Name: Hajime Hirase, Ph.D.

Date of Birth: 21 December 1972

Place of Birth: Hiroshima, Japan

Nationality: Japan

Contact information:

Hajime Hirase, Ph.D. <hirase@sund.ku.dk>
Center for Translational Neuromedicine
University of Copenhagen
Blegdamsvej 3B (section 24.3)
2200 Copenhagen N, Denmark. Tel. +45 93509398

Current position:

Main appointment: Professor, Center for Translational Neuromedicine, University of Copenhagen

Other appointment(s): Adjunct Professor of Neurology, Center for Translational Neuromedicine, School of Medicine and Dentistry, University of Rochester Medical Center

Education:

1993-1996: Ph.D., Neuroscience, Department of Anatomy and Developmental Biology, University College London, (University of London, UK) (Ph.D. awarded in April 1997)

1990-1993: B.Sc. (1st Class Honours), Computer Science, University College London (University of London, UK)

Work experience:

2019-present Professor, Center for Translational Neuromedicine, University of Copenhagen.

2022-present Adjunct Professor of Neurology, School of Medicine and Dentistry, University of Rochester Medical Center, Rochester, NY

2009-2019 Affiliated Associate Professor, Brain and Body System Science Institute, Saitama University

2004-2020 Principal Investigator, RIKEN (2004-2011 Unit Leader, 2011-2020 Team Leader; 2004-2018 Brain Science Institute, 2018-2020 Center for Brain Science)

2003-2004 Research Assistant Professor, Center for Molecular and Behavioral Neuroscience, Rutgers University, Newark, NJ

2000-2001 Postdoctoral Fellow, Department of Biological Sciences, Columbia University, New York, NY (Mentor: Rafael Yuste)

1996-2002 Postdoctoral Fellow, Center of Molecular and Behavioral Neuroscience, Rutgers University, Newark, NJ (Mentor: György Buzsáki)

Editorial positions:

Editorial board (current): General Psychiatry (2017-present), Neuroscience Next (2019-2020), GLIA (2019-present), International Journal of Molecular Sciences (2021-present)

Editorial board(past): Progress in Brain Research (2014-2020), Opera Medica et Physiologica (2014-2020), Neuroglia (2018-2019), OA Neurosciences, (2013-2015)

Review editor (current): Frontiers in Neural Circuits (2012-present), Frontiers in Cellular Neuroscience (2014-present), Frontiers in Integrative Neuroscience (2018-present)

Permanent Advisory Board: International Astrocyte School, 2011-present

Awards and fellowships received:

UCL Japan Scholarship (1993)
Overseas Research Students Awards (1994-1996)
Human Frontier Long-Term Fellowship (1998-2000)
Uehara Memorial Foundation Fellowship (2000-2001)
Epilepsy Foundation Research Training Fellowship (2003-2004)
Lundbeck Foundation visiting professorship (2016, to University of Copenhagen, with Prof. Maiken Nedergaard)

Grants received:

Grant-in-Aid for Scientific Research on Priority Areas from the Ministry of Education, Culture, Sports, Science and Technology (Grant #17022048) ¥2,700,000 Year 2005

Grant-in-Aid for Scientific Research on Priority Areas from the Ministry of Education, Culture, Sports, Science and Technology (Grant #18053026) ¥6,100,000 Year 2006-2007

Human Frontier Research Grant (Grant #RGY0073/2006-C, Principal Investigator: Attila Sik), $337,500, Year 2006-2008

Grant-in-Aid for Challenging Exploratory Research from the Ministry of Education, Culture, Sports, Science and Technology (Grant #21650081) ¥3,100,000 Year 2009-2010

Saitama Regional Innovation Cluster Program (Principal Investigator: Junichi Nakai), ¥4,630,000, Year 2010-2012

Grant-in-Aid for Innovative Research from the Ministry of Education, Culture, Sports, Science and Technology (Grant #23115522) ¥5,400,000 Year 2011-2012

Grant-in-Aid for Innovative Research from the Japan Society for the Promotion of Science (Grant #26117520) ¥6,700,000 Year 2014-2015

Human Frontier Research Grant (Grant #RGP0036/2014, Principal Investigator: Giovanni Marsicano), appx. $300,000 Year 2014-2016

Grant-in-Aid for Challenging Exploratory Research from the Japan Society for the Promotion of Science (Grant #16K13116) ¥2,700,000 Year 2016-2017

Grant-in-Aid for Scientific Research (A) the Japan Society for the Promotion of Science (Grant #16H01888) ¥33,500,000 Year 2016-2019

Grant-in-Aid for Innovative Research from the Japan Society for the Promotion of Science (Grant #18H05150) ¥4,400,000 Year 2018-2019

The Novo Nordisk Foundation Project Grant in Bioscience and Basic Biomedicine (0058058) DKK 2,500,000 Year 2020-2022.

The Lundbeck Foundation grant for international meetings. “Brain States: transformation of neural circuit dynamics and functions” DKK 300,000 (Meeting held on October 13-14, 2021).

DFF Independent Research Fund Denmark (0134-00107B), DKK 6,191,507 Year 2020-2024

Danish Agency for Higher Education and Science: International Network Programme (with NIPER, India and University of Miami, USA), DKK 258,198 Year 2021-2022.

Lundbeck Foundation NIH Brain Initiative (R360-2021-613), DKK 3,000,000 Year 2022-2024.

Ono Pharmaceutical collaboration grant, Eur 974,000 (~DKK 7,200,000) Year 2022-2024.

NIH/NINDS U19 Brain Initiative Team-Research BRAIN Circuit Programs (U19NS128613) $691,000 (~DKK 5,100,000) Year 2022-2027

Lundbeck Foundation Experiment (R436-2023-1219), DKK 1,999,998 Year 2024-2025

DFF Independent Research Fund Denmark (4285-00317A), DKK 3,168,000 Year 2025-2027.

Ph.D. thesis:

Hirase H., "Performance analysis of a partially connected recurrent associative net", PhD. thesis, University College London – University of London, UK, 1997

Research articles:

Hirase H, Recce M, (1996) A search for the optimal thresholding sequence in an associative memory. Network: Computation in Neural Systems 7: 741-758

Csicsvari J, Hirase H, Czurko A, Buzsaki G (1998) Reliability and state dependence of pyramidal cell-interneuron synapses in the hippocampus: an ensemble approach in the behaving rat. Neuron 21:179-189.

