

Jaeyoung Yoon, Ph.D.

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EMPLOYMENT

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

EDUCATION

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|---|---------------------|
| Ph.D., Seoul National University 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) | Mar 2013 – Feb 2019 |
| B.S., Seoul National University School of Biological Sciences, College of Natural Sciences | Mar 2009 – Feb 2013 |

AWARDS AND HONORS

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| 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 |

SELECTED PUBLICATIONS

- Yoon J***, Ferguson B*, et al. (2025). Thalamocortical synaptic hyperconnectivity in the human neocortex with ASD. (*in preparation*) (* **co-corresponding author**)
- 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

OTHER PUBLICATIONS

- Yoon J***, Ferguson B*. (2025). Electric stimulation selectively modulates excitation-inhibition balance in the human neocortex. (*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*)
- He M, Chung L, Hathaway D, **Yoon J**, Yan T, Yu S, Chalif J, Ferguson B, Osterweil E, He Z. (2025). Establishing human cortical neuron-based assays to study axon regeneration. (*in preparation*)
- 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

INVITED TALKS

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| <i>China-Japan-Korea Neuroscience Meeting</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 & Center for Autism Research Joint Symposium, McGovern Institute for Brain Research (MIBR), MIT</i> | Jul 2021 |
| "Subcellular connectivity and synaptic integration in cortical pyramidal neurons" | Cambridge, MA, USA |

MEETING ABSTRACTS

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| <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 |

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

Korean Society for Brain and Neural Science (KSBNS)

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 > 80 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, simultaneously with electrophysiology (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>)
- Contributed to abfload: MATLAB function for reading .abf file format from Axon Instruments (<https://github.com/fcollman/abfload>)

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)
- Basic experience with plasmid DNA purification, viral vector packaging, immunohistochemistry, expansion microscopy, and stereotaxic surgery

ENDORSED PROJECTS

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| "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

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| 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 rating \leq 2131)