CURRICULUM VITAE

May 29, 2025

PERSONAL

Name:	Daeyeol Lee
Current Position:	Bloomberg Distinguished Professor The Zanvyl Krieger Mind/Brain Institute Department of Neuroscience Department of Psychological and Brain Sciences Johns Hopkins University
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EDUCATION

1989	B.Econ.	Economics	Seoul National University, Korea.
1990	M.S.	Biology	University of Illinois at Urbana-Champaign, USA
1995	Ph.D.	Neuroscience	University of Illinois at Urbana-Champaign, USA

ACADEMIC POSITIONS

1995-1997	Postdoctoral Associate	Department of Physiology University of Minnesota, USA
1997-2000	Assistant Professor (tenure track)	Department of Neurobiology and Anatomy Wake Forest University School of Medicine
2000-2006	Assistant Professor (tenure track)	Department of Brain and Cognitive Sciences Center for Visual Science University of Rochester
2006-2012	Associate Professor (tenured)	Department of Neurobiology Yale School of Medicine Department of Psychology, Yale University
2012-2019	Professor	Department of Neuroscience (formerly Department of Neurobiology) Yale School of Medicine Department of Psychology, Yale University
2017-2019	Professor	Department of Psychiatry Yale School of Medicine
2018-2019	Professor	Department of Cellular and Molecular Physiology

		Yale School of Medicine
2019-2024	Professor Adjunct	Department of Neuroscience Yale School of Medicine
2019-	Bloomberg Distinguished Professor	The Zanvyl Krieger Mind/Brain Institute Department of Neuroscience Department of Psychological and Brain Sciences Kavli Neuroscience Discovery Institute Johns Hopkins University

HONORS AND AWARDS

1986-1989	Danam Fellowship, Danam Foundation
1987-1989	Fellowship for Prominent Collegians, Korea Foundation for Advanced Studies
1989	Graduate *cum laude*, Seoul National University
1989-1990	University Fellowship, University of Illinois at Urbana-Champaign
1989-1995	Fellowship for Study Abroad, Korea Foundation for Advanced Studies
2008	Loucks Lecture, Department of Psychology, University of Washington at Seattle
2009	Wellington-Burnham Lecture, Department of Economics, Tufts University
2017-2019	Dorys McDonnell Duberg Professor of Neuroscience, Yale University
2019	Bloomberg Distinguished Professor of Neuroscience, Johns Hopkins University
2021	Samsung Ho-am Prize for Medicine, Ho-am Foundation
2022	Harley Hotchkiss Memorial Lecture, Department of Neuroscience, University of Lethbridge
2024-	Salzburg Global Fellow

RESEARCH INTEREST

Neural mechanisms of sequence learning and selection
Neural mechanisms of decision making under uncertainty
Neural mechanisms of inter-temporal choice
Reinforcement learning and its neural substrates
Behavioral economics and game theory
Functions of primate prefrontal cortex and basal ganglia
Neural coding
Interval timing
Neural basis of numerosity and arithmetic

ACTIVE GRANT SUPPORT

2022-2027	co-PI	NSF/NIH Research Grant (R01 MH132386) "CRCNS Research Proposal: Neural Basis of Inductive Bias" (PI: John Murray, Yale University) Total award (direct cost): $1,250,000 Annual direct cost (subcontract only): $150,000
2024-2029	PI	NIH Research Grant (R01 MH137210) "Neural Basis of Planning" (co-PI: Weiji Ma, New York University) Total award: $3,853,557

