

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: "Short-term synaptic plasticity and persistent activity in the prefrontal cortex" (2016 - 2019: Research Personnel, Republic of Korea Army; military service) | Mar 2013 – Feb 2019 |
| B.S., Seoul National University School of Biological Sciences, College of Natural Sciences | Mar 2009 – Feb 2013 |

PUBLICATIONS

Yoon J*, Ferguson B*, et al. (2025). Functional hyperconnectivity of thalamocortical synapses in human ASD. (*in preparation*) (* co-corresponding author)

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*)

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 preprint*. 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

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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 |
| Molecular Therapeutics Impact Report 2020 - 2022 (featured), Massachusetts Institute of Technology (MIT) | 2022 |
| Y. Eva Tan Postdoctoral Fellowship, K. Lisa Yang and Hock E. Tan Center for Molecular Therapeutics in Neuroscience, MIT (130.00 k USD) | 2021 – 2023 |

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| Merit-based Scholarships, Seoul National University (SNU) | 2014 – 2014 |
| BK21 / BK21+ Fellow, National Research Foundation of Korea (NRF) | 2013 – 2017 |
| Lecture and Research Scholarship, SNU | 2013 – 2013 |
| Superior Academic Performance Scholarships, SNU | 2009 – 2011 |

INVITED TALKS

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

MEETING ABSTRACTS

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| <i>F.M. Kirby Neurobiology Center Retreat</i> Yoon J* , Ferguson B*. "Functional hyperconnectivity of thalamocortical synapses in human ASD" (* co-corresponding author) | Mar 2025 Boston, MA, USA |
| <i>Gordon Research Conference (GRC)</i> 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 |
| <i>Neuro2019</i> 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 |
| <i>KSBNS</i> 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 > 60 adult and pediatric patients diagnosed with tumor or epilepsy; healthy and patched at soma and distal apical dendrite up to 120 h post-resection (Yoon, 2024; Cho et al., 2024; Yoon et al., 2025)

(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)

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 (available at https://flosfor.github.io/pulse_splitter.pdf - provided to University of Ottawa in 2022)
- Intracellular calcium imaging and 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 / Neuropixels setup (MIT MIBR, 46-6171)
- Plasmid DNA purification, viral vector packaging, immunohistochemistry, stereotaxic surgery

ENDORSED PROJECTS

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| "Human cortical hierarchy characterized by synaptic drive scaling rules of fast-spiking interneurons". Rosamund Stone Zander Translational Neuroscience Center, BCH | 2024 - present |
| "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, Biology Lab 1 & 2 / Biological Sciences Research 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 \leq 2131)