Curriculum Vitae

Byeongwook Lee, Ph.D.

KAIST Cognitive & Systems Neuroscience Laboratory
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RESEARCH GOAL

By integrating cognitive, systems-neuroscience, and computational models with advanced functional neuroimaging techniques, I seek dynamic connectivity-based mechanisms that explain cognitive resilience and decline in aging and neurodegenerative diseases. My ultimate goal is to advance our fundamental understanding of the human brain and provide insights into healthy aging as well as drive applications in artificial intelligence.

RESEARCH TOPICS & KEYWORDS

Brain resilience in aging: Dynamic connectivity-based brain resilience mechanisms in the super-ager group.
Aberrant brain dynamics in neurodegenerative disease: Disruption of dynamic brain connectivity in brain diseases.
Dynamic brain network organization in rodent brain: Dynamic neural mechanisms underlying DMN-SN interactions.
E/I balance in brain function: Functional role of excitatory/Inhibitory balance in brain function/dysfunction.
Control architecture of the brain: Unique brain network architectures that support cognitive functioning.

Keywords: Cognitive aging and brain resilience, latent brain state dynamics, whole-brain effective connectivity, dynamic functional connectivity, biophysical neuron modeling, rodent and non-human primate applications.

ACADEMIC EMPLOYMENT

Assistant Professor, Department of Brain and Cognitive Science, KAIST Aug. 2025 – Current

Postdoctoral Fellow, Stanford University, School of Medicine Sep. 2019 – July, 2025
Advisor: Prof. Vinod Menon
Research topic: Investigation of latent brain state dynamics underlying neurocognitive phenomena

EDUCATION

Postdoctoral Fellow, Stanford University, School of Medicine Sep. 2019 – July, 2025
Advisor: Prof. Vinod Menon
Research topic: Investigation of latent brain state dynamics underlying neurocognitive phenomena

Korea Advanced Institute of Science and Technology (KAIST) Feb. 2011 - Feb. 2019
Combined M.S. & Ph. D. Bio and Brain Engineering
Advisor: Kwang-Hyun Cho
Thesis: System-level analysis of organizational design principles underlying brain networks

Korea Advanced Institute of Science and Technology (KAIST) Feb. 2007 - Feb. 2011
B.S. Electrical Engineering

KEY PUBLICATIONS & PREPRINTS (Selected; 1st author; IF: 5-year IF)

Title	Journal	IF
Brain resilience in aging:		
• Latent brain state dynamics and cognitive flexibility in older adults	Prog. Neurobio. (2022)	10.2
Aberrant brain dynamics in neurodegenerative disease:		
• Dopaminergic modulation and dosage effects on brain state dynamics and working memory processes in Parkinson's disease.	Nature Comm. (2025)	17.0
Dynamic brain network organization in rodent brain:		
• Space wandering in the rodent default mode network	PNAS (2024)	12.0
• Neuronal dynamics of the default mode network and anterior insular cortex: Intrinsic properties and modulation by salient stimuli	Science Adv. (2023)	15.4

• Dynamic decoupling of salience and default mode networks by optogenetic manipulation of anterior insular cortex	Nature Comm. (2023)	17.0
E/I balance in brain function:		
• Combined positive and negative feedback allows modulation of neuronal oscillation frequency during sensory processing	Cell Reports (2018)	9.9
Control architecture of human brain:		
• The hidden control architecture of complex brain networks.	iScience (2018)	6.2

AWARDS & SCHOLARSHIP

Scholarship & Fellowship

2021-2024 Alzheimer's Association Research Fellowship (Amount of grant: $175,000 USD)
(Title: Computational modeling of dynamic causal brain circuits underlying cognitive dysfunction in Alzheimer's disease)
2011-2019 National scholarship student of KAIST (Integrated M.S. and Ph.D. Course)
2007-2011 National scholarship student of KAIST (B.S. Course)

Award

2019 Best Doctoral Dissertation Award in Department of Bio and Brain Engineering, KAIST
2013 Qualcomm Innovation Award

FULL PUBLICATIONS & PREPRINTS

(*contributed equally to this study, #Co-correspoding authors)

Brain resilience in aging

1. **Lee, B.**#, Cai, W., Young, C. B., Yuan, R., Ryman, S., Kim, J., ... & Menon, V.# (2022). Latent brain state dynamics and cognitive flexibility in older adults. ***Progress in Neurobiology*** (IF=10.2).

