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EDUCATION & PROFESSIONAL APPOINTMENTS

2022 – present	Adjunct Professor, IBS-UNIST Neuroscience program, UNIST BME
2024 – present	Adjunct Professor, IBS-SKKU Neuroscience program
2017 – present	Professor, Basic Science, IBS School, UST (University of Science and Technology)
2015 – present	Research Fellow/Principal Investigator Center for Cognition and Sociality, Institute for Basic Science, Korea
2012 – 2015	Assistant Professor Department of Physiology, Jeju National University School of Medicine
2009 – 2012	Research Associate Department of Neuroscience, Johns Hopkins University School of Medicine, prof. Paul Worely (PI)
2004 – 2009	Postdoctoral Fellow Department of Neuroscience, Johns Hopkins University School of Medicine, prof. Paul Worely (PI)
2004	Ph.D. Department of Physiology, Seoul National University College of Medicine (Korea), prof. Jun Kim (Advisor)
2000	M.S. Department of Physiology, Seoul National University College of Medicine (Korea), prof. Jun Kim (Advisor)
1997	B.S. Department of Biology, College of Natural Science, Sogang University (Korea)

HONORS AND AWARDS

2024	Excellence Award, Outstanding Faculty Award, University of Science and Technology, 2024
2015	The distinguished Scientist Support program funded by Jeju National University
2014	The distinguished Scientist Support program funded by Jeju National University

PROFESSIONAL MEMBERSHIP

2019 – 2022	KNRF National Research Planning Committee
2012 – present	The Korean Society for Brain and Neural Science
2012 – present	Korean Physiological Society
2004 – present	Society for Neuroscience
2004	The Korean Society for Brain and Neural Science
1997 – 2004	Korean Physiological Society

CONTRIBUTIONS TO SCIENCE & SCIENTIFIC INTERESTS

My scientific career centers on understanding mechanisms of activity-dependent synaptic plasticity at central synapses, particularly long-term potentiation (LTP) and long-term depression (LTD). I've made significant contributions to uncovering cellular and molecular mechanisms driving immediate early gene (IEG)-dependent long-term synaptic plasticity, exploring both Hebbian and non-Hebbian forms. My research integrates various techniques including electrophysiology, microscopy, and behavioral assessments to study plasticity in both excitatory and inhibitory synapses. Recently, I've focused on developing neuromodulation algorithms to advance therapies for neurological disorders, aiming to translate our understanding of synaptic plasticity into potential clinical applications.

RESEARCH TOPIC & PLAN

My research focuses on developing non-invasive neuromodulation techniques to enhance brain function, with a particular emphasis on ultrasonic neuromodulation as an alternative to electrical stimulation for studying synaptic plasticity. Building upon my previous work on Hebbian and non-Hebbian plasticity mechanisms, I aim to uncover new insights into the mechanisms of synaptic plasticity related to learning and memory by employing patterned ultrasound stimulation.

A key aspect of this work is exploring activity-dependent neuro- and gliotransmission, with a focus on the interactions between synaptic and astrocytic events beyond traditional synapses. This approach extends my earlier research on immediate early gene (IEG)-dependent plasticity to include the role of glial cells. To achieve this, I will focus on astrocyte-specific expression of mechanogating proteins and employ sonogenetic modulation to understand astrocytes' role in neural plasticity and behavior. Leveraging my experience with various electrophysiological and imaging techniques, I will investigate how cross-frequency coupling (CFC) generated by patterned ultrasound stimulation affects neural plasticity and cognitive functions. My future work will explore the potential for CFC-based stimulation to induce synaptic learning rules and influence adult-born neurogenesis, a process closely tied to cognitive function. This research ultimately aims to establish non-invasive neuromodulation as a powerful tool for inducing long-lasting plasticity and regulating cognitive processes in the brain, advancing our understanding of both normal brain function and potential therapies for neurological disorders.