Czurko A, Hirase H, Csicsvari J, Buzsaki G (1999) Sustained activation of hippocampal pyramidal cells by 'space clamping' in a running wheel. Eur J Neurosci 11:344-352.

Csicsvari J, Hirase H, Czurko A, Mamiya A, Buzsaki G (1999) Fast network oscillations in the hippocampal CA1 region of the behaving rat. J Neurosci 19:RC20.

Csicsvari J, Hirase H, Czurko A, Mamiya A, Buzsaki G (1999) Oscillatory coupling of hippocampal pyramidal cells and interneurons in the behaving Rat. J Neurosci 19:274-287.

Nadasdy Z, Hirase H, Czurko A, Csicsvari J, Buzsaki G (1999) Replay and time compression of recurring spike sequences in the hippocampus. J Neurosci 19:9497-9507.

Hirase H, Czurko A, Csicsvari J, Buzsaki G (1999) Firing rate and theta-phase coding by hippocampal pyramidal neurons during 'space clamping'. Eur J Neurosci 11:4373-4380.

Harris KD, Henze DA, Csicsvari J, Hirase H, Buzsaki G (2000) Accuracy of tetrode spike separation as determined by simultaneous intracellular and extracellular measurements. J Neurophysiol 84:401-414.

Csicsvari J, Hirase H, Mamiya A, Buzsaki G (2000) Ensemble patterns of hippocampal CA3-CA1 neurons during sharp wave-associated population events. Neuron 28:585-594.

Szabo I, Czurko A, Csicsvari J, Hirase H, Leinekugel X, Buzsaki G (2001) The application of printed circuit board technology for fabrication of multi-channel micro-drives. J Neurosci Methods 105:105-110.

Hirase H, Leinekugel X, Csicsvari J, Czurko A, Buzsaki G (2001) Behavior-dependent states of the hippocampal network affect functional clustering of neurons. J Neurosci 21:RC145.

Hirase H, Leinekugel X, Czurko A, Csicsvari J, Buzsaki G (2001) Firing rates of hippocampal neurons are preserved during subsequent sleep episodes and modified by novel awake experience. Proc Natl Acad Sci U S A 98:9386-9390.

Harris KD, Hirase H, Leinekugel X, Henze DA, Buzsaki G (2001) Temporal interaction between single spikes and complex spike bursts in hippocampal pyramidal cells. Neuron 32:141-149.

Hirase H, Nikolenko V, Goldberg JH, Yuste R (2002) Multiphoton stimulation of neurons. J Neurobiol 51:237-247.

Marshall L, Henze DA, Hirase H, Leinekugel X, Dragoi G, Buzsaki G (2002) Hippocampal pyramidal cell-interneuron spike transmission is frequency dependent and responsible for place modulation of interneuron discharge. J Neurosci 22:RC197.

Harris KD, Henze DA, Hirase H, Leinekugel X, Dragoi G, Czurko A, Buzsaki G (2002) Spike train dynamics predicts theta-related phase precession in hippocampal pyramidal cells. Nature 417:738-741.

Leinekugel X, Khazipov R, Cannon R, Hirase H, Ben-Ari Y, Buzsaki G (2002) Correlated bursts of activity in the neonatal hippocampus in vivo. Science 296:2049-2052.

Harris KD, Csicsvari J, Hirase H, Dragoi G, Buzsaki G (2003) Organization of cell assemblies in the hippocampus. Nature 424:552-556.

Hirase H, Creso J, Singleton M, Bartho P, Buzsaki G (2004) Two-photon imaging of brain pericytes in vivo using dextran-conjugated dyes. Glia 46:95-100.

Hirase H, Qian L, Bartho P, Buzsaki G (2004) Calcium dynamics of cortical astrocytic networks in vivo. PLoS Biol 2:E96.

Bartho P, Hirase H, Monconduit L, Zugaro M, Harris KD, Buzsaki G (2004) Characterization of neocortical principal cells and interneurons by network interactions and extracellular features. J Neurophysiol 92:600-608.

Hirase H, Creso J, Buzsaki G (2004) Capillary level imaging of local cerebral blood flow in bicuculline-induced epileptic foci. Neuroscience 128:209-216.

Gulyas AI, Buzsaki G, Freund TF, Hirase H (2006) Populations of hippocampal inhibitory neurons express different levels of cytochrome c. Eur J Neurosci 23:2581-2594.

Sakatani S, Seto-Ohshima A, Itohara S, Hirase H (2007) Impact of S100B on local field potential patterns in anesthetized and kainic acid-induced seizure conditions in vivo. Eur J Neurosci 25:1144-1154.

Mishima T, Sakatani S, Hirase H (2007) Intracellular labeling of single cortical astrocytes in vivo. J Neurosci Methods 166:32-40.

Takata N, Hirase H (2008) Cortical layer 1 and layer 2/3 astrocytes exhibit distinct calcium dynamics in vivo. PLoS One 3:e2525.

Sakatani S, Seto-Ohshima A, Shinohara Y, Yamamoto Y, Yamamoto H, Itohara S, Hirase H (2008) Neural-activity-dependent release of S100B from astrocytes enhances kainate-induced gamma oscillations in vivo. J Neurosci 28:10928-10936.

Shinohara Y, Hirase H, Watanabe M, Itakura M, Takahashi M, Shigemoto R (2008) Left-right asymmetry of the hippocampal synapses with differential subunit allocation of glutamate receptors. Proc Natl Acad Sci U S A 105:19498-19503.

Sakatani S, Yamada K, Homma C, Munesue S, Yamamoto Y, Yamamoto H, Hirase H (2009) Deletion of RAGE causes hyperactivity and increased sensitivity to auditory stimuli in mice. PLoS One 4:e8309.

Mishima T, Hirase H (2010) In vivo intracellular recording suggests that gray matter astrocytes in mature cerebral cortex and hippocampus are electrophysiologically homogeneous. J Neurosci 30:3093-3100.

Shinoda Y, Sadakata T, Nakao K, Kato-Semba R, Kinameri E, Furuya A, Yanagawa Y, Hirase H, Furuichi T (2011) Augmented BDNF secretion kinetics by CAPS2 is critical for development of hippocampal GABAergic interneuron networks, Proc Natl Acad Sci USA 108:373-378.

