Sungho Hong, PhD

Center for Memory and Glioscience
Institute for Basic Science
55 Expo-ro, Yuseong-gu
Daejeon 34126, South Korea

Phone: +81-10-3092-7201
Email: sunghohong@ibs.re.kr
Homepage: http://shhong.github.io

Education

University of Pennsylvania	Aug 2004

PhD in Physics - Theoretical High Energy Physics.
Thesis: *Hadron Form Factors and Interactions: Comparing AdS/CFT and QCD.*

Korea Advanced Institute of Science and Technology	Aug 1999

MSc in Physics - Elementary Particle Physics.
Thesis: *Aspects of String Theory Compactified on Orbifold.*

Korea Advanced Institute of Science and Technology	Feb 1995

BSc in Physics.

Academic Positions

Senior Research Fellow, Institute for Basic Science
Center for Memory and Glioscience. Principal Investigator   2024-presently

Adjunct Professor, Ulsan National Institute of Science and Technology
Department of Biomedical Engineering   2025-presently

Group Leader, Okinawa Institute of Science and Technology   2012–2024
Computational Neuroscience Unit. Supervisor: Erik De Schutter

Researcher, Okinawa Institute of Science and Technology   2007–2012
Computational Neuroscience Unit. Advisor: Erik De Schutter

Senior Fellow, University of Washington   2004–2007
Physiology and Biophysics Department. Advisor: Adrienne L. Fairhall

Grants and Awards

Role of Ion Channel Distributions in Dendritic Information Processing of the Cerebellar Purkinje Cell. PI: Sungho Hong and Weiliang Chen. JSPS KAKENHI (科研費) (Grant no:15K06725). Amount: ¥4,810,000. Role: <u>Principal Investigator</u>. Designed the research program and wrote the grant.   2015–2017

OCNS Travel Award for OCNS conference *60 Years of the Hodgkin-Huxley*   2012

Teaching Experience

Courses:

Computational Neuroscience (A310), Okinawa Institute of Science and Technology (Okinawa, Japan)   2014-2023

Responsibilities: Teaching mathematical formulations, how to build physiologically detailed computer models of neurons/neural networks, designing modeling assignments, and grading reports. Materials are available at https://github.com/shhong/a310_cns_2023.

Lectures:

Hong, S. (2025) Cerebellar computations for sensorimotor learning. Korean Society for Computational Neuroscience Winter School 2025 (Daejeon, South Korea)

Hong, S. (2023). Numerical methods for ordinary differential equations, Okinawa Course of Computational Neuroscience (Okinawa, Japan)

Hong, S. (2018). Impact of neuronal properties on network coding. NCTS Winter School: *Frontiers of Complex Systems Science*. (Taipei, Taiwan).

Hong, S. (2016). Introduction to numerical methods for ordinary/partial differential equations, Okinawa Course of Computational Neuroscience (Okinawa, Japan)

Mentees (selected):

Oliver James (IBS): Senior researcher.	2025–presently
Jisub Bae (IBS): Postdoctoral researcher.	2025
Sanghun Jee (Korea U): Research intern. Co-authored *Wichert et al., 2020*.	Winter 2018
Ines Wichert (BCCN Berlin): Research intern. Co-authored *Wichert et al., 2020*.	Winter 2017
Dongqi Han (OIST): Rotation student. Co-authored *Han et al., 2020*.	Spring 2017
Claus Lang (BCCN Berlin): Research intern. Co-authored *Sudhakar et al., 2017*.	Fall 2016

Service and Outreach

Symposium organizer: *Neuroscience-inspired AI: Computational insights into biological and artificial intelligence* at the Korea Society for Brain and Neural Sciences (KSBNS) 2025 meeting.	2025
Board member of *Korean Society for Computational Neuroscience*.	Since 2025
Academic editor of *PeerJ*.	Since 2016
Reviewer for the *Computational Neuroscience Meeting*.	Since 2012
Reviewer for *PLOS Biology, Cell Reports, eLife, Cerebellum, Neuroinformatics, PLOS Computational Biology, Neural Networks, Neural Computation, Physical Review Letters, and Journal of Physics A*.	Since 2004
Lab instructor in *Penn Summer Science Academy*, a summer science program for high school students.	2000
Military service (mandatory). The 72nd Infantry Division, Republic of Korea Army.	1995–1996

Publications

Journal and Peer-reviewed Conference Publications:

1. Kim, M.-Y., Kim, M. J., Lee, C., Lee, J., Kim, S. S., **Hong, S.**, Kim, H. T., Seo, J., Yoon, K.-J., Han, S. (2023) Trametinib activates endogenous neurogenesis and recovers neuropathology in a model of Alzheimer's disease. Exp. Mol. Med. *55*, 2177-89.

