

# 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 -

### **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**

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: Research Personnel, Republic of Korea Army; military service)

### **B.S., Seoul National University**

Mar 2009 - Feb 2013

School of Biological Sciences, College of Natural Sciences

## PUBLICATIONS

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**Yoon J\***, et al. (2025). Functional hyperconnectivity of thalamocortical synapses in human ASD.  
(in preparation)

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

## INVITED TALKS

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*Korean Society for Brain and Neural Science (KSBNS)* Aug 2025  
"Electrophysiological hallmarks of epilepsy and autism in the human neocortex"  
Incheon, Korea

*F.M. Kirby Neurobiology Center, Boston Children's Hospital (BCH)* May 2025  
"Functional hyperconnectivity of L1 afferents in the human cortex with ASD"  
Boston, MA, USA

*New England Bioscience Society* Sep 2024  
"Net synaptic drive of fast-spiking interneurons is inverted towards inhibition in  
human FCD I epilepsy"  
Boston, MA, USA

*F.M. Kirby Neurobiology Center, Boston Children's Hospital (BCH)* May 2024  
"Synaptic drive of neocortical fast-spiking interneurons supporting attention"  
Boston, MA, USA

<i>Department of Physiology, College of Medicine, Seoul National University (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), Massachusetts Institute of Technology (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

<i>F.M. Kirby Neurobiology Center Retreat</i> <b>Yoon J*</b> , Ferguson B*. "Functional hyperconnectivity of L1 afferents in the human cortex with ASD"	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*, <b>Yoon J*</b> , Ho WK*. "Net synaptic drive of fast-spiking interneurons is inverted towards inhibition in human FCD I epilepsy"	Aug 2024 Waterville Valley, NH, USA
<i>Neuro2019</i> <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 Niigata, Japan
<i>KSBNS</i> 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 Goyang, Korea

#### 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, BCH	2024
Molecular Therapeutics Impact Report 2020 - 2022 (featured), 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
Merit-based Scholarships, 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

#### TECHNICAL EXPERIENCE

##### **ex vivo electrophysiology (patch clamp), in human and rodent neurons:**

- Patch clamp in acute brain slice; human neocortex (L2/3, L5); mouse/rat neocortex (L2/3, L5, L4, L6; TeA, PFC, V1, S1, RSC), hippocampus (CA1, CA3, DG), thalamus (MD), amygdala (BLA), and Calyx of Held; whole-cell (somatic, dendritic, paired), excised (outside-out, nucleated, inside-out)
- Human brain slice preparation and electrophysiology; from temporal, frontal, occipital, and parietal cortex, surgically 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))
- 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)
  - Optogenetic or electric stimulation under physiological or therapeutic scenarios, with computational modeling of cellular and network biophysics (Yoon et al., 2020; Yoon et al., 2025)
  - Patch clamp with single-cell RNA sequencing from human neurons (Patch-seq)
  - Patch clamp in human slice culture (prepared from BCH; 2024)
  - Patch clamp in human cortical organoids (prepared from Broad Institute of MIT and Harvard; 2022)

## 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 (schematics and instructions 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
- Morphological reconstruction and analysis
- 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)
- Local field potential (LFP) recordings in acute brain slices
- Plasmid DNA purification, viral vector packaging and quantification, immunohistochemistry
- Stereotaxic surgery for virus injection, cannulation, and intracranial electroencephalography (iEEG)

## ENDORSED PROJECTS

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"Human cortical hierarchy characterized by the synaptic drive scaling of fast-spiking interneurons". Rosamund Stone Zander Translational Neuroscience Center, BCH	2024 -
"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 blitz rating  $\leq 2131$ )