Iwai Y, Honda S, Ozeki H, Hashimoto M, Hirase H (2011) A simple head-mountable LED device for chronic stimulation of optogenetic molecules in freely moving mice. Neurosci Res 70:124-127.

Shinohara Y, Yahagi K, Kawano M, Nishiyori H, Kawazu C, Suzuki N, Manabe R, Hirase H (2011) miRNA profiling of bilateral rat hippocampal CA3 by deep sequencing. Biochem Biophys Res Commun 409:293-298.

Kaneko M, Yamaguchi K, Eiraku M, Takata N, Kiyohara Y, Mishina M, Hirase H, Hashikawa T, Kengaku M (2011) Remodeling of monoplanar Purkinje cell dendrites during cerebellar circuit formation. PLoS One 6:e20108.

Takata N, Mishima T, Hisatsune C, Nagai T, Eibusi E, Mikoshiba K, Hirase H (2011) Astrocyte calcium signaling transforms cholinergic modulation to cortical plasticity in vivo. J Neurosci 31:18155-18165.

Shinohara Y, Hosoya A, Yamasaki N, Ahmed H, Hattori S, Eguchi M, Yamaguchi S, Miyakawa T, Hirase H, Shigemoto R (2012) Right-hemispheric dominance of spatial memory in split-brain mice, Hippocampus 22:117-121.

Shinohara Y, Hosoya A, Yahagi K, Ferecsko AS, Yaguchi K, Sik A, Itakura M, Takahashi M, Hirase H (2012) Hippocampal CA3 and CA2 have distinct bilateral innervation patterns to CA1 in rodents. Eur J Neurosci 35: 702-710.

Hirase H, Nikolenko V, Yuste R (2012) Multiphoton stimulation of neurons and spines. Cold Spring Harb Protoc. 2012(4):472-5.

Miyazaki T, Takase K, Nakajima W, Tada H, Ohya D, Sano A, Goto T, Hirase H, Malinow R, Takahashi T (2012) Disruption of cortical function underlies behavior dysfunction due to social isolation. J Clin Invest 122:2690-2701.

Molter C, O'Neill J, Yamaguchi Y, Hirase H, Leinekugel X (2012) Rhythmic modulation of theta oscillations supports encoding of spatial and behavioral information in the rat hippocampus. Neuron 75:889-903.

Shinohara Y, Hosoya A, Hirase H (2013) Experience enhances gamma oscillations and interhemispheric asymmetry in the hippocampus. Nature Commun 4:1652.

Takata N, Nagai T, Ozawa K, Oe Y, Mikoshiba K, Hirase H (2013) Cerebral blood flow modulation by basal forebrain or whisker stimulation can occur independently of large cytosolic Ca^{2+} signaling in astrocytes. PLoS One 8:e66525.

Hashimoto M, Hata A, Miyata T, Hirase H (2014), Programmable and wireless LED-stimulator for chronic stimulation of optogenetic molecules in freely moving mice. Neurophotonics 1:011002.

Aida T, Yoshida J, Nomura M, Tanimura A, Iino Y, Soma M, Bai N, Ito Y, Cui W, Aizawa H, Yanagisawa M, Nagai T, Takata N, Tanaka K, Takayanagi R, Kano M, Gotz M, Hirase H, Tanaka K (2015) Astroglial glutamate transporter deficiency increases synaptic excitability and leads to pathological repetitive behaviors in mice. Neuropsychopharmacology 40:1569-1579.

Nagai T, Takata N, Shinohara Y, Hirase H (2015) Adaptive changes of extracellular amino acid concentrations in mouse dorsal striatum by 4-AP-induced cortical seizures. Neuroscience 205: 229-236.

Monai H, Ohkura M, Tanaka M, Oe Y, Konno A, Hirai H, Mikoshiba K, Itohara S, Nakai, J, Iwai Y, Hirase H (2016) Calcium imaging reveals glial involvement in transcranial direct current stimulation-induced plasticity in mouse brain. Nature Commun 7:11100.

Oe Y, Baba O, Ashida H, Nakamura KC, Hirase H (2016) Glycogen distribution in the microwave-fixed mouse brain reveals heterogeneous of astrocytic patterns. Glia 64:1532-1545.

Nakai N, Nagano M, Saitow F, Watanbe Y, Kawamura Y, Kawamoto A, Tamada K, Mizuma H, Onoe H, Watanabe Y, Monai H, Hirase H, Nakatani J, Inagaki H, Kawada T, Miyazaki T, Watanabe M, Sato Y, Okabe S, Kitamura K, Kano M, Hashimoto K, Suzuki H, Takumi T (2017) Serotonin rebalances cortical tuning and behavior linked to autism symptoms in 15q11-13 CNV mice. Sci Adv. 3(6): e1603001.

Harada K, Ito M, Wang X, Tanaka M, Wongso D, Konno A, Hirai H, Hirase H, Tsuboi T, Kitaguchi T (2017) Red fluorescent protein-based cAMP indicator applicable to optogenetics and *in vivo* imaging. Sci Rep 7:7351.

Tanaka M, Wang X, Mikoshiba K, Hirase H, Shinohara Y (2017) Hippocampal LFP changes by rearing condition and their dependence on inositol trisphosphate receptor type 2 in mice. J Physiol 595:6557-6568.

Ue Y, Monai H, Higuchi K, Nishiwaki D, Tajima T, Okazaki K, Hama H, Hirase H, Miyawaki A (2018) A spherical aberration-free microscopy system for live brain imaging. Biochem Biophys Res Commun 500:236-241.

