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: *"Short-term synaptic plasticity and persistent activity in the prefrontal cortex"*
(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

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 Ca^{2+} 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 (featured), MIT	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

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

MEETING ABSTRACTS

Harvard Mind-Brain-Behavior Research Showcase **Yoon J***, Ferguson B*. "Functional hyperconnectivity of thalamocortical synapses in human ASD" **(* co-corresponding author)**	Apr 2025 Cambridge, MA, USA
F.M. Kirby Neurobiology Center Retreat **Yoon J***, Ferguson B*. "Functional hyperconnectivity of thalamocortical synapses in human ASD" **(* co-corresponding author)**	Mar 2025 Boston, MA, USA
F.M. Kirby Neurobiology Center Retreat 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"	Mar 2025 Boston, MA, USA
Gordon Research Conference (GRC) 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)**	Aug 2024 Waterville Valley, NH, USA
Neuro2019 **Yoon JY**, Lee HR, Ho WK, Lee SH. "Disparities in short-term depression among prefrontal cortex synapses sustain persistent activity in a balanced network"	Jul 2019 Niigata, Japan
KSBNS Yang CH, **Yoon JY**, Ho WK, Lee SH. "Presynaptic mitochondrial calcium release during high-frequency train pulse enhances short-term facilitation"	Oct 2016 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)