

# Jaeyoung Yoon, Ph.D.

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## EMPLOYMENT

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

## EDUCATION

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

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><br>"Electrophysiological hallmarks of epilepsy and autism in the human neocortex"  | Aug 2025<br>Incheon, Korea        |
| <i>F.M. Kirby Neurobiology Center, BCH</i><br>"Functional hyperconnectivity of L1 afferents in the human cortex with ASD"   | May 2025<br>Boston, MA, USA       |
| <i>New England Bioscience Society</i><br>"Net synaptic drive of fast-spiking interneurons is inverted towards inhibition in human FCD I epilepsy"   | Sep 2024<br>Boston, MA, USA       |
| <i>F.M. Kirby Neurobiology Center, BCH</i><br>"Synaptic drive of neocortical fast-spiking interneurons supporting attention"  | May 2024<br>Boston, MA, USA       |
| <i>Department of Physiology, College of Medicine, SNU</i><br>"Synaptic integration in human dendrites"  | Dec 2023<br>Seoul, Korea          |
| <i>Yang-Tan Center for Molecular Therapeutics in Neuroscience,<br/>McGovern Institute for Brain Research (MIBR), MIT</i><br>"Subcellular connectivity and synaptic integration in cortical pyramidal neurons" | Jul 2021<br>Cambridge,<br>MA, USA |
| <i>Department of Physiology, College of Medicine, SNU</i><br>"Short-term synaptic plasticity and persistent activity in the prefrontal cortex"  | Aug 2018<br>Seoul, Korea          |

#### MEETING ABSTRACTS

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| <i>F.M. Kirby Neurobiology Center Retreat</i><br><b>Yoon J*</b> , Ferguson B*. "Functional hyperconnectivity of thalamocortical synapses in human ASD" (* <b>co-corresponding author</b> )   | Mar 2025<br>Boston, MA, USA               |
| <i>Gordon Research Conference (GRC)</i><br>Cho E, Kwon J, Lee G, Shin J, Lee H, Lee SH, Chung CK*, <b>Yoon J*</b> , Ho WK*. "Net synaptic drive of fast-spiking interneurons is inverted towards inhibition in human FCD I epilepsy" (* <b>co-corresponding author</b> ) | Aug 2024<br>Waterville Valley,<br>NH, USA |
| <i>Neuro2019</i><br><b>Yoon JY</b> , Lee HR, Ho WK, Lee SH. "Disparities in short-term depression among prefrontal cortex synapses sustain persistent activity in a balanced network"  | Jul 2019<br>Niigata, Japan                |
| <i>KSBNS</i><br>Yang CH, <b>Yoon JY</b> , Ho WK, Lee SH. "Presynaptic mitochondrial calcium release during high-frequency train pulse enhances short-term facilitation"  | Oct 2016<br>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 temporal, frontal, occipital, and parietal cortex, resected 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](https://flosfor.github.io/pulse_splitter.pdf) - provided to University of Ottawa in 2022)
- Intracellular calcium imaging, combined with 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**

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

**MEMBERSHIPS**

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