Mestre H, Hablitz LM, Xavier ALB, Feng W, Zou W, Pu T, Monai H, Murlidharan G, Rivera RMC, Simon MJ, Pike MM, Plá V, Du T, Kress BT, Wang X, Plog BA, Thrane AS, Lundgaard I, Abe Y, Yasui M, Thomas JH, Xiao M, Hirase H, Asokan A, Iliff JJ, Nedergaard M (2018) Aquaporin-4-dependent glymphatic solute transport in the rodent brain. eLife 7:e40070. DOI: 10.7554/eLife.40070

Wu CH, Hung CY, Hirase H, Tain YL, Lee WC, Chan JYH, Fu, MH, Chen LW, Liu WC, Liang CK, Ho YH, Kung YC, L S, Wu KLH (2019) Pioglitazone reversed the fructose-programmed astrocytic glycolysis and oxidative phosphorylation, Am J Physiol Endocrinol Metab 316: E622-E634. DOI: 10.1152/ajpendo.00408.20180

Monai H, Wang X, Yahagi K, Lou N, Mestre H, Xu Q, Abe Y, Yasui M, Iwai Y, Nedergaard M, Hirase H (2019) Adrenergic receptor antagonism induces neuroprotection and facilitates recovery from acute ischemic stroke. Proc Natl Acad Sci USA, 116:11010-11019. DOI: 10.1073/pnas.1817347116

Mishima M, Nagai T, Yahagi K, Akther S, Oe Y, Monai H, Kohsaka S, Hirase H (2019) Transcranial direct current stimulation (tDCS) induces adrenergic receptor-dependent microglial morphological changes in mice. eNeuro 6. DOI: 10.1523/ENEURO.0204-19.2019

Oe Y, Wang X, Patriarch T, Konno A, Ozawa K, Yahagi K, Hirai H, Tsuboi T, Kitaguchi T, Tian L, McHugh TJ, Hirase H (2020) Distinct temporal integration of noradrenaline signaling by astrocytic second messengers during vigilance. Nature Commun 11:471, DOI: 10.1038/s41467-020-14378-x.

Mestre H, Du T, Sweeney AM, Liu G, Samson AJ, Peng W, Mortensen KN, Staeger FF, Bork PAR, Bashford L, Toro ER, Tithof J, Kelley DH, Thomas JH, Hjorth PG, Martens EA, Mehta RI, Solis O, Blinder P, Kleinfeld D, Hirase H, Mori Y, Nedergaard M (2020) Cerebrospinal fluid influx drives acute ischemic tissue swelling. Science 367:eaax7171. DOI: 10.1126/science.aax7171.

Stæger FF, Mortensen K, Nielsen MSN, Sigurdsson B, Kaufmann L, Hirase H, Nedergaard M (2020) A three-dimensional, population-based average of the C57BL/6 mouse brain from DAPI-stained coronal slices. Scientific Data 7:235. DOI: 10.1038/s41597-020-0570-z

Iwai Y, Ozawa K, Yahagi K, Mishima T, Akther S, Vo CT, Lee AB, Tanaka M, Itohara S, Hirase H (2021) Transient Gq signaling underlies remote memory enhancement. Front Neural Circuits 15:658343 DOI: 10.3389/fncir.2021.658343 (BioRxiv 2019, DOI: 10.1101/753095)

Sugimoto H, Horii T, Hirota J, Sano Y, Shinoda Y, Konno A, Hirai H, Ishizaki Y, Hirase H, Hatada I, Furuichi T, Sadakata T (2021) The Ser19Stop single nucleotide polymorphism (SNP) of human PHYHIPL affects the cerebellum in mice. Molecular Brain 14: 52. DOI: 10.1186/s13041-021-00766-x

Monai H, Koketsu S, Shinohara Y, Ueki T, Kusk P, Hauglund NH, Samson AJ, Nedergaard M, Hirase H (2021) Adrenergic inhibition facilitates normalization of extracellular potassium after cortical spreading depolarization. Scientific Reports. 11:8185. DOI: 10.1038/s41598-021-87609-w

Dubanet O, Ferreira Gomes Da Silva A, Frick A, Hirase H, Beyeler A, Leinekugel X (2021) Probing the polarity of spontaneous GABAergic synaptic transmission in vivo. Cell Rep 36: 109381. DOI: 10.1016/j.celrep.2021.109381 (BioRxiv 2019, DOI: 10.1101/630608)

Du T, Mestre H, Kress, BT, Sweeney AM, Liu G, Olveda GE, Samson AJ, Peng W, Rasmussen MK, Mortensen KN, Bork PAR, Bashford L, Toro ER, Tithof J, Kelley DH, Thomas JH, Mehta RI, Hirase H, Mori Y, Nedergaard M. (2021) Cerebrospinal fluid is a significant fluid source for anoxic cerebral edema. Brain. DOI: 10.1093/brain/awab293

Vongsouthi V, Whitfield JH, Unichenko P, Mitchell JA, Breithausen B, Khersonsky O, Kremers L, Janovjak H, Monai H, Hirase H, Fleishman SJ, Henneberger C, Jackson CJ (2021) A rationally and computationally designed fluorescent biosensor for D-serine. ACS Sensors. DOI: 10.1021/acssensors.1c01803 (BioRxiv 2020, DOI: 10.1101/2020.08.18.255380)

Fukuda M, Matsumura T, Suda T, Hirase H (2022) Depth-targeted intracortical microstroke by two-photon photothrombosis in rodent brain. Neurophotonics 9, 021910. DOI: 10.1117/1.NPh.9.2.021910 (BioRxiv DOI: 10.1101/2021.11.10.466928)

Kjaerby C, Andersen M, Hauglund N, Ding F, Wang W, Xu Q, Deng S, Kang N, Peng S, Sun Q, Dall C, Jorgensen PK, Feng J, Li Y, Weikop P, Hirase H, Nedergaard M (2022) Memory-enhancing properties of sleep depend on the oscillatory amplitude of norepinephrine. Nat Neurosci 25:1059-1070. DOI: 10.1038/s41593-022-01102-9 (BioRxiv DOI: 10.1101/2020.09.01.274977 (2020))

Wu SY, Wen Y, Serre NBC, Laursen CCH, Dietz AG, Taylor BR, Drobizhev M, Molina RS, Aggarwal A, Rancic V, Becker M, Ballanyi K, Podgorski K, Hirase H, Nedergaard M, Fendrych M, Lemieux MJ, Eberl DF, Kay AR, Campbell RE, Shen Y (2021) A sensitive and specific genetically encoded potassium ion biosensor for in vivo applications across the tree of life. PLoS Biol 20:e3001772. DOI: 10.1371/journal.pbio.3001772 (BioRxiv DOI: 10.1101/2021.10.07.463410)

Wang X, Delle C, Asiminas A, Akther S, Vittani M, Brøgger P, Kusk P, Vo CT, Radovanovic T, Konno A, Hirai H, Fukuda M, Weikop P, Goldman SA, Nedergaard M, Hirase H (2022) Liver-secreted fluorescent blood plasma markers enable chronic imaging of the microcirculation. Cell Rep Methods 2:100302. DOI: 10.1016/j.crmeth.2022.100302 (BioRxiv: DOI: 10.1101/2022.04.08.487498)

