

Jaeyoung Yoon, Ph.D.

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EMPLOYMENT

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

EDUCATION

Ph.D., Seoul National University	Mar 2013 – Feb 2019
Biological Sciences, College of Natural Sciences / Physiology, College of Medicine (<i>joint affiliation</i>)	
Thesis: "Short-term synaptic plasticity and persistent activity in the prefrontal cortex"	
(2016 – 2019: Military service, Republic of Korea Army)	
B.S., Seoul National University	Mar 2009 – Feb 2013
Biological Sciences, College of Natural Sciences	

AWARDS AND HONORS

Pioneers Grant, Harvard Brain Science Initiative (HBI), Harvard University (<i>application under review</i>)	2025
Travel/Research Award, Mind-Brain-Behavior Initiative, Harvard University (2.0 k USD)	2024
Best Presenter Award, F.M. Kirby Neurobiology Center, Boston Children's Hospital (BCH)	2024
Y. Eva Tan Fellowship, Yang-Tan Center for Molecular Therapeutics in Neuroscience, Massachusetts Institute of Technology (MIT) (130.0 k USD)	2021 – 2023
Molecular Therapeutics Impact Report 2020 – 2022, MIT (featured)	2022
BK21 / BK21+ Fellow, National Research Foundation of Korea (NRF) (21.3 k USD)	2013 – 2017
Lecture and Research Scholarship & Merit-based Scholarships, Seoul National University (SNU)	2013 – 2014
Superior Academic Performance Scholarships, SNU	2009 – 2011

SELECTED PUBLICATIONS

- Yoon J***, Terauchi A, Castro A, Cohen A, Umemori H, Ferguson B*. (2025). Human cortical and thalamocortical synaptic dysconnectivity in ASD. (*in preparation; preview available upon request*) (* 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). Selective modulation of excitation-inhibition balance by human cortical electric stimulation. (*in preparation*) (* co-corresponding author)
- Yoon J.** (2025). Acute human brain slice preparation for ex vivo electrophysiology and imaging. *protocols.io*. DOI: 10.17504/protocols.io.ewov124qogr2/v1 (embargoed until 2026-05-01)

- Yoon J.** (2025). 2-photon glutamate uncaging with pulse splitter for ex vivo electrophysiology. *protocols.io*. DOI: 10.17504/protocols.io.eq2lyxpjwgx9/v1 (embargoed until 2026-05-01)
- 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
- Lee BJ, et al. (2025). A specific association of presynaptic K⁺ channels with Ca²⁺ channels underlies K⁺ channel-mediated regulation of glutamate release. (*under review*)
- He M, et al. (2025). Human cortical neuron-based assays to study axon regeneration. (*in preparation*)

INVITED TALKS

- "Electrophysiological hallmarks of epilepsy and autism in the human neocortex". *China-Japan-Korea Neuroscience Meeting*. Incheon, Korea. (Aug 2025)
- "Thalamocortical synaptic hyperconnectivity in the human neocortex with ASD". *F.M. Kirby Neurobiology Center, BCH & Harvard Medical School (HMS)*. Boston, MA, USA. (May 2025)
- "Net synaptic drive of fast-spiking interneurons is inverted towards inhibition in human FCD I epilepsy". *New England Bioscience Society*. Boston, MA, USA. (Sep 2024)
- "Synaptic integration in human neuronal dendrites". *College of Medicine, SNU*. Seoul, Korea. (Dec 2023)
- "Subcellular connectivity and synaptic integration in cortical pyramidal neurons". *Yang-Tan Center for Molecular Therapeutics in Neuroscience & Tan-Yang Center for Autism Research Joint Symposium, McGovern Institute for Brain Research (MIBR), MIT*. Cambridge, MA, USA. (Jul 2021)

