* 10(7):e0132688, 2015.
25. Lee K\*, Kobayashi Y, Seo H, Kwak J-H, Masuda A, Lim C-S, Lee H-R, Kang SJ, Park P, Sim S-E, Kogo N, Kawasaki H, Kaang B-K, and Itohara S\*. Involvement of cAMP-guanine nucleotide exchange factor II in hippocampal long-term depression and behavioral flexibility. *Mol. Brain* 8(1):38, 2015.
26. Takahashi A, Lee RX, Iwasato T, Itohara S, Arima H, Bettler B, Miczek KA, and Koide T\*. Glutamate input in the dorsal raphe nucleus as a determinant of escalated aggression in male mice. *J. Neurosci.*, 35(16):6452-63, 2015.
27. Suzuki A, Lee L-J, Hayashi Y, Muglia L, Itohara S, Erzurumlu RS, and Iwasato T\*. Thalamic adenylyl cyclase 1 is required for barrel formation in the somatosensory cortex. *Neuroscience* 290:518-29, 2015.
28. Mishiba T, Tanaka M, Mita N, He X, Sasamoto K, Itohara S, and Ohshima T\*. Cdk5/p35 functions as a crucial regulator of spatial learning and memory. *Mol. Brain* 7(1):82, 2014.
29. Itohara S\*, Kobayashi Y, and T. Nakashiba. Genetic factors underlying attention and impulsivity: mouse models of attention-deficit/hyperactivity disorder. *Curr. Opin. Behav. Sci.*, 2:46-51, 2015.
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32. Arakawa H, Suzuki A, Zhao S, Tsytsarev V, Lo F-S, Hayashi Y, Itohara S, Iwasato T, and Erzurumlu RS\*. Thalamic NMDA receptor function is necessary for patterning of the thalamocortical somatosensory map and for sensorimotor behaviors. *J. Neurosci.*, 34(36):12001-14, 2014.
33. Srimontri P, Endo S, Sakamoto T, Nakayama Y, Kurosaka A, Itohara S, Hirabayashi Y, and Kato K\*. Sialyltransferase ST3Gal IV deletion protects against temporal lobe epilepsy. *J. Neurochem.*, 131(5):675-87, 2014.
34. Kawase S, Kuwako K, Imai T, Renault-Mihara F, Yaguchi K, Itohara S, and Okano H\*. Rfx Transcription Factors Control Musashi1 Transcription in Mouse Neural Stem/Progenitor Cells. *Stem Cells Dev.*, 23(18):2250-61, 2014.
35. Onodera T\*, Sakudo A, Tsubone H, and Itohara S. Review of studies that have used knockout mice to assess normal function of prion protein under immunological or pathophysiological stress. *Microbiol. Immunol.*, 58(7):361-74, 2014.
36. Saito T, Matsuba Y, Mihira N, Takano J, Nilsson P, Itohara S, Iwata N, and Saido TC\*. Single APP locus knockin mouse models of Alzheimer's disease. *Nature Neurosci.*, 17(5):661-3, 2014.
37. Ono K\*, Clavairoly A, Nomura T, Gotoh H, Uno A, Armant O, Takebayashi H, Zhang Q, Shimamura K, Itohara S, Parras CM, and Ikenaka K. Development of the prethalamus is crucial for thalamocortical projection formation and is regulated by Olig2. *Development* 141(10):2075-84, 2014.
38. Yaguchi K, Nishimura-Akiyoshi S, Kuroki S, Onodera T, and Itohara S\*. Identification of transcriptional regulatory elements for *Ntng1* and *Ntng2* genes in mice. *Mol. Brain* 7:19, 2014.
39. Mizuno H, Luo W, Tarusawa E, Saito YM, Sato T, Yoshimura Y, Itohara S, and Iwasato T. NMDAR-regulated dynamics of layer 4 neuronal dendrites during thalamocortical reorganization in neonates. *Neuron* 82(2):365-79, 2014.
40. Borgius L, Nishimaru H, Caldeira V, Kunugise Y, Löw P, Reig R, Itohara S, Iwasato T, and Kiehn O\*. Spinal glutamatergic neurons defined by EphA4 signaling are essential components of normal locomotor circuits. *J. Neurosci.*, 34(11):3841-53, 2014.
41. Wu Y-W, Tang X, Arizono M, Bannai H, Shih P-Y, Dembitskaya Y, Kazantsev V, Tanaka M, Itohara S, Mikoshiba K, and Semyanov A\*. Spatiotemporal Calcium Dynamics in Single Astrocytes and Its Modulation by Neuronal Activity. *Cell Calcium* 55(2):119-29, 2014.
42. Kondo T\*, Isono K, Kondo K, Endo TA, Itohara S, Vidal M, and Koseki H\*. Polycomb Potentiates Meis2 Activation in Midbrain by Mediating Interaction of the Promoter with a Tissue-Specific Enhancer. *Dev. Cell* 28(1):94-101, 2014.
43. Sadakata T, Kakegawa W, Shinoda Y, Hosono M, Katoh-Semba R, Sekine Y, Sato Y, Tanaka M, Iwasato T, Itohara S, Furuyama K, Kawaguchi Y, Ishizaki Y, Yuzaki M, and Furuichi T. CAPS1 deficiency perturbs dense-core vesicle trafficking and Golgi structure and reduces presynaptic release probability in the mouse brain. *J. Neurosci.*, 33(44):17326-34, 2013.
