

Jaeyoung Yoon, Ph.D.

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EMPLOYMENT

Boston Children's Hospital / Harvard Medical School	Aug 2023 – present
Research Fellow, F.M. Kirby Neurobiology Center / Department of Neurology	
Massachusetts Institute of Technology	Aug 2019 – Jul 2023
Postdoctoral Fellow, McGovern Institute for Brain Research	
Seoul National University	Mar 2019 – Jul 2019
Postdoctoral Associate, Medical Research Center	

EDUCATION

Ph.D., Seoul National University	Mar 2013 – Feb 2019
School of Biological Sciences, College of Natural Sciences & Department of Physiology, College of Medicine (joint affiliation) Thesis: " <i>Short-term synaptic plasticity and persistent activity in the prefrontal cortex</i> " (2016 – 2019: Military service, Republic of Korea Army)	
B.S., Seoul National University	Mar 2009 – Feb 2013
School of Biological Sciences, College of Natural Sciences	

PUBLICATIONS

- Yoon J***, Ferguson B*, et al. (2025). Thalamocortical synaptic hyperconnectivity in the human neocortex with ASD. (*in preparation*) (* co-corresponding author)
- Yoon J** (2025). Acute human brain slice preparation for patch clamp electrophysiology. *protocols.io*. DOI: 10.17504/protocols.io.ewov124qogr2/v1 (*embargoed until 2025-12-31*)
- Lee BJ, Lee SE, Han YE, Kim YD, **Yoon J**, Chang S, Lee S, Lee SH, Ho WK. (2025). A specific association of presynaptic K⁺ channels with Ca²⁺ channels underlies K⁺ channel-mediated regulation of glutamate release. (*under review at Proceedings of the National Academy of Sciences of the USA*)
- Cho E, Kwon J, Lee G, Shin J, Lee H, Lee SH, Chung CK*, **Yoon J***, Ho WK*. (2024). Net synaptic drive of fast-spiking interneurons is inverted towards inhibition in human FCD I epilepsy. *Nature Communications*. DOI: 10.1038/s41467-024-51065-7 (* co-corresponding author)
- Yoon J.** (2024). Geometrical determinant of nonlinear synaptic integration in human cortical neurons. *arXiv*. DOI: 10.48550/arXiv.2408.05633
- Yoon JY**, Lee HR, Ho WK, Lee SH. (2020). Disparities in short-term depression among prefrontal cortex synapses sustain persistent activity in a balanced network. *Cerebral Cortex*. DOI: 10.1093/cercor/bhz076
- Yoon JY**, Choi S. (2017). Evidence for presynaptically silent synapses in the immature hippocampus. *Biochemical and Biophysical Research Communications*. DOI: 10.1016/j.bbrc.2016.12.044

AWARDS AND HONORS

Postdoctoral Travel/Research Award, Mind-Brain-Behavior Interfaculty Initiative, Harvard University (1.99 k USD)	2024
Best Presenter Award, F.M. Kirby Neurobiology Center, Boston Children's Hospital (BCH)	2024
Y. Eva Tan Postdoctoral Fellowship, Yang-Tan Center for Molecular Therapeutics in Neuroscience, Massachusetts Institute of Technology (MIT) (130.00 k USD)	2021 – 2023

Molecular Therapeutics Impact Report 2020 – 2022, MIT (featured)	2022
BK21 / BK21+ Fellow, National Research Foundation of Korea (NRF) (~21.26 k USD)	2013 – 2017
Merit-based Scholarships, Seoul National University (SNU)	2014 – 2014
Lecture and Research Scholarship, SNU	2013 – 2013
Superior Academic Performance Scholarships, SNU	2009 – 2011

INVITED TALKS

<i>Korean Society for Brain and Neural Science (KSBNS)</i>	Aug 2025
"Electrophysiological hallmarks of epilepsy and autism in the human neocortex"	Incheon, Korea
<i>F.M. Kirby Neurobiology Center, BCH</i>	May 2025
"Thalamocortical synaptic hyperconnectivity in the human neocortex with ASD"	Boston, MA, USA
<i>New England Bioscience Society</i>	Sep 2024
"Net synaptic drive of fast-spiking interneurons is inverted towards inhibition in human FCD I epilepsy"	Boston, MA, USA
<i>F.M. Kirby Neurobiology Center, BCH</i>	May 2024
"Synaptic drive of neocortical fast-spiking interneurons supporting attention"	Boston, MA, USA
<i>Department of Physiology, College of Medicine, SNU</i>	Dec 2023
"Synaptic integration in human dendrites"	Seoul, Korea
<i>Yang-Tan Center for Molecular Therapeutics in Neuroscience, McGovern Institute for Brain Research (MIBR), MIT</i>	Jul 2021
"Subcellular connectivity and synaptic integration in cortical pyramidal neurons"	Cambridge, MA, USA
<i>Department of Physiology, College of Medicine, SNU</i>	Aug 2018
"Short-term synaptic plasticity and persistent activity in the prefrontal cortex"	Seoul, Korea