PAST GRANT SUPPORT

1999-2003	PI	James S. McDonnell Foundation, Cognitive Neuroscience Grant "Neural Mechanisms of Binding and Short-term Memory Capacity" Total award: $148,478
1999-2005	PI	NIH Research Grant (R01 MH059216) "Cortical Mechanisms of Sequence Learning" Total award: $1,443,720
2004-2005	PI	NIH Conference Grant (R13 MH070450) "Symposium: Adaptive Representation and Control in Vision" Total award: $35,746
2003-2008	PI	NIH Research Grant (R01 NS044270) "Dynamics of Cortical Communication" Total award: $1,346,624
2004-2009	PI	NIH Research Grant (R01 MH073246) "CRCNS: Dynamics and Neural Basis of Decision Making in Primate Frontal Cortex" (co-PI: Xiao-Jing Wang, Yale University) Total award: $1,498,529
2005-2010	PI	NIH Program Project Grant (P01 NS048328) "Neural Interactions Among Multiple Motor Structures" (Director, Marc H. Schieber) Project 3: Corticostriatal Network Total award: $7,666,627 Annual direct cost for Project 3: $147,162
2006-2010	co-PI	NSF Research Grant (SES-0624190) "The evolution of our preferences: evidence from primate trading behavior" (PI: Laurie Santos, Department of Psychology, Yale University) Total award: $749,324
2005-2010	PI	NIH Research Grant (R01 MH059216) "Cortical Mechanisms of Sequence Learning" Total award: $1,395,936
2007-2012	PI	NIH Research Grant (RL1 DA024855) Interdisciplinary Research Consortium on Stress, Self-control and Addiction (Director, Rajita Sinha, Department of Psychiatry, Yale University) Project 4: Stress, prefrontal cortex, and decision making. Total direct cost for Project 4: $750,000
2008-2013	Co-PI	NIH Program Project Grant Molecular and Cellular Basis of Cognitive Aging in Prefrontal Cortical Network (Project 1; Director, Amy Arnsten; PI, Min Wang, Department of Neurobiology, Yale University) Annual direct cost for Project 1: $167,284

2010-2014	PI	NIH Exploratory Center Grant Translational Research of Cocaine, Striatum, and Impulsivities (Director, Marc Potenza, Department of Psychiatry, Yale University) Project 3: Cocaine, Impulsivity, and Striatal Function in NHPs Annual direct cost for Project 3: $100,000
2010-2016	PI	NIH Research Grant (R01 DA029330) "Decision Making and Orbitofrontal Cortex" Total award: $1,861,875
2014-2016	PI	NIH Research Grant (R21 MH104460) "Learning and Selection in the Basal Ganglia" Total direct cost: $275,000
2015-2018	co-PI	BlackThorn Therapeutics "Effects of kappa receptor antagonist on prefrontal functions related to decision making" Total award: $367,166
2016-2019	PI	NIH Research Grant (R01 MH108643) "Rapid Actions of Ketamine in the Prefrontal Cortex" (co-PI: Amy Arnsten, Yale University) Total award: $3,286,756
2016-2019	Investigator	NIH Research Grant (R01 DA043443) "Individual Differences & Cocaine Effects on Impulsive Choice in Rats" (PI: Jane Taylor, Yale School of Medicine)
2015-2021	PI	NIH Research Grant (R01 MH108629) "Neural Basis of Temporal Decision Making" Total award: $2,085,708
2016-2021	Sub-PI	NIH Research Grant (R01 MH111425) "Neuronal Substrates of Hemodynamic Signals in the Prefrontal Cortex" (PI: John O'Doherty, Doris Tsao, Caltech)
2019-2021	sub-PI	NIH Research Grant (R01 MH108643) "Rapid Actions of Ketamine in the Prefrontal Cortex" (PI: Amy Arnsten, Yale University) Total award: $3,286,756
2017-2022	Investigator	NIH Research Grant (R01 DA041480) "Decision-making Dysfunction and Chronic Cocaine" (PI: Jane Taylor, Yale School of Medicine)
2018-2023	PI	NIH Research Grant (R01 MH118925) "CRCNS: Neural Basis of Planning" (co-PI: Weiji Ma, New York University) Total award: $1,994,783 Annual direct cost (subcontract only): $200,000