PUBLICATIONS

1. Ji Hun Kim; Keunhyung Lee; Minseok Koo; Doeun Kim; Jin Kyung Hong; Jeong-Yun Choi; Han Seok Ko; Joo-Ho Shin; Joo Min Park; Jinhyoung Park*; Yunjong Lee*, Ultrasonic repression of TRPA1-dependent astrocyte reactivity confers neuroprotection in models of Lewy body dementia. *Translational Neurodegeneration* (2026 Mar 10;15(1):9. doi: 10.1186/s40035-026-00544-6
2. Tien Phan, Sangyep Ship, Ho Jeong Kim, Keunhyung Lee, Tai-Young Kim, Jae Hoon Lee, Dong-Wook Kang, Lee, Hyunjin Shin, Hye Eun Lee, Nishani Jayanika Jayathilake, Minseok Koo, Hyungju Park, Hyun-Woo Kim, Yee-Joon Kim, Ji Young Mun, Hyungju Park, Kyu Pil Lee, C. Justin Lee, Joo Min Park*, Harnessing Theta-Gamma Coupled Brainwave Using Ultrasound for Spinal Astrocyte Revitalization and Sustained Neuropathic Pain Relief. *Nature Communications* (2025) Dec 6;17(1):273. doi: 10.1038/s41467-025-66980-6
3. Hee Hwan Park, Yurim Kim, Byeong Seong Jang, Simay Genişcan, Dong Hoon Hwang, Yeojin Seo, Seung-Ah Jee, Hyo Gyeong Seo, Hyung Soon Kim, Ariandokht Einisadr, Ho-Jeong Kim, Seolhee Lee, Sangwoo Kwon, Kyung Sook Kim, Kang In Lee, Jae Young Lee, Joo Min Park, Young-Min Kim, Soo-Chang Song, Byung Gon Kim, Mechanical Environment Afforded by Engineered Hydrogel Critically Regulates Survival of Neural Stem Cells Transplanted in the Injured Spinal Cord via Piezo1-mediated Mechanotransduction, *Advanced Science* (2025) doi: 10.1002/advs.202507160
4. Nishani Jayanika Jayathilake, Tien Thuy Phan, Jeongsook Kim, Kyu Pil Lee*, Joo Min Park* Modulating Neuroplasticity for Chronic Pain Relief: Non-Invasive Neuromodulation as a Promising Approach, *Experimental Molecular & Medicine* (2025) <https://doi.org/10.1038/s12276-025-01409-0>
5. Ho-Jeong Kim, Tien Thuy Phan, Keunhyung Lee, Jeong Sook Kim, Sang-Yeong Lee, Jung Moo Lee, Jongrok Do, Doyun Lee, Sung-Phil Kim, Kyu Pil Lee, Jinhyoung Park, C. Justin Lee, Joo Min Park*, Long-lasting Forms of Plasticity through Patterned Ultrasound-induced Brainwave Entrainment. *Science Advances* (2024) 10(8):eadk3198. doi: 10.1126/sciadv.adk3198.
6. Tien Thuy Phan, Nishani Jayanika Jayathilake, Kyu Pil Lee*, Joo Min Park*, BDNF/TrkB Signaling Inhibition Suppresses Astroglialosis and Alleviates Mechanical Allodynia in a Partial Crush Injury Model. *Experimental Neurobiology* (2023) 32(5):343-353