Takahashi K, Kanekiyo K, Sakuda K, Muto Y, Iguchi M, Matsuda N, Hashimoto Y, Kanai K, Ogawa H, Hirase H, Kakita A, Bizen N, Takebayashi H, Kawaguchi Y, Uzuki M, Kitazume S. (2023) Brain-specific glycosylation of protein tyrosine phosphatase receptor type Z (PTPRZ) marks a demyelination-associated astrocyte subtype. J Neurochem DOI: 10.1111/jnc.15820

Untiet V, Beinlich FRM, Kusk P, Kang N, Lardon-de-Guevara A, Song W, Kjaerby C, Andersen M, Hauglund N, Bojarowska Z, Sigurdsson B, Deng S, Hirase H, Petersen NC, Verkhratsky A, Nedergaard M (2023) Astrocytic chloride is brain state dependent and modulates inhibitory neurotransmission in mice. Nat Commun 14:1871 DOI: 10.1038/s41467-023-37433-9 (Research Square DOI: 10.21203/rs.3.rs-1364562/v1)

Dietz AG, Weikop P, Hauglund N, Andersen M, Petersen NC, Rose L, Hirase H, Nedergaard M (2023) Local extracellular K^+ in cortex regulates norepinephrine levels, network state, and behavioral output. Proc Natl Acad Sci USA, 120:e2305071120. DOI: 10.1073/pnas. pnas.2305071120

Ozawa K, Nagao M, Konno A, Iwai Y, Vittani M, Kusk P, Mishima T, Hirai H, Nedergaard M, Hirase H. (2023) Astrocytic GPCR-induced Ca^{2+} signaling is not causally related to local cerebral blood flow changes. Int J Mol Sci 24:13590. DOI: 10.3390/ijms241713590

Nasu Y, Aggarwal A, Le GNT, Vo CT, Kambe Y, Wang X, Beinlich FRM, Lee AB, Ram TR, Wang F, Gorzo K, Kamijo Y, Boisvert M, Gordon GR, Ge S, Hirase H, Nedergaard M, Paquet ME, Drobizhev M, Podgorski K, Campbell RE (2023) Lactate biosensors for spectrally and spatially multiplexed fluorescence imaging. Nat Commun 14:6598 DOI: 10.1038/s41467-023-42230-5

Hussain R, Tithof J, Wang W, Cheetham-West A, Song W, Peng W, Sigurdsson B, Kim D, Sun Q, Peng S, Plá V, Kelley DH, Hirase H, Castorena-Gonzalez JA, Weikop P, Goldman SA, Davis, MJ, Nedergaard M. (2023) Potentiating glymphatic drainage minimizes post-traumatic cerebral oedema. Nature 623:992-1000. DOI: 10.1038/s41586-023-06737-7

Wu KLH, Liu WC, Wu CW, Fu MH, Huang HM, Tain YL, Liang CK, Hung CY, Chen IC, Hung PL, Lin YJ, Hirase H (2024) Butyrate reduction and HDAC4 increase underline maternal high fructose-induced metabolic dysfunction in hippocampal astrocytes in female rats. J Nutr Biochem 126:109571 DOI: 10.1016/j.jnutbio.2024.109571

Tan W, Ikoma Y, Takahashi Y, Konno A, Hirai H, Hirase H, Matsui K (2024) Anxiety control by astrocytes in the lateral habenula. Neurosci Res. DOI: 10.1016/j.neures.2024.01.006

Beinlich FRM, Asiminas A, Untiet V, Bojarowska Z, Pla V, Sigurdsson B, Timmel V, Gehrig L, Graber MH, Hirase H, Nedergaard M (2024) Oxygen imaging of hypoxic pockets in the mouse cerebral cortex. Science 383:1471-1478. DOI: 10.1126/science.adn1011

Li B, Sun Q, Ding F, Xu Q, Kang N, Xue Y, Ladron-de-Guevara A, Hirase H, Weikop P, Gong S, Smith N, Nedergaard M (2025) Adrenergic signaling dampens neural activity by release of free fatty acids. Cell Metabolism 37:2230238.e5 DOI: 10.1016/j.cmet.2024.10.011

Hauglund NL, Andersen M, Tokarska K, Radovanovic T, Kjaerby C, Sørensen FL, Bojarowska Z, Untiet V, Ballestero SB, Kolmos MG, Weikop P, Hirase H, Nedergaard M (2025) Norepinephrine-mediated slow vasomotion drives glymphatic clearance during sleep. Cell 188:606-622. DOI: 10.1016/j.cell.2024.11.027

Shinohara Y, Koketsu S, Ohno N, Hirase H, Ueki T (2025, in press) Brain state-dependent neocortico-hippocampal network dynamics are modulated by postnatal stimuli. J Neurosci e0053212025. DOI: 10.1523/JNEUROSCI.0053-21.2025 (BioRxiv. DOI: 10.1101/2020.12.25.424297)

Vittani M, Lee AB, Wang X, Hiraoka Y, Konno K, Knak PG, Kusk P, Nagao M, Asiminas A, Courtin J, Putranto MF, Nasu Y, Tsuno S, Ueda K, Osuga Y, Tsuboi T, Bienvenu T, Terunuma M, Hirai H, Nedergaard M, Tanaka K, Hirase H (2025, submitted) Functional and structural profiling of circulation via genetically encoded modular fluorescent probes. BioRxiv DOI: 10.1101/2025.03.18.643859

Book chapters/proceedings:

Hirase H, Recce M. "Performance analysis of progressive recall in partially connected recurrent networks", Proceedings of the International Conference on Artificial Neural Networks (ICANN'95), 1995, pp509-514.

Hirase H, Recce M. "Interneuron plasticity in associative networks", Computational Neuroscience: Trends in Research, 1997 pp:347-351, Plenum, New York (CNS*96 Computational neuroscience meeting, MA, USA)

Buzsaki G, Carpi D, Csicsvari J, Dragoi G, Harris KD, Henze DA, Hirase H. Maintenance and modification of firing rates and sequences in the hippocampus: does sleep play a role? In Maquet P, Smith C, Stickgold R. (eds). Sleep and Plasticity. Oxford University Press, Oxford. 2003. Pp. 247-270.