PROFESSIONAL ACTIVITIES

Editorial Experience:

2006	Guest Editor, Neural Networks, Special issue on neurobiology of decision making
2009-2012	Associate Editor, Journal of Neuroscience
2009	Guest Editor, Frontiers in Behavioral Neuroscience, Special topic on Neuroeconomics
2010	Guest Editor, Frontiers in Behavioral Neuroscience, Special topic on Reinforcement learning
2010	Guest Editor, Frontiers in Decision Neuroscience, Special topic on Neurobiology of choice
2008-2014	Review Editor, Frontiers in Behavioral Neuroscience
2014-2015	Associate Editor, Frontiers in Behavioral Neuroscience
2012-2018	Reviewing Editor, Journal of Neuroscience
2019-2020	Advisory Board, Neuroscience Next.
2016-2023	Faculty, Faculty Opinion
2016-2019	Editorial Board, Computational Psychiatry
2010-	Associate Editor, Frontiers in Decision Neuroscience
2017-	Board of Reviewing Editors (BRE), eLife

Advisory Boards:

2009	Advisory Board	Faculty of 1000 Medicine Reports
2016	Advisory Board	Institute of Basic Sciences, Korea

Scientific Advisory Boards:

2014-2018	Bonsai AI, Inc.
2014-	Neurogazer, Inc.

Society committees:

2008	Program Committee	International Conference of Cognitive Science.

Meetings Organized:

2004	Co-organizer	Center for Visual Science Sympoisum, “Adaptive Representation and Control in Vision”, University of Rochester, Rochester, NY
2007	Co-organizer	Okinawa Institute of Science and Technology Workshop on Cognitive Neurobiology, Okinawa, Japan.
2008	Co-organizer	Symposium on Decision Making and the Brain, 6th International Conference of Cognitive Sciences, Seoul, Korea.
2009	Co-organizer	Perspective of Decision Neuroscience: Beyond the Biological Approach of Brain Science, 36th International Congress of Physiological Science, Kyoto, Japan.
2010	Organizer	Machine Learning in the Brain: Quo Vadis? American Psychological Association 118th Annual Convention, San Diego.
2013	Co-organizer	Neural Circuits for Decision Making and Reinforcement Learning Kavli Symposium, Department of Neurobiology, Yale University School of Medicine
2014	Co-organizer	Yale Workshop on Perception and Choice
2022	Co-organizer	Flexible Reward Learning and Decision Making Center for Cognitive Neuroscience, Dartmouth College
2023	Organizer	World Neuroscience and Neurobusiness Conference, Seoul, Korea

Grant Review:

2003, 2006-07,

2011, 2013	The Wellcome Trust, UK
2006	Medical Research Council, UK
2004, 2006	Netherlands Organisation for Scientific Research (NWO)
2004, 2009-10	Human Frontier Science Program
2001, 2004-05, 2008, 2011-13	National Institute of Health, Special Emphasis Panels
2005	National Institute of Health Learning and Memory Study Section (ad hoc)
2002-04, 2008, 2011-12	National Science Foundation (ad hoc)
2005-06, 2008	CRCNS Review Panel, National Science Foundation
2006	United States-Israel Binational Science Foundation
2007	Cognitive Neuroscience Study Section (ad hoc) National Institute of Health, (ad hoc)
2007-11	Cognitive Neuroscience Study Section (regular member) National Institute of Health
2008	Global Centers of Excellence (COE) Program, Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan.
2008	Natural Sciences and Engineering Research Council of Canada
2021	NIMH BRAINS Review
2021-22	BRAIN Circuit Programs Review (NIH)