MEETING ABSTRACTS

- Yoon J***, Ferguson B* (* co-corresponding author). "Functional hyperconnectivity of thalamocortical synapses in human ASD". *Harvard Mind-Brain-Behavior Research Showcase*. Cambridge, MA, USA. (Apr 2025)
- Yoon J***, Ferguson B* (* co-corresponding author). "Functional hyperconnectivity of thalamocortical synapses in human ASD". *F.M. Kirby Neurobiology Center Retreat*. Boston, MA, USA. (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". *F.M. Kirby Neurobiology Center Retreat*. Boston, MA, USA. (Mar 2025)
- Cho E, Kwon J, Lee G, Shin J, Lee H, Lee SH, Chung CK*, **Yoon J***, Ho WK* (* co-corresponding author). "Net synaptic drive of fast-spiking interneurons is inverted towards inhibition in human FCD I epilepsy". *Gordon Research Conference (GRC)*. Waterville Valley, NH, USA. (Aug 2024)
- Yoon JY**, Lee HR, Ho WK, Lee SH. "Disparities in short-term depression among prefrontal cortex synapses sustain persistent activity in a balanced network". *Neuro2019*. Niigata, Japan. (Jul 2019)
- Yang CH, **Yoon JY**, Ho WK, Lee SH. "Presynaptic mitochondrial calcium release during high-frequency train pulse enhances short-term facilitation". *Korean Society for Brain and Neural Science (KSBNS)*. Goyang, Korea. (Oct 2016)

TECHNICAL EXPERIENCE

ex vivo electrophysiology (patch clamp) in acute human brain slices: 2019 – present

- Whole-cell (somatic, dendritic, & paired) or excised (outside-out, nucleated, inside-out) patch clamp in human neocortex (PN, FSIN, nFSIN; in L2/3, L5, L6; from temporal, frontal, occipital, parietal, insular lobe)
- 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
(https://flosfor.github.io/human_brain_slicing)
- Research Non-Employee Collaborator, Massachusetts General Hospital (MGH) (2021 – 2023)

ex vivo electrophysiology (patch clamp) in general applications: 2013 – present

- Slice electrophysiology setup at BCH/HMS (CLS 13052), MIT MIBR (46-6178), SNU College of Medicine (2-726, 2-724), and SNU College of Natural Sciences (504-201)
- Patch clamp in rodent brain slices (mouse, rat); in neocortex (L2/3, L5, L4, L6; TeA, PFC, ACC, V1, S1, RSC), hippocampus (CA1, CA3, DG), thalamus (MD), amygdala (BLA), and Calyx of Held
- Patch clamp in human brain slice culture, human cortical organoids, and human embryonic kidney cells (HEK 293)

- Single-cell RNA (scRNA) sequencing with Patch clamp (Patch-seq) from human neurons in acute slice and culture
- Computational modeling of vesicular dynamics and network biophysics, with optogenetic or electric stimulation under physiological or therapeutic scenarios
- Local field potential (LFP) recording in acute brain slices

2-photon excitation microscopy (2PEF) and fluorescence microscopy:

2013 – present

- 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), with 8x pulse splitter for enhanced 2PEF; setup and application (https://flosfor.github.io/pulse_splitter.pdf - provided to University of Ottawa in 2022)
- Intracellular calcium imaging & structural imaging for functional and morphological analysis
- Subcellular channelrhodopsin-assisted circuit mapping (sCRACM)

Data analysis and processing:

2013 – present

- Software development for electrophysiology and 2-photon imaging data analysis (<https://github.com/flosfor/pvbs>)
- Contribution to abfload: MATLAB function for processing .abf file format (<https://github.com/fcollman/abfload>)

Teaching experience:

2013 – present

- Postdoctoral mentor, Postdoctoral Fellow-Student Mentorship Program, BCH
- Teaching Assistant, Data Analysis in Neuroscience Workshop, Interdisciplinary Program in Neuroscience, SNU
- Teaching Assistant, Biology Lab 1 & 2 / Biological Sciences Research Lab 1 & 2, SNU
- Laboratory personnel training (SNU, MIT, BCH, HMS)

Other research and laboratory experience:

2013 – present

- *ad hoc* reviewer for *Nature Communications*, *Neuron*, *Cell Reports*, and *Frontiers in Synaptic Neuroscience*
- Technical assistance for *in vivo* patch clamp and Neuropixels setup at MIT MIBR (46-6171)
- Experience with Plasmid DNA purification, viral vector packaging, immunohistochemistry (IHC), stereotaxic surgery, and expansion microscopy (ExM)

LANGUAGES

English (bilingual), Korean (bilingual), Italian (proficient), French (intermediate), German (beginner), MATLAB (proficient)

MEMBERSHIPS

Society for Neuroscience (SfN), Federation of European Neuroscience Societies (FENS), Italian Society for Neuroscience (SINS), Korean Physiological Society, Korean Society for Brain and Neural Sciences (KSBNS), Japan Neuroscience Society, US Chess Federation (USCF; chess.com rating ≤ 2131)