Hirase H, Nikolenko V, Yuste R. "Direct multiphoton stimulation of neurons and spines", In Yuste, R. and Konnerth A. (eds.), Imaging in Neuroscience and Development – a Laboratory Manual, Cold Spring Harbor Laboratory Press, New York, 2005, Chapter 54, pp421-424.

Hashikawa T, Hirase H. "Morphology and function in neural systems", In Amari S. and Furuichi T. (eds.) Molecular, cellular, and synaptic view of the brain, University of Tokyo Press, 2008, Chapter 2 pp 7-42.

Hirase H, Nikolenko V, Yuste R. "Multiphoton stimulation of neurons and spines", In Helmchen F, Konnerth A, and Yuste R (eds.), Imaging in Neuroscience: A Laboratory Manual, Cold Spring Harbor Laboratory Press, New York, 2011, Chapter 42, pp411-416.

Takata N, Shinohara Y, Ohkura M, Mishima T, Nakai J, Hirase H. "Imaging of Astrocytic Activity in Living Rodents", In Helmchen F and Weber B (eds.), Optical Imaging of Neocortical Dynamics, Neuromethods 2014, 85:191-207, Humana Press, Springer Science+Business Media, New York

Oe Y, Akther S, Hirase H. "Regional distribution of glycogen in the mouse brain visualized by immunohistochemistry" In DiNuzzo M and Schousboe A (eds.), Brain Glycogen Metabolism, Advances in Neurobiology, 2019, 23:147-168. Springer.

Fukuda M, Ozawa K, Hirase H. "Imaging Living Organisms", in Branso, M and Intes X (eds.), Chapter 19, Imaging from Cells to Animals In Vivo, 2020, Chapman and Hall/CRC, 2020, New York.

Vittani M, Knak PAG, Fukuda M, Nagao M, Wang X, Kjaerby C, Konno A, Hirai H, Nedergaard M, Hirase H. "Virally induced CRISPR/Cas9-based knock-in of fluorescent albumin allows long-term visualization of cerebral circulation in infant and adult mice". In Rusakov D (ed), Fluorescence Imaging of the Brain, Neuromethods 2024, 209:127-144. DOI: 10.1007/978-1-0716-4011-1_6 (BioRxiv DOI: 10.1101/2023.07.10.548084)

Asiminas A, Gomolka RS, Gregoriades S, Hirase H, Nedergaard M, Beinlich FRM. "Protocol to study oxygen dynamics in the in vivo mouse brain using bioluminescence microscopy". STAR Protoc. 2024 25:5, 103334. DOI: 10.1016/j.xpro.2024.103334.

Reviews/comments:

Buzsaki G, Csicsvari J, Dragoi G, Harris K, Henze D, Hirase H (2002) Homeostatic maintenance of neuronal excitability by burst discharges in vivo. Cereb Cortex 12:893-899.

Hirase H (2002) Local field potential and neuronal firing in rat hippocampus. Saibo Kogaku (Cell Engineering), 21: 999-1003 (Japanese).

Hirase H (2005) A multi-photon window onto neuronal-glial-vascular communication. Trends Neurosci 28:217-219.

Hirase H, Takata N (2007) In vivo measurements of astrocyte dynamics. Brain Nerve 59:773-781 (Japanese).

Shinohara Y, Hirase H (2009) Size and receptor density of glutamatergic synapses: a viewpoint from left-right asymmetry of CA3-CA1 connections. Frontiers in Neuroanatomy 3:10.

Sik A, Kocsiis B, Hirase H (2013) A new challenge in neurosciences. OA Neurosciences 2013 1:1.

Hirase H, Iwai Y, Takata N, Shinohara Y, Mishima T (2014) Volume transmission signalling via astrocytes. Philos Trans R Soc Lond B Biol Sci 369:20130604.

Hirase H, Shinohara Y (2014) Transformation of cortical and hippocampal neural circuit by environmental enrichment. Neuroscience 280:282-298.

Nuriya M, Hirase H (2016) Involvement of astrocytes in neurovascular communication. Progress in Brain Research 225:41-62.

Masamoto K, Yamada K, Hirase H (2016) Neurovascular coupling - what next? Progress in Brain Research 225:269-272.

Monai H, Hirase H (2016) Astrocytic calcium activation in a mouse model of tDCS – extended discussion. Neurogenesis 3, DOI: 10.1080/23262133.2016.1240055

Monai H, Hirase H (2018) Astrocytes as a target of transcranial direct current stimulation (tDCS) to treat depression. Neuroscience Research 126:15-21. DOI: 10.1016/j.neures.2017.08.012

Hirase H, Akther S, Wang X, Oe Y (2019) Glycogen distribution in mouse hippocampus. Journal of Neuroscience Research. 97:923-932. DOI: 10.1002/jnr.24386

Yuste R, …, Hirase H, …, Lein ES [29th/71 authors, alphabetical listing] (2020) A community-based transcriptomics classification and nomenclature of neocortical cell types. Nat Neurosci. DOI: 10.1038/s41593-020-0685-8 (formerly, arXiv:1909.03083 [q-bio.GN])

Akther S, Hirase H (2022) Assessment of astrocytes as a mediator of memory and learning in rodents. Glia 70:1484-1505. DOI: 10.1002/glia.24099

Kjaerby C, Andersen M, Hauglund N, Untiet V, Dall C, Ding F, Hirase H, Nedergaard M (2023) Reply to: 'Do all norepinephrine surges disrupt sleep?'. Nat Neurosci DOI: 10.1038/s41593-023-01314-7

Hirase H, Nedergaard M. (2023) Locomotion induces fundamentally different patterns of Ca2+ signaling in astrocytes and neurons. Function DOI: 10.1093/function/zqad028

Invited lectures/symposia:

Third International Congress of the World Federation of Sleep Research Societies, October 2001, Punta del Este, Uruguay, "Memory formation during sleep"

International Symposium: Glial Activities in Neural Plasticity and Information Processing, January 2005, Tokyo, Japan, "Calcium dynamics of cortical astrocytes in vivo"

7th European Meeting on Glial Cell Function in Health and Disease (EUROGLIA), May 2005, Amsterdam, Netherlands. "Calcium dynamics of cortical astrocytes in vivo"

