

Jaeyoung Yoon, Ph.D.

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EMPLOYMENT

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

Ph.D., Seoul National University 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)	Mar 2013 – Feb 2019
B.S., Seoul National University Biological Sciences, College of Natural Sciences	Mar 2009 – Feb 2013

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 (1.99 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) (130.00 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
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 Palacin A, Cohen A, Umemori H, Ferguson B*. (2025). Local and thalamocortical synaptic dysconnectivity in human cortex with ASD. (*under review*) (* **co-corresponding author**)

Yoon J*, Ferguson B*. (2025). Selective modulation of excitation-inhibition balance by human cortical electric stimulation. (*under review*) (* **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. (2025a). 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. (2025b). 2-photon glutamate uncaging with pulse splitter for ex vivo electrophysiology. *protocols.io*. DOI: 10.17504/protocols.io.eq2lyxpjw9/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 drive of neocortical fast-spiking interneurons supporting attention". *F.M. Kirby Neurobiology Center, BCH & HMS*. Boston, MA, USA. (May 2025)

"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 (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; Yoon & Ferguson, 2025; Yoon, 2025a; 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, V1, S1, RSC),

hippocampus (CA1, CA3, DG), thalamus (MD), amygdala (BLA), and Calyx of Held (Yoon & Ferguson, 2025; Yoon, 2024; Yoon et al., 2020; Yoon & Choi, 2017; Lee et al., 2025; Yang et al., 2016)

- Patch clamp for single-cell RNA (scRNA) sequencing from human neurons (Patch-seq) (He et al., 2025)
- Patch clamp in human brain slice culture and human cortical organoids (He et al., 2025)
- Computational modeling of cellular and network biophysics, with optogenetic or electric stimulation under physiological or therapeutic scenarios (Yoon & Ferguson, 2025; Yoon et al., 2020)
- Local field potential (LFP) recording in acute brain slices

2-photon excitation microscopy (2PEF):

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), setup and application (Yoon, 2024)
- 8x pulse splitter setup and application, for enhanced 2PEF (Yoon, 2025b; provided to University of Ottawa in 2022)
- Intracellular calcium imaging, simultaneously with electrophysiology (Yoon, 2024)
- Structural imaging for morphological analysis (Yoon, 2024; Cho et al., 2024; Yoon et al., 2025)
- 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

- 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)
- Plasmid DNA purification, viral vector packaging, immunohistochemistry (IHC), expansion microscopy (ExM), stereotaxic surgery

LANGUAGES

English (bilingual), Korean (bilingual), Italian (proficient, C2), French (intermediate), 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 \leq 2131)

REFERENCES

Suk-Ho Lee, MD PhD (SNU), Won-Kyung Ho, MD PhD (SNU), Sukwoo Choi, PhD (SNU), Brielle Ferguson, PhD (HMS), Chinfei Chen, MD PhD (HMS), Gloria Choi, PhD (MIT)