44. Matsuyama M, Tanaka H, Inoko A, Goto H, Yonemura S, Kobori K, Hayashi Y, Kondo E, Itohara S, Izawa I, and Inagaki M\*. Defect of mitotic vimentin phosphorylation causes microphthalmia and cataract via aneuploidy and senescence in lens epithelial cells. *J. Biol. Chem.*, 288:35626-35, 2013.
45. Ushiki-Kaku Y, Iwamaru Y, Masujin K, Imamura M, Itohara S, Ogawa-Goto K, Hattori S, and Yokoyama T\*. Different antigenicities of the N-terminal region of cellular and scrapie prion proteins. *Microbiol. Immunol.*, 57(11):792-6, 2013.

46. Song YS, Lee HJ, Prosselkov P, Itohara S, and Kim E\*. Trans-induced cis interaction in the tripartite NGL-1, netrin-G1, and LAR adhesion complex promotes excitatory synaptic development. *J. Cell Sci.*, 126(Pt 21):4926-38, 2013.
47. Ogiwara I, Iwasato T, Miyamoto H, Iwata R, Yamagata T, Mazaki E, Yanagawa Y, Tamamaki N, Hensch TK, Itohara S, and Yamakawa K\*. Nav1.1 haploinsufficiency in excitatory neurons ameliorates seizure-associated sudden death in a mouse model of Dravet syndrome. *Hum. Mol. Genet.*, 22(23):4784-4804, 2013.
48. Hägglund M, Dougherty KJ, Borgius L, Itohara S, Iwasato T, and Kiehn O\*. Optogenetic dissection reveals multiple rhythmogenic modules underlying locomotion. *Proc. Natl. Acad. Sci. USA* 110(28):11589-94, 2013.
49. Sassa T, Ohno Y, Suzuki S, Nomura T, Nishioka C, Kashiwagi T, Hirayama T, Akiyama M, Taguchi R, Shimizu H, Itohara S, and Kihara A\*. Impaired epidermal permeability barrier in mice lacking the *Elovl1* gene responsible for very long-chain fatty acid production. *Mol. Cell Biol.*, 33(14):2787-96, 2013.
50. Kobayashi Y, Sano Y, Vannoni E, Goto H, Suzuki H, Oba A, Kawasaki H, Kanba S, Lipp H-P, Murphy NP, Wolfer DP, and Itohara S\*. Genetic dissection of medial habenula-interpeduncular nucleus pathway function in mice. *Front. Behav. Neurosci.*, 7:17, 2013.
51. Tanaka M, Shih PY, Gomi H, Yoshida T, Nakai J, Ando R, Furuichi T, Mikoshiba K, Semyanov A, and Itohara S\*. Astrocytic Ca<sup>2+</sup> signals are required for the functional integrity of tripartite synapses. *Mol. Brain* 6(1):6, 2013.
52. Ninomiya S, Esumi S, Ohta K, Fukuda T, Ito T, Imayoshi I, Kageyama R, Ikeda T, Itohara S, and Tamamaki N\*. Amygdala kindling induces nestin expression in the leptomeninges of the neocortex. *Neurosci. Res.*, 75(2):121-9, 2013.
53. Yamamoto M, Matsuzaki T, Takahashi R, Adachi E, Maeda Y, Yamaguchi S, Kitayama H, Echizenya M, Morioka Y, Alexander DB, Yagi T, Itohara S, Nakamura T, Akiyama H, and Noda M\*. The transformation suppressor gene *Reck* is required for postaxial patterning in mouse forelimbs. *Biol. Open* 1(5):458-466, 2012.
54. Sadakata T, Shinoda Y, Oka M, Sekine Y, Sato Y, Tanaka M, Itohara S, and Furuichi T\*. Reduced axonal localization of a *Caps2* splice variant impairs polarization of BDNF release and causes autistic-like behavior in mice. *Proc. Natl. Acad. Sci. USA* 109(51):21104-9, 2012.
55. Sathe K, Maetzler W, Lang J, Fleckenstein C, Martin HL, Schulte C, Mustafa S, Synofzik M, Vukovic Z, Itohara S, Berg D, and Teismann P\*. S100B ablation protects against MPTP-induced toxicity via the RAGE and TNF- $\alpha$  pathway and is increased in Parkinson's disease. *Brain* 135(Pt 11):3336-47, 2012.
56. Yamashita H, Chen S, Komagata S, Hishida R, Iwasato T, Itohara S, Yagi T, Endo N, Shibata M, and Shibuki K\*. Restoration of contralateral representation in the mouse somatosensory cortex after crossing nerve transfer. *PLoS One* 7(4):e35676, 2012.
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- Miyawaki A, Itohara S, and Okano H\*. Identification of a novel intronic enhancer responsible for the transcriptional regulation of musashi1 in neural stem/progenitor cells. *Mol. Brain* 4:14, 2011.
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  65. Mizoguchi H, Ibi D, Takuma K, Toth E, Sato J, Itohara S, Nabeshima T, and Yamada K\*. Alterations of emotional and cognitive behaviors in matrix metallo-proteinase-2 and -9-deficient mice. *Open Behav. Sci. J.*, 4:19-25, 2010.
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