2. Kim, S., Jeon, J. Ganbat, D., Kim, T., Shin, K., **Hong, S.** and Hong, J. (2023) Alteration of Neural Network and Hippocampal Slice Activation through Exosomes Derived from 5XFAD Nasal Lavage Fluid. Int. J. Mol. Sci. *24(18)*, 14064.

3. Myung, J., **Hong, S.**, Schmal, C., Vitel, H., and Wu, M.-Y. (2023) Weak synchronization can alter circadian period length: Implications for aging and disease conditions. Front. Neurosci. *17*, 1242800.

4. Markanday, A.*, **Hong, S**.*, Inoue, J., De Schutter, E., and Thier, P. (2023). Multidimensional cerebellar computations for flexible kinematic control of movements. Nat. Commun. *14*, 2548. (*contributed equally)

5. Schmal, C.*, **Hong, S.**, Tokuda, I., and Myung, J.* (2022) Coupling in biological systems: Definitions, mechanisms, and implications. Front. Netw. Physiol. *2*, 1076702.

6. Medlock, L*, Sekiguchi, K.*, **Hong, S.,** Dura-Bernal, S., Prescott, S. A., and Lytton, W. W. (2022) Multiscale computer model of the spinal dorsal horn reveals changes in network processing associated with chronic pain. J. Neurosci. *42* (15), 3133-3149.

7. Linderman, S.*, **Hong, S.***, Kros, L*, Meijas, J.F., Romano, V., Oostenveld, R., Negrello, M., Bosman, L.W.J, De Zeeuw, C.I. (2020). Cerebellar Purkinje cells can differentially modulate coherence between sensory and motor cortex depending on region and behavior. Proc. Nat. Acad. Sci. USA *118*, e2015292118. (*contributed equally)

8. Han, D., De Schutter, E., and **Hong, S.** (2020). Lamina-specific neuronal properties promote robust, stable signal propagation in feedforward networks. In Larochelle, H., Ranzato, M., Hadsell, R., Balcan, M. F., and Lin, H., eds., Advances in Neural Information Processing Systems *33*, 3033–44.

9. Zang, Y., **Hong. S**, and De Schutter, E. (2020). Firing rate-dependent phase responses of Purkinje cells support transient oscillations. eLife *9*, e60692.

10. Wichert, I., Jee, S., De Schutter, E., and **Hong, S.** (2020). Pycabnn: Efficient and extensible software to construct an anatomical basis for a physiologically realistic neural network model. Front. Neuroinform. *14*, 31.

11. Myung, J.*, Schmal, C.*, **Hong, S.***, Tsukizawa, Y., Rose, P., Zhang, Y., Holtzman, M. J., De Schutter, E., Herzel, H., Bordyugov, G., and Takumi, T. (2018). The choroid plexus is an important circadian clock component. Nat. Commun. *9,* 1062. (*contributed equally)

12. Sudhakar, S. K.*, **Hong, S.***, Raikov, I., Publio, R., Lang, C., Close, T., Guo, D., Negrello, M., and De Schutter, E. (2017). Spatiotemporal network coding of physiological mossy fiber inputs by the cerebellar granular layer. PLOS Comput. Biol. *13*, e1005754. (*contributed equally)

13. **Hong, S.**, Negrello, M., Junker, M., Smilgin, A., Thier, P., and De Schutter, E. (2016). Multiplexed coding by cerebellar Purkinje neurons. eLife *5*, e13810.

14. Huang, S., **Hong, S.**, and De Schutter, E. (2015). Non-linear leak currents affect mammalian neuron physiology. Front. Cell. Neurosci. *9*, 432-41.

15. Myung, J., **Hong, S.**, DeWoskin, D., De Schutter, E., Forger, D., and Takumi, T. (2015). GABA-mediated repulsive coupling between circadian clock neurons in the SCN encodes seasonal time. Proc. Nat. Acad. Sci. USA *112*, E3920-9.

16. Ratté, S., **Hong, S.**, De Schutter, E., and Prescott, S.A. (2013). Impact of neuronal properties on network coding: Roles of spike initiation dynamics and robust synchrony transfer. Neuron *78*, 758-72.