6th FENS Forum of European Neuroscience Satellite Symposium on Synaptic and Extrasynaptic Signaling Versus Glia, July, 2008, Geneva, Switzerland, "Neuron-glia communication through S100B"

11th Annual Japanese-American Kavli Frontiers of Science Symposium, December 2008, Irvine, USA, "Optical measurement and control of neural activity"

29th Naito Conference on GLIA WORLD, October 2010, Kanagawa, Japan, "Astrocytic modulation of local field potential and synaptic plasticity"

1st Japanese-French Frontiers of Engineering Symposium, October 2008, Grenoble, France, "In vivo investigation of astrocytic dynamics"

Gordon Research Conference: Glial Biology, March 2011, Ventura, USA, "Astrocytic modulation of sensory-evoked LFP response"

14th Annual Meeting of the Korean Society for Brain and Neural Science, September 2011, Seoul, Korea "Astrocytic modulation of local field potential in vivo"

International Astrocyte School, March 2011, 2012, 2014. Bertinoro, Italy, "Modulation of sensory induced cortical plasticity by astrocytic calcium elevation" (permanent advisory board)

First International Symposium on In Vivo Microscopy, May 2012, Helsinki, Finland, "Cholinergic modulation of in vivo barrel cortical plasticity via astrocytes"

SFB 894 Calcium Signaling: Molecular Mechanisms and Integrative Functions, September 2012, Saarland University, Homburg, Germany," Astrocyte calcium signaling transforms cholinergic modulation to cortical plasticity in vivo"

Cajal Institute seminar, September 2012, Madrid, Spain, "Astrocyte Ca^{2+} surges, gamma oscillations, and synaptic plasticity"

UAB Mini Symposium: Physiology and Pathophysiology of Astroglia, October 2012, Birmingham, AL, "Astrocyte calcium signaling in plasticity of local cortical circuits in vivo"

11th European Meeting on Glial Cells in Health and Disease (Euroglia), July 2013, Berlin, Germany, "Astrocytic Ca^{2+} surges, gamma oscillations, and synaptic plasticity" Invited seminar at Scuola Normale Superiore, April 2014, Pisa, Italy, "Experience enhances gamma oscillations and interhemispheric asymmetry in the hippocampus"

Special Neuroscience Seminar, October 2014, Paris Descartes University, Paris, France. "Ca2+ signaling of astrocytes in cortical plasticity and blood flow"

Kick-off meeting of Human Frontiers Research Program, October 2014, Bordeaux, France. "Astrocytic Ca2+ surges, gamma oscillations, and synaptic plasticity"

Glial heterogeneity SPP 1757 Symposium, October 2014, Dusseldorf, Germany. "Ca2+ signaling of astrocytes in cortical plasticity and blood flow"

The 3rd "International Institute for Advanced Studies" Conference of Novel Developments on the Study of Life and Biological Systems Based on Genome Engineering and Imaging Science", October 2014, Kyoto, Japan, "Ca^{2+} signaling of astrocytes in cortical plasticity"

Special Seminar, November, 2014, University of Minnesota, Minneapolis, "An attempt to monitor and manipulate astrocytic Ca2+ signaling in the cerebral cortex"

International Symposium 2014 (Current trends on neurobiology), Ulsan National Institute of Science and Technology, Ulsan, Korea, November 2014, "Experience-dependent development of gamma oscillations and interhemispheric asymmetry in the hippocampus"

27th International Symposium on Cerebral Blood Flow, Metabolism and Function & 12th International Conference on Quantification of Brain Function with PET (BRAIN 2015), June, 2015, Vancouver, Canada. "Cerebral blood flow modulation can occur independently of large cytosolic Ca2+ signaling in astrocytes"

6th FAONS Congress and Chinese Neuroscience Society Conference, September, 2015, Wuzhen, China, "Cortical plasticity induced via volume transmitter-activated glia"

1st IBRO/APRC Chandigarh Neuroscience Symposium, February, 2016, Chandigarh, India, "Cortical plasticity induced via volume transmitter-activated glia"

Invited seminar at National Institute of Neuroscience (NCNP), May 2016, Tokyo, Japan. "Activation of astrocytes by transcranial direct current stimulation" (in Japanese)

Special Seminars, May 2016, Korean Institute of Science and Technology (KIST) and Yonsei University, "Astrocyte-mediated synaptic plasticity promoted by volume-transmitted neuromodulators"

DNP/CBTN Seminar, August 2016, University of Copenhagen, "Transcranial direct current stimulation, astrocytes, and glycogen in the mouse brain"

NYC Neuromodulation 2017, January 2017, New York, NY "tDCS metaplasticity and astrocytic calcium in mice"

International Astrocyte School, March 2017, Bertinoro, Italy, "Role of astrocytic calcium elevation in transcranial direct current stimulation in mice" (permanent advisory board)

Two-photon Imaging Course, October 2017, Chongqing China, "Imaging of neural activity during transcranial DC stimulation"

20th International Symposium on Calcium Binding Proteins and Calcium Function in Health and Disease (CaBP20), October 2017, Awajishima, Japan, "Transcranial direct current stimulation triggers cortical metaplasticity via glial calcium elevation"

Saitama University Brain Center International Symposium, November 2017, Saitama, Japan. "Imaging of brain cell activity during transcranial DC stimulation"

Yanbian University Cellular Function Research Center special seminar, January 2018, Yanji, China. "Imaging of neural activity during transcranial DC stimulation"

13th International Conference on Brain Energy Metabolism, March 2018, Valdivia, Chile. "Brain glycogen distribution by glycogen immunohistochemistry in the mouse"

Brain Glycogen Symposium, June 2018, King Abdullah University of Science and Technology (KAUST), Saudi Arabia. "Brain glycogen distribution by glycogen immunohistochemistry in the mouse"

DFG priority programme Glial Heterogeneity meeting, October 2018, Speyer, Germany. "Imaging of neural activity during transcranial direct current stimulation"

The Brain Conferences: The necessity of cell types for brain function, October 2018, Copenhagen, Denmark. "Astrocyte heterogeneity: Adrenergic receptor antagonism provides neuroprotection and facilitates recovery from cortical spreading depression/depolarization" (selected for a short talk)

23rd Annual Meeting of the Japan Glia, December 2018, Nagoya, Japan. "Adrenergic receptor antagonism provides neuroprotection and facilitates recovery from cortical spreading depression/depolarization"