Manuscript Review:
Brain and Cognition / Cerebral Cortex / Current Biology / eLife
Experimental & Clinical Psychopharmacology / Experimental Brain Research
Frontiers in Behavioral Neuroscience / Frontiers in Decision Neuroscience
Human Brain Mapping / Journal of Cognitive Neuroscience
Journal of Computational Neuroscience / Journal of Neuroscience / Journal of Neurophysiology
Nature / Nature Neuroscience / Nature Reviews Neuroscience / Neural Networks
Neurology / Neuron / Neuroscience Letters / Perception / PLoS Biology
PLoS Computational Biology / PNAS / Quarterly Journal of Experimental Psychology
Science / Somatosensory and Motor Research / Trends in Cognitive Sciences

Review of Book Proposals:
Garland Science / Oxford University Press

Society Memberships:

1997-2008	Psychonomic Society
2003-2012	Society for Cognitive Neuroscience
2004-2008	Society for Neuroeconomics
2011-2012	New York Academy of Sciences
1989-	Society for Neuroscience
2002-	Association for Psychological Science

TEACHING EXPERIENCE

Undergraduate Teaching:

2001-2006	Neuroscience Senior Seminar	University of Rochester
2001-2006	Sensory and Motor Neuroscience	University of Rochester
2020-2021	Neuroscience and Sociality	Seoul National University (virtual)
2021-	Human and Machine Intelligence	Johns Hopkins University

Medial Teaching:

1997-1999	Microanatomy

Graduate Teaching:

1998-2000	Introduction to Neuroscience
1998-2000	Sensory Neuroscience
1998-2000	Research Design and Methods
2001-2005	Sensory Systems
2004	Neuroeconomics: Cognitive Neuroscience of Decision Making
2007-	Principles of Neuroscience
2008	Seminar in Visuomotor Neurophysiology (with James Mazer)
2010, 2013	Seminar in Neurophysiology of Decision Making (with James Mazer)
2012, 2015	Seminar in Neuroeconomics (with Ifat Levy)
2017, 2019	Statistics and Data Analysis in Neuroscience

STUDENT ADVISING

Undergraduate students (research):

2007-2008	Drew Marticorena	Yale University (Cognitive Science)
2008	Eric Tsytsylin	Yale University (Cognitive Science)
2020	Fanbo Sophia Xu	Johns Hopkins Univ (Computer Science)

Graduate students:

2001-03	Michelle Conroy	University of Rochester
2001-06	Jeong-Woo Sohn	University of Rochester
2004-06	Jaewon Hwang	University of Rochester
2008-14	Christopher Donahue	Yale University (Neurobiology)
2009-15	Matthew Kleinman	Yale University (Neurobiology)
2012-18	Bart Massi	Yale University (Neuroscience)
2016-21	Maxwell Shinn	Yale University (Neuroscience)
2016-23	Shanna Murray	Yale University (Neuroscience)
2021-23	Zhuoyaung (Gio) Li	Johns Hopkins University (Neuroscience)
2020-25	Hexin Liang	Johns Hopkins University (Neuroscience)
2024-25	Ruoxi Sun	Johns Hopkins University (Neuroscience)
2024-25	Wezheng (Kevin) Yuan	Johns Hopkins University (Biomedical Engineering)

Postdoctoral fellows:

2000-01	Stephan Quessy	University of Rochester
2001-06	Dominic J. Barraclough	University of Rochester
2001-06	Bruno B. Averbeck	University of Rochester
2004-08	Hyojung Seo	Yale University
2005-12	Soyoun Kim	Yale University
2006-08	Sang June Oh	Yale University
2007-09	Xinying Cai	Yale University
2007-10	Hiroshi Abe	Yale University
2008-12	Timothy Vickery	Yale University (co-advised by Marvin Chun)
2013-15	Hansem Sohn	Yale University
2015-16	Matthew McGinley	Yale University (co-advised by David McCormick)
2014-20	Stephanie Groman	Yale University (co-advised by Jane Taylor)
2017-20	Zhixian Cheng	Yale University/Johns Hopkins University