MEETING ABSTRACTS

<i>Harvard Mind-Brain-Behavior Research Showcase</i>	Apr 2025
Yoon J* , Ferguson B*. "Functional hyperconnectivity of thalamocortical synapses in human ASD" (* co-corresponding author)	Cambridge, MA, USA
<i>F.M. Kirby Neurobiology Center Retreat</i>	Mar 2025
Yoon J* , Ferguson B*. "Functional hyperconnectivity of thalamocortical synapses in human ASD" (* co-corresponding author)	Boston, MA, USA
<i>F.M. Kirby Neurobiology Center Retreat</i>	Mar 2025
He M, Chung L, Hathaway D, Yoon J , Yan T, Yu S, Chalif J, Ferguson B, Osterweil E, He Z. "Establishing human cortical neuron-based assays to study axon regeneration"	Boston, MA, USA
<i>Gordon Research Conference (GRC)</i>	Aug 2024
Cho E, Kwon J, Lee G, Shin J, Lee H, Lee SH, Chung CK*, Yoon J* , Ho WK*. "Net synaptic drive of fast-spiking interneurons is inverted towards inhibition in human FCD I epilepsy" (* co-corresponding author)	Waterville Valley, NH, USA
<i>Neuro2019</i>	Jul 2019
Yoon JY , Lee HR, Ho WK, Lee SH. "Disparities in short-term depression among prefrontal cortex synapses sustain persistent activity in a balanced network"	Niigata, Japan
<i>KSBNS</i>	Oct 2016
Yang CH, Yoon JY , Ho WK, Lee SH. "Presynaptic mitochondrial calcium release during high-frequency train pulse enhances short-term facilitation"	Goyang, Korea

TECHNICAL EXPERIENCE

ex vivo electrophysiology (patch clamp) in acute human brain slices:

- Whole-cell (somatic, dendritic, paired) or excised (outside-out, nucleated, inside-out) patch clamp in human neocortex (temporal, frontal, occipital, parietal, insular; L2/3, L5, L6; PN, FSIN, nFSIN)
- Human brain slice preparation, from > 70 adult and pediatric patients diagnosed with tumor or epilepsy; healthy and patched at soma and distal apical dendrite up to 132 h post-resection (Yoon, 2024; Cho et al., 2024; Yoon et al., 2025; https://flosfor.github.io/human_brain_slicing) (2021 - 2023: Research Non-Employee Collaborator, Massachusetts General Hospital (MGH))

ex vivo electrophysiology in other applications:

- Slice electrophysiology setup at BCH (CLS 13052), MIT MIBR (46-6178), SNU medical campus (2-726), and SNU main campus (504-201) (throughout 2014 – 2023)
- Patch clamp in rodent brain slices (mouse, rat); in neocortex (L2/3, L5, L4, L6; TeA, PFC, V1, S1, RSC), hippocampus (CA1, CA3, DG), thalamus (MD), amygdala (BLA), and Calyx of Held
- Patch clamp for single-cell RNA (scRNA) sequencing from human neurons (Patch-seq)
- Patch clamp in human brain slice culture (prepared from BCH; 2024)
- Patch clamp in human cortical organoids (prepared from Broad Institute of MIT and Harvard; 2022)
- Computational modeling of cellular and network biophysics, with optogenetic or electric stimulation under physiological or therapeutic scenarios (Yoon et al., 2020; Yoon et al., 2025)
- Local field potential (LFP) recording in acute brain slices

2-photon excitation microscopy (2PEF):

- MIT MIBR 2-photon core facility (46-6178) setup and management, including user training (6 postdocs from MIT & Broad Institute of MIT and Harvard trained during 2019 – 2023)
- 2-photon glutamate uncaging (2PGU), setup and application (Yoon, 2024)
- 8x pulse splitter setup and application, for enhanced 2PEF (https://flosfor.github.io/pulse_splitter.pdf - provided to University of Ottawa in 2022)
- Intracellular calcium imaging (Yoon, 2024)
- Structural imaging for morphological analysis (Yoon, 2024)
- Subcellular channelrhodopsin-assisted circuit mapping (sCRACM)

Data analysis and processing:

- MATLAB-based GUI development for electrophysiology and 2-photon imaging data analysis (<https://github.com/flosfor/pvbs>)

Others:

- *ad hoc* reviewer for *Nature Communications*, *Neuron*, *Cell Reports*, *Frontiers in Synaptic Neuroscience*
- Technical assistance for *in vivo* patch clamp setup (MIT MIBR, 46-6171)
- Technical assistance for Neuropixels setup (MIT MIBR, 46-6171)
- Plasmid DNA purification, viral vector packaging, immunohistochemistry, stereotaxic surgery

ENDORSED PROJECTS

"Functional hyperconnectivity of thalamocortical synapses in human ASD". Rosamund Stone Zander Translational Neuroscience Center (RSZ TNC), BCH	2025 – present
"Human cortical hierarchy characterized by synaptic drive scaling rules of fast-spiking interneurons". RSZ TNC, BCH	2024 – 2025
"Neural Mechanisms of Emotional Consciousness". NRF (PI: Sukwoo Choi; ~1.33 M USD)	2016 – 2019
"Mechanisms of Conscious Fear Memory Formation from Inference-Based Learning". College of Natural Sciences, SNU (with Gyuryang Heo; ~6.75 k USD)	2016 – 2017

TEACHING EXPERIENCE

Teaching Assistant, Data Analysis in Neuroscience Workshop, Interdisciplinary Program in Neuroscience, SNU	2018 – 2018
Teaching Assistant, Biological Sciences Research Lab 1 & 2, School of Biological Sciences, College of Natural Sciences, SNU	2014 – 2014
Teaching Assistant, Biology Lab 1 & 2, School of Biological Sciences, College of Natural Sciences, SNU	2013 – 2014

LANGUAGES

English (bilingual), Korean (bilingual), Italian (proficient, C2), French (intermediate), MATLAB (proficient)

MEMBERSHIPS

Society for Neuroscience, Korean Physiological Society, Japan Neuroscience Society,
US Chess Federation (chess.com blitz rating ≤ 2131)