Aberrant brain dynamics in neurogenerative diseases

1. **Lee, B.** *,#, Young, C. B.*, Cai, W., Yuan, R., Ryman, S., Kim, J., ... & Menon, V.# (2025). Dopaminergic modulation and dosage effects on brain state dynamics and working memory processes in Parkinson's disease. ***Nature Communications*** (IF=17.0).
2. Cai, W., Young, C. B., **Lee, B.**, Yuan, R., Ryman, S., Kim, J., ... & Menon, V.# (2024). Subthalamic-language network connectivity predicts dopaminergic modulation on speech function in Parkinson's disease. *In press.* ***PNAS*** (IF=12.0).
3. Cai, W., Young, C. B., Yuan, R., **Lee, B.**, Ryman, S., Kim, J., ... & Menon, V.# (2022). Dopaminergic medication normalizes aberrant cognitive control circuit signaling in Parkinson's disease. ***Brain*** (IF=14. 6).

Dynamic brain network organization

1. Nghiem, T. A. E.*, **Lee, B.***, Chao, T. H. H.*, Branigan, N. K., Mistry, P. K., Shih, Y. Y. I., & Menon, V. (2023). Space wandering in the rodent default mode network. ***PNAS*** (IF=12.0).
2. Chao, T. H. H.*, **Lee, B.***, Hsu, L. M. *, Cerri, D. H., Zhang, W., Wang, T. W. W., ... & Menon, V.#, Shih, Y. Y. I.# Neuronal dynamics of the default mode network and anterior insular cortex: Intrinsic properties and modulation by salient stimuli (2023). ***Science Advances*** (IF=15.4).
3. Menon, V. *,#, Cerri, D.*, **Lee, B.***, Yuan, R., Lee, S., & Shih, Y. Y. I.# Dynamic decoupling of salience and default mode networks by optogenetic manipulation of anterior insular cortex (2023). ***Nature Communications*** (IF=17.0).

E/I balance in brain functions

1. **Lee, B.**, Shin, D., Gross, S. P., & Cho, K. H.# (2018). Combined positive and negative feedback allows modulation of neuronal oscillation frequency during sensory processing. ***Cell Reports*** (IF=9.9).

Control structure in human brain network

1. **Lee, B.**, Kang, U., Chang, H., & Cho, K. H.# (2019). The hidden control architecture of complex brain networks. ***iscience*** (IF=6.2).
2. **Lee, B.**, Kang, U., Chang, H., & Cho, K. H.# (2022). The hidden community architecture of human brain networks. ***Scientific reports*** (IF=5.52).

Brain-inspired engineering

1. **Lee, B.,** & Cho, K. H.# (2016). Brain-inspired speech segmentation for automatic speech recognition using the speech envelope as a temporal reference. ***Scientific reports*** (IF=5.52).

CONFERENCE PRESENTATION

1. **Lee, B.**, Rouillard, L., Ambrogioni, L., Ryali S., Branigan N., Mistry, P., Wassermann, D., Menon, V. (2024, July). Brain-wide modeling of causal circuit dynamics in human working memory . *In Organization of Human Brain Mapping (OHBM)*
2. **Lee, B.**, Ryali S., Menon, V. (2023, July). Modeling Aberrant Dynamic Causal Brain Circuits in Alzheimer's Disease. In *Alzheimer's Association International Conference (AAIC).*
3. **Lee, B.**, Kang, U., Chang, H., & Cho, K. H. (2017, August). The minimum dominating sets in a brain network critically determine the efficiency of local communication of the network. In *Proc. 18th Int. Conf. on Systems Biology (ICSB).*
4. **Lee, B.**, Shin, D., & Cho, K. H. (2016, September). The regulation principle underlying interneuron circuits for frequency modulation of neuronal oscillations. In *17th Int. Conf. on Systems Biology (ICSB).*

PATENTS

1. Cho, K. H., **Lee, B.**, Jung, S.H., "Noise robust speech recognition method inspired from speech processing of brain", *U.S. Patent*, No. US. 10,008,198 B2, June, 2018.
2. Cho, K. H., **Lee, B.**, Jung, S.H., "Nested segmentation method for speech recognition based on sound processing of brain", *Korea Patent, No. 10-1614768-0000,* April, 2016.
3. Cho, K. H., **Lee, B.**, Jung, S.H., "Speech signal segmentation method based on sound processing of brain", *Korea Patent, No. 10-1434592-0000,* April, 2014.

REFERENCES

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