

# Jaeyoung Yoon, Ph.D.

[jy.yoon@tch.harvard.edu](mailto: jy.yoon@tch.harvard.edu) | 3 Blackfan St. CLS 13030.15, Boston, MA 02115, USA

## EMPLOYMENT

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

## EDUCATION

<b>Ph.D., Seoul National University</b> 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>B.S., Seoul National University</b> School of Biological Sciences, College of Natural Sciences	Mar 2009 – Feb 2013

## 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

## SELECTED PUBLICATIONS

- Yoon J\***, Terauchi A, Castro Palacin A, Cohen A, Umemori H, Ferguson B\*. (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<sup>+</sup> channels with Ca<sup>2+</sup> channels underlies K<sup>+</sup> 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 &amp; 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                   |
| <b>Yoon J*</b> , Ferguson B*. "Functional hyperconnectivity of thalamocortical synapses in human ASD" (* <b>co-corresponding author</b> )   | Cambridge, MA, USA         |
| <i>F.M. Kirby Neurobiology Center Retreat</i>   | Mar 2025                   |
| <b>Yoon J*</b> , Ferguson B*. "Functional hyperconnectivity of thalamocortical synapses in human ASD" (* <b>co-corresponding author</b> )   | Boston, MA, USA            |
| <i>F.M. Kirby Neurobiology Center Retreat</i>   | Mar 2025                   |
| He M, Chung L, Hathaway D, <b>Yoon J</b> , 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*, <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> ) | 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

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### **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](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](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

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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 rating  $\leq$  2131)