2018-20	Mariann Oemisch	Yale University/Johns Hopkins University
2020-25	Min-Yoon Park	Johns Hopkins University
2023-	Yifeng Cheng	Johns Hopkins University (co-advised by Patricia Janak)
2025-	Eunju Shin	Johns Hopkins University
2025-	Norman Lam	Johns Hopkins University

DEPARTMENT AND UNIVERSITY SERVICE

2000	Graduate Recruitment Planning Committee Center for Visual Science, University of Rochester
2002	Admission committee, Department of Brain and Cognitive Sciences, University of Rochester
2002-06	Curriculum committee, Inter-departmental Graduate Program in Neuroscience, University of Rochester
2002-06	Web and Communications committee, Interdepartmental Graduate Program in Neuroscience, University of Rochester
2003	Director, Center for Visual Science Summer Undergraduate Research Fellowship, University of Rochester
2003-06	Coordinator, Center for Visual Science Web site, University of Rochester.
2005-06	Undergraduate Committee, Department of Brain and Cognitive Sciences, University of Rochester
2006	Associate Director, Center for Visual Science, University of Rochester
2008-	Executive Committee, Cognitive Science Program, Yale University
2012	Computational Neuroscience Faculty Search Committee Department of Neurobiology, Yale University School of Medicine
2012-17	Admission Committee, Interdepartmental Neuroscience Program, Yale University
2015	Cognitive Neuroscience Planning Committee, Yale University
2015-17	Faculty Search Committee, Department of Neuroscience, Yale University
2015-17	Biological Sciences Advisory Committee, Yale University
2015-19	Steering Committee, Kavli Institute for Neuroscience, Yale University
2016-19	Department of Neuroscience, Seminar Committee, Yale University
2016-19	Interdepartmental Neuroscience Program, Education Committee, Yale University
2020-	Steering Committee, Kavli Neuroscience Discovery Institute, Johns Hopkins University
2023-	BDP Senior Search Committee, Johns Hopkins University
2024-2025	PBS Faculty Search Committee, Johns Hopkins University

PUBLICATIONS

Books:

1. Lee D (2017) Birth of Intelligence (in Korean). Bada Publisher. Selected as a *book of the year* by the following newspapers in Korea: Kyungyang, Hankyoreh, and Moonwha, and as a *science book of the year* by the Asia Pacific Center for Theoretical Physics and Chosun newspaper.
2. Lee D (2020) Birth of Intelligence. Oxford University Press.
3. Lee D (2021) Birth of Intelligence. 2nd Ed (in Korean). Bada Publisher.

Peer-reviewed Journal Articles:

1. Lee D, Lee C, and Malpeli JG (1992) Acuity-sensitivity trade-offs of X and Y cells in the cat lateral geniculate complex: role of the medial interlaminar nucleus in scotopic vision. *Journal of Neurophysiology* 68: 1235-1247.

2. Malpeli JG and Lee D (1994) Thermodynamic model of the morphogenesis of the primate lateral geniculate nucleus. *Proc. Inter. Conf. Neural Information Processing*, 1: 309-314.

3. Lee D and Malpeli JG (1994) Global form and singularity: modeling the blind spot's role in geniculate morphogenesis. *Science* 263: 1292-1294.

4. Lee D and Malpeli JG (1995) Retinal representation: response. *Science* 267: 1038.

5. Malpeli JG, Lee D, and Baker FH (1996) Laminar and retinotopic organization of the macaque lateral geniculate nucleus: magnocellular and parvocellular magnification functions. *Journal of Comparative Neurology* 375: 363-377.

6. Port NL, Lee D, Dassonville P, and Georgopoulos AP (1997) Manual interception of moving targets: I. Performance and movement initiation. *Experimental Brain Research* 116: 406-420.

7. Lee D, Port NL, and Georgopoulos AP (1997) Manual interception of moving targets: II. Online control of overlapping submovements. *Experimental Brain Ressearch* 116: 421-433.