DFG-Forschergruppe 2795 mini-symposium: Synapses under stress, December 2018, Dusseldorf, Germany. "Macroscopic imaging of cortical spreading depression and recovery"

Gordon Research Conference: Glial Biology, March 2019, Ventura, USA, "Astrocytic GPCR activation in behaving and stroke mice"

Developing a theory on how brains work, May 2019, Copenhagen, Denmark, "Developing a theory on how brains work: a neuron-glia perspective"

CLS Lecture, June 2019, Tokyo Institute of Technology, Yokohama, Japan, “In vivo Ca2+ imaging of stroke in mice”

Neuro2019: the 42nd annual meeting of the Japan Neuroscience Society, July 2019, Niigata, Japan, “Heterogeneity of astrocytes as observed in glycogen distribution”

International Conference on Neurological Disorders & Therapeutics (ICNDT-2019), October 2019, NIPER, Ahmedabad, (Gandhinagar), India, “Macroscopic imaging of cortical spreading depression and recovery”

NYC Neuromodulation 2020 Online Conference, April 2020, “Microglial activation by tDCS in awake mice”

ASSM 2021 3rd congress of Asian Society of Sleep Medicine, May 2021, Beijing, China (virtual presentation), “Adrenergic Blockers Induce Neuroprotection and Facilitate Recovery from K+-induced Cortical Spreading Depression and Acute Ischemic Stroke”

39th Annual meeting of Indian Academy of Neurosciences, December 2021, Kolkata, India (virtual presentation), “Enhancement of remote memory by optogenetic activation of astrocytic Gq signaling”

Synaptic Microenvironment 2nd International Seminar and mini-Workshop, March 2022, Sölden, Austria, “Activity and activation of astrocytic metabotropic signaling”

8th Mediterranean Neuroscience Society Conference, June 2022, “Second messenger signaling expressed in cortical astrocytes during fear conditioning learning”

University of Miami Miller School of Medicine, Special seminar, November 2022, Miami, FL, USA, “Refined tools to investigate thrombosis by optical imaging”

15th Göttingen Meeting of the German Neuroscience Society, March 2023, Göttingen, Germany, “Astrocyte control of neural circuit function and animal behaviour”

Institute of Translational Research in Biomedicine, Kaohsiung Chang Gung Memorial Hospital special seminar, April 2023, Kaohsiung, Taiwan. “Optogenetic activation of transient astrocytic Gq signaling in frontal cortex”

NPAS Academia Sinica special seminar, April 2023, Taipei, Taiwan. “Optogenetic activation of transient astrocytic Gq signaling in frontal cortex”

BRIC neuroscience seminar, University of Copenhagen, seminar, August 2023. Copenhagen, Denmark. “Optogenetic induction of Gq-induced Ca^{2+} signaling in cortical astrocytes in vivo”

Inmed (Institute de neurobiology de la méditerranée), invited seminar, September 2023. Marseilles, France. “The effect of optogenetic Gq-induced astrocytic Ca^{2+} signaling on memory and blood flow”

50th Naito Conference on Glia World – Glial Cells Governing Brain Functions –. October 2023, Sapporo, Japan. “Optogenetic tools for chronic assessment of astrocyte-vascular functional relationship”

7th Glia Decode meeting (organized by young committee), October, 2023. Hokkaido University, Sapporo, Japan. “Laboratories, Life, and science”

Jiaxing University Symposium: The brain active milieu in norm and pathology. April 2024. Jiaxing, China. “A genetic toolset for investigating glio-vascular interactions”

Dept Anatomy Special Seminar, National University of Taiwan, May 2024. Taipei, Taiwan. “Molecular genetics tools for visualization of microcirculation”

NUS Life Science Institute Special Seminar, May 2024. Singapore. “Regulation of brain activity by astrocytes”

Fralin Biomedical Research Institute at Virginia Tech Carilion School of Medicine (VTC) Special Seminar, October 2024. Roanoke, VA, USA. “A Genetic Toolset for Investigating Glio-vascular Interactions”

IPT Pharmacology Seminar, Institute of Pharmacology & Toxicology, University of Zurich. December 2024, Zurich, Switzerland. “A Molecular genetic toolset for investigating glio-vascular interactions”

Neurovascular Unit Kenkyukai, Keio University Medical School, January 2025, Tokyo, Japan. “Molecular genetics toolset for brain microcirculation (and beyond)”

Molecular and Cellular Cognition Society Meeting, NYU Abu Dhabi, February 2025, Abu Dhabi, United Arab Emirates. “Molecular genetics toolset for brain microcirculation (and beyond)”

Hirase lab shared resources

Fluorescent blood AAVs (for mice)

- DNA plasmids at Addgene.org:
  - 183460 pAAV-P3-Alb-mNG
  - 183461 pAAV-P3-Alb-mScarlet
  - and more
- AAV particles:
  - Zurich VVF (v820-8 for Alb-mNG, v821-8 for Alb-mScarlet)
  - Brain VTA (PT-9075 for Alb-mNG, PT-8805 for Alb-mScarlet)
  - Canadian Neurophotonics Viral Vector Core AAV-P3-Alb-mNG (we advise to order AAV2/8)
- Citation: Wang et al. (2022) Cell Rep Methods DOI: 10.1016/j.crmeth.2022.100302

Fluorescent blood CRISPR AAVs (knock-in for mice)

- DNA plasmids at Addgene.org:
  - 201780 pAAV-U6-AlbEx14-mNG
- Citation: Vittani et al. (2023) BioRxiv DOI: 10.1101/2023.07.10.548084

Astrocyte markers and biosensors

- DNA plasmids at Addgene.org
  - 164140 pAAV-hGfap-R-CaMP1.07-WPRE-SV40 (via Hirai lab)
  - 178790 pAAV-hGFAP-Pink Flamindo-WPRE-SV40 (via Kitaguchi lab)

Membrane-bound fluorescent protein - generic

- DNA plasmids available from Zurich VVF
  - pAAV-CAG-Lck-mTagBFP2 (v1064)
  - pAAV-CAG-Lck-Cerulean3 (v1061)
  - pAAV-CAG-Lck-mStayGold(E138D) (v1063)
  - pAAV-CAG-Lck-mScarlet3 (v1062)