7. Keunhyung Lee, Jung Moo Lee, Tien Thuy Phan, C Justin Lee, Joo Min Park*, Jinhyoung Park*, Ultrasonocoverslip: In-Vitro Platform for High-Throughput Assay of Cell Type-Specific Neuromodulation with Ultra-low-intensity Ultrasound Stimulation. *Brain Stimulation* (2023) <https://doi.org/10.1016/j.brs.2023.08.002>
8. Seonghyun Lee, Hyunji Lee, Gayoung Baek, Eunji Namgung, Joo Min Park, Sanghun Kim, Seongho Hong, Jin-Soo Kim, Enhanced mitochondrial DNA editing in mice using nuclear-exported TALE-linked deaminases and nucleases. *Genome Biology* (2022) 23, 211
9. Raozhou Lin, Lisa N Learman, M Ali Bangash, Tatiana Melnikova, Erica Leyder, Sai C Reddy, Nirinjini Naidoo, Joo Min Park*, Alena Savonenko*, Paul F Worley*, Homer1a Regulates Shank3 Expression and Underlies Behavioral Vulnerability to Stress in a Model of Phelan-McDermid Syndrome. *Cell Reports* (2021) 37:110014
10. Eunee Lee, Seungjoon Lee, Jae Jin Shin, Woochul Choi, Changuk Chung, Suho Lee, Jihye Kim, Seungmin Ha, Ryunhee Kim, Taesun Yoo, Ye-Eun Yoo, Jisoo Kim, Young Woo Noh, Issac Rhim, Soo Yeon Lee, Woohyun Kim, Taekyung Lee, Hyogeun Shin, Il-Joo Cho, Karl Deisseroth, Sang Jeong Kim, Joo Min Park*, Min Whan Jung*, Se-Bum Paik*, Eunjoon Kim* (2021) Excitatory synapses and gap junctions cooperate to improve Pv neuronal burst firing and cortical social cognition in Shank2-mutant mice. *Nature Communications* (2021)12:5116
11. Raozhou Lin, Lisa N Learman, Chan-Hyun Na, Santosh Renuse, Kevin T Chen, Po Yu Chen, Gum-Hwa Lee, Bo Xiao, Susan M Resnick, Juan C Troncoso, Karen K Szumlanski, David J Linden, Joo-Min Park, Alena Savonenko, Akhilesh Pandey, Paul F Worley, Persistently elevated mTOR Complex 1-S6 Kinase 1 Disrupts DARPP-32-Dependent D1 Dopamine Receptor Signaling and Behaviors. *Biological Psychiatry* (2021) 3223(20)32031-32027
12. Hye-Jin Kim, Sung Won Hur, Jun Bum Park, Jieun Seo, Jae Jin Shin, Seon-Young Kim, Myoung-Hwan Kim, Do Hyun Han, Jong-Wan Park, Joo Min Park*, Sang Jeong Kim*, Yang-Sook Chun*, Histone demethylase PHF2 activates CREB and promotes memory consolidation. *EMBO Reports* (2019) e45907