8. Lee D, Port NL, Kruse W, and Georgopoulos AP (1998) Variability and correlated noise in the discharge of neurons in motor and parietal areas of the primate cortex. *Journal of Neuroscience* 18: 1161-1170.

9. Lee D and Malpeli JG (1998) Effects of saccades on the activity of neurons in the cat lateral geniculate nucleus. *Journal of Neurophysiology* 79: 922-936.

10. Lee D (1999) Effects of exogenous and endogenous attention on visually guided hand movements. *Cognitive Brain Research* 8: 143-156.

11. Lee D (2000) Learning of Spatial and Temporal Patterns in Sequential Hand Movements. *Cognitive Brain Research* 9:35-39.

12. Jung MW, Qin Y, Lee D, and Mook-Jung I (2000) Relationship among discharges of neighboring neurons in the rat prefrontal cortex during spatial working memory tasks. *Journal of Neuroscience* 20: 6166-6172.

13. Lee D and Chun MM (2001) What are the Units of Visual Short-term Memory: Objects or Spatial Locations? *Perception & Psychophysics* 63: 253-257.

14. Port NL, Kruse W, Lee D, and Georgopoulos AP (2001) Motor cortical activity during interception of moving targets. *Journal of Cognitive Neuroscience* 13: 306-318.

15. Lee D, Port NL, Kruse W, and Georgopoulos AP (2001) Neuronal clusters in the primate motor cortex during interception of moving targets. *Journal of Cognitive Neuroscience* 13: 319-331.

16. Lee D (2002) Analysis of phase-locked oscillations in multi-channel single-unit spike activity with wavelet cross-spectrum. *Journal of Neuroscience Methods* 115: 67-75.

17. Lee D and Quessy S (2003) Activity in the supplementary motor area related to learning and performance during a sequential visuomotor task. *Journal of Neurophysiology* 89: 1039-1056.

18. Lee D and Quessy S (2003). Visual search is facilitated by scene and sequence familiarity in rhesus monkeys. *Vision Research* 43: 1455-1463.

19. Lee D (2003). Coherent oscillations in neuronal activity of the supplementary motor area during a visuomotor task. *Journal of Neuroscience* 23: 6798-6809.

20. Averbeck BB and Lee D (2003). Neural noise and movement-related codes in macaque supplementary motor area. *Journal of Neuroscience* 23: 7630-7641.

21. Averbeck BB and Lee D (2004) Coding and transmission of information by neural ensembles. *Trends in Neuroscience* 27: 225-230.

22. Barraclough DJ, Conroy ML and Lee D (2004). Prefrontal cortex and decision making in a mixed-strategy game. *Nature Neuroscience* 7: 404-410.

23. Lee D (2004) Behavioral context and coherent oscillations in the supplementary motor area. *Journal of Neuroscience* 24: 4453-4459.

24. Lee D, Conroy ML, McGreevy BP, and Barraclough DJ (2004) Reinforcement learning and decision making in monkeys during a competitive game. *Cognitive Brain Research* 22: 45-58.

25. Lee D, McGreevy BP, and Barraclough DJ (2005) Learning and decision making in monkeys during a Rock-Paper-Scissors game. *Cognitive Brain Research* 25: 416-430.

26. Averbeck BB, Sohn J, and Lee D (2006). Activity in prefrontal cortex during dynamic selection of action sequences. *Nature Neuroscience* 9: 276-282.

27. Lee D (2006). Neural basis of quasi-ratioanl decision making. *Current Opinion in Neurobiology* 16:191-198.

28. Averbeck BB, and Lee D (2006) Effects of noise correlations on information encoding and decoding. *Journal of Neurophysiology* 95: 3633-3644.

29. Lee D, Schieber MH (2006) Serial correlation in lateralized choices of hand and target. *Experimental Brain Research* 174: 499-509.

30. Soltani A, Lee D, and Wang X-J (2006) Neural mechanism for stochastic behavior during a competitive game. *Neural Networks