17. **Hong, S.**, Robberechts, Q., and De Schutter, E. (2012). Efficient estimation of Phase Response Curves via Compressive Sensing. J. Neurophysiol., *208*, 2069–81.

18. Myung, J., **Hong, S.**, Hatanaka, F., Nakajima, Y., De Schutter, E., and Takumi, T. (2012). Period coding of *Bmal1* oscillators in the suprachiasmatic nucleus. J. Neurosci. *32*, 8900–18.

19. **Hong, S.**, Ratté, S., Prescott, S. A., and De Schutter, E. (2012). Single neuron firing properties impact correlation-based population coding. J. Neurosci. *32*, 1413–28.

20. Anwar, H., **Hong, S.**, and De Schutter, E. (2010). Controlling Ca^{2+}-Activated K^+ channels with models of Ca^{2+} buffering in Purkinje cells. Cerebellum, 1–13 (online first).

21. **Hong, S.**, and De Schutter, E. (2008). Purkinje neurons: What is the signal for complex spikes? Curr. Biol. *18*, R969–R971.

22. **Hong, S.**, Lundstrom, B.N., and Fairhall, A.L. (2008). Intrinsic gain modulation and adaptive neural coding. PLOS Comput. Biol. *4*, e1000119.

23. Lundstrom, B.N., **Hong, S.**, Higgs, M.H., and Fairhall, A.L. (2008). Two computational regimes of a single-compartment neuron separated by a planar boundary in conductance space. Neural Comput. *20*, 1239–60.

24. **Hong, S.**, Agüera y Arcas, B., and Fairhall, A.L. (2007). Single neuron computation: from dynamical system to feature detector. Neural Comput. *19*, 3133–72.

25. **Hong, S.**, Yoon, S., and Strassler, M.J. (2006). On the couplings of vector mesons in AdS/QCD. J. High Energy Phys. *04*, 003.

26. **Hong, S.**, Yoon, S., and Strassler, M.J. (2006). Adjoint Trapping: A new phenomenon at strong 't Hooft coupling. J. High Energy Phys. *03*, 012.

27. Erlich, J., **Hong, S.**, and Unsal, M. (2004). Matrix models, monopoles and modified moduli. J. High Energy Phys. *09*, 024.

28. **Hong, S.**, Yoon, S., and Strassler, M.J. (2004). Quarkonium from the fifth dimension. J. High Energy Phys. *04*, 046.

Preprints online:

1. Kwon, J., Kim, S., Woo, J., De Schutter, E., **Hong, S.**, Lee, C.J. (2024). Cerebellar tonic inhibition orchestrates the maturation of information processing and motor coordination. bioRxiv, https://doi.org/10.1101/2024.05.30.596563.

2. Hong, S., Yoon, S., and Strassler, M.J. (2004). On the couplings of the rho meson in AdS/QCD. arXiv:hep-ph/0501197. https://arxiv.org/abs/hep-ph/0501197.

Other Publications:

Hong, S. (2004). Hadron Form Factors and Interactions: Comparing AdS/CFT and QCD. University of Pennsylvania Thesis (Philadelphia: University of Pennsylvania).

Presentations

Talks in Conferences and Workshops:

Hong, S. (2025) Cell-type specific computations in biological neural networks. Samsung Global Technology Conference – *Beyond Silicon: Bio & Neuro Computing* (Seoul, South Korea).

Hong, S. (2025) Cell-type specific connectivity enables network-level control of synaptic plasticity. KSBNS Synapse Section Annual Meeting (Mungyeong, South Korea).

Hong, S. (2025) Synchrony and desynchrony of cellular oscillators for circadian rhythm. GIST-IBS-AMC Sleep Medicine Symposium (Daejeon, South Korea).

Hong, S. (2024) Cerebellar computations for flexible control of movements. Life Science Institute Symposium (Mungyeong, South Korea).

Hong, S. (2023) Multidimensional cerebellar computations for flexible kinematic control of movements. OIST-RIKEN Brain Symposium (Okinawa, Japan).

Hong, S., Markanday, A., Inoue, J., De Schutter, E., and Thier, P. (2022) Multidimensional cerebellar computations for flexible kinematic control of movements. NEURO2022. (Okinawa, Japan).

Hong, S., Kwon J., Woo, J., Kim, S., De Schutter, E., and Lee, C.J. (2022) Computational modeling of age-dependent tonic inhibition in the cerebellar granule cells in a network context. The 99th Annual Meeting of the Physiological Society of Japan (Sendai, Japan).