13. Hye-Hyun Kim, Joo Min Park, Suk-Ho Lee, Won-Kyung Ho, Association of mGluR-Dependent LTD of Excitatory Synapses with Endocannabinoid-Dependent LTD of Inhibitory Synapses Leads to EPSP to Spike Potentiation in CA1 Pyramidal Neurons. **Journal of Neuroscience** (2019) 39(2) 224-237
14. Sehoon Keum, Arie Kim, Jae Jin Shin, Jong-Hyun Kim, Joo Min Park, Hee-Sup Shin, A Missense Variant at the Nrnx3 Locus Enhances Empathy Fear in the Mouse. **Neuron** (2018) 98:588-601
15. Youn Na, Sungjin Park, Changhee Lee, Dong-Kyu Kim, Joo Min Park, Shanthini Sockanathan, Richard L Huganir, Paul F Worley, Real-Time Imaging Reveals Properties of Glutamate-Induced Arc.Arg3.1 Translation in Neuronal Dendrites. **Neuron** (2016) 91: 561-573
16. Hyun-Ji Kim, Myong-Ho Jeong, Kyung-Ran Kim, Chang-Yun Jung, Seul-Yi Lee, Hanna Kim, Jewoo Koh, Tuan Anh Vuong, Seungmoon Jung, Hyunwoo Yang, Su-Kyung Park, Dahee Choi, Sung Hun Kim, KyeongJin Kang, Jong-Woo Sohn, Joo Min Park, Daejong Jeon, Seung-Hoi Koo, Won-Kyung Ho, Jong-Sun Kang, Seong-Tae Kim, Hana Cho, Protein Arginine Methylation Facilitates KCNQ Channel-PIP2 Interaction Leading to Seizure Suppression. **eLife** (2016) 2016;5:e17159
17. Hyun Geun Shim, Sung-Soo Jang, Dong Cheol Jang, Yunju Jin, Wonseok Chang, Joo Min Park*, Sang Jeong Kim*, mGluR1 receptor mediates homeostatic control of intrinsic excitability through Ih in cerebellar Purkinje cells. **Journal of Neurophysiology** (2016) 115:2446-2455
18. Dash Oyunbileg, Joo Min Park, Su-Yong Eun, Sung-Cherl Jung, Modulatory function of calcium excitability in astrocytes by NMDA receptor antagonist, **The Journal of Medicine and Life Science** (2016) 13(2):93-97.
19. Joo Min Park*, Sung-Cherl Jung, Su-Yong Eun, Long-term Synaptic Plasticity: Circuit Perturbation and Stabilization. **Korean Journal of Physiology and Pharmacology** (2014) 18(6):457-460
20. Sung Won Hur, Joo Min Park*, Long-Term Potentiation of Excitatory Synaptic Strength in Spinothalamic tract Neurons of the Rat Spinal Cord. **Korean Journal of Physiology and Pharmacology** (2013) 17(6):553-558
21. Joo Min Park*, Jia-Hua Hu, Aleksandr Milshteyn, Ping-Wu Zhang, Chester G. Moore, Sungjin Park, Michael C. Datko, Racquel D. Domingo, Cindy M. Reyes, Xiaodong J. Wang, Felicia A. Etzkorn, Bo Xiao, Karen K. Szumlinski, Dorothee Kern, David J. Linden, Paul F. Worley, A Prolyl-isomerase Mediates Dopamine-dependent Plasticity and Cocaine Motor Sensitization. **Cell** (2013) 154(3):637-650
22. Ishita Das, Joo Min Park, Jung H. Shin, Soo Kyeong Jeon, Hernan Lorenzi, David J. Linden, Paul F. Worley, and Roger H. Reeves, Hedgehog agonist therapy corrects structural and cognitive deficits in a Down syndrome mouse model. **Science Translational Medicine** (2013) 5(201):201ra120
23. Jia-Hua Hu, Linlin Yang, Paul J Kammermeier, Chester G Moore, Paul R Brakeman, Jiancheng Tu, Shouyang Yu, Ronald S Petralia, Zhe Li, Ping-Wu Zhang, Joo Min Park, Xinzhong Dong, Bo Xiao, Paul F Worley F, Preso1 dynamically regulates group I metabotropic glutamate receptors. **Nature Neuroscience** (2012) 15(6):836-844
24. Jia-Hua Hu*, Joo Min Park*, Sungjin Park*, Bo Xiao, Marlin H Dehoff, Sangmok Kim, Takashi Hayashi, Martin K Schwarz, Richard L Huganir, Peter H Seeburg, David J Linden, Paul F Worley, Homeostatic scaling requires group I mGluR activation mediated by Homer1a. **Neuron** (2010) 68:1128-1142
25. Michael C Chang, Joo Min Park, Kenneth A Pelkey, Heidi L Grabenstatter, Desheng Xu, David J Linden, Thomas P Sutula, Chris J McBain, Paul F Worley, Narp regulates homeostatic scaling of excitatory synapses on parvalbumin-expressing interneurons. **Nature Neuroscience** (2010) 13(9): 1090-1097
26. Sungjin Park*, Joo Min Park*, Sangmok Kim, Jin-Ah Kim, Jason D Shepherd, Constance L Smith-Hicks, Shoaib Chowdhury, Walter Kaufmann, Dietmar Kuhl, Alexey G Ryazanov, Richard L Huganir, David J Linden, Paul F Worley, Elongation factor 2 and fragile X mental retardation protein control the dynamic translation of Arc/Arg3.1 essential for mGluR-LTD. **Neuron** (2008) 59(1): 70-83
27. Richard W Cho, Joo Min Park, Steffen B E Wolff, Desheng Xu, Carsten Hopf, Jin-Ah Kim, Radhika C Reddy, Ronald S Petralia, Mark S Perin, David J Linden, Paul F Worley, mGluR1/5-dependent long-term depression requires the regulated ectodomain cleavage of neuronal pentraxin NPR by TACE. **Neuron** (2008) 57(6): 858-871

[Patent NO] 10-2020-0098553, Brain Plasticity Control Device and Method Using Theta-Burst Ultrasound

[Patent NO] 10-2024-0016980, The cell or tissue stimulation device and the cell or stimulation and monitoring device utilizing it.