Hong, S. (2019) Lamina-specific neuronal properties promote robust, stable signal propagation in feedforward networks. OCNS Workshop: *Neural Multiplexed Coding* (Barcelona, Spain).

Han, D. and **Hong, S.** (2017). Heterogeneous layers stabilize propagation of a multiplexed spike signal in a feedforward network. Computational Neuroscience Meeting (CNS) 2017 (Antwerp, Belgium).

Hong, S. (2016) Multiplexed coding in the cerebellar cortex. Annual Meeting of Korean Society for Chemical Senses (Ansan, Korea).

Hong, S. and Myung, J. (2016) GABA-mediated phase couplings and seasonal time coding in the suprachiasmatic nucleus. Japanese Society for Mathematical Biology Meeting (Fukuoka, Japan).

Hong, S. (2015) GABA-mediated phase couplings and seasonal time coding in the suprachiasmatic nucleus. East Asia Joint Symposium on Biomedical Research (Okinawa, Japan).

Hong, S. (2015) Multiplexed coding by cerebellar Purkinje cells. OCNS Workshop: *Rate vs. temporal coding schemes: mutually exclusive or cooperatively coexisting?* (Prague, Czech).

Hong, S. (2015) Multiplexed coding by cerebellar Purkinje cells. Mini Symposium: *Recent Findings on the Cerebellar Microcircuitry* (Okinawa, Japan).

Hong, S. (2014) Exploring microcircuits in the cerebellum via computational modeling. Korean Society for Computational Neuroscience Meeting (Seoul, Korea) (*Plenary talk*).

Sudhakar, S. K., **Hong, S.**, and De Schutter, E. (2014). Patterns in network activity and information processing in a detailed computer model of the cerebellar granular layer, CNS 2014 (Quebec City, Canada).

Hong, S. (2012) Adaptive computation of neurons with Hodgkin-Huxley mechanisms. OCNS Conference: *60 Years of the Hodgkin-Huxley* (Cambridge, UK).

Hong, S. (2012) Single neuron firing properties impact correlation-based population coding. RIKEN BSI Workshop: *Circuit Function of the Brain* (Wako, Japan).

Hong, S. (2011) Single neuron firing properties impact correlation-based population coding. APCTP Young Computational Neuroscientist Workshop (Daejon, Korea).

Hong, S., and De Schutter, E. (2009). Rich single neuron computation implies a rich structure in noise correlation and population coding. CNS 2009 (Berlin, Germany).

Invited Talks:

Apr 2025	Dept. of Brain Sciences, DGIST (Daegu, Korea)
Jul 2024	Dept. of Neuroscience, Erasmus MC (Rotterdam, Netherlands)
Dec 2022	GIMBC, Taipei Medical University (Taipei, Taiwan) (online)
Jun 2022	School of Physiology, Pharmacology & Neuroscience, University of Bristol (Bristol, UK)
Nov 2021	Carey Lab, Champalimaud Center for the Unknown (Lisbon, Portugal)
Oct 2021	Département de Biologie, École Normale Supérieure (Paris, France)
Oct 2017	Center for Functional Connectomics, KIST (Seoul, Korea)
Oct 2017	Dept. of Bio and Brain Engineering, KAIST (Daejon, Korea)
Oct 2016	Dept. of Brain and Cognitive Science, DGIST (Daegu, Korea)
Jul 2016	Center for Functional Connectomics, KIST (Seoul, Korea)

Dec 2015   College of Pharmacy, Hanyang University (Ansan, Korea)
Jul 2015   Dept. of Neuroscience, Erasmus MC (Rotterdam, Netherlands)
Jul 2015   Dept. of Cognitive Neurology, University of Tübingen (Tübingen, Germany)
Aug 2013   Blue Brain Project, EPFL (Lausanne, Switzerland)
Aug 2013   Dept. of Neuroscience, Erasmus MC (Rotterdam, Netherlands)
Oct 2009   Dept. of Physics, Kyoto University (Kyoto, Japan)
Oct 2009   Graduate School of Biomedical Sciences, Hiroshima University (Hiroshima, Japan)
Mar 2008   Dept. of Neurobiology, Yale School of Medicine (New Haven, CT)
Jun 2007   Center for Brain Science, Harvard University (Cambridge, MA)
Jun 2006   Dept. of Bio and Brain Engineering, KAIST (Daejon, Korea)
Oct 2003   Physics Dept., University of Washington (Seattle, WA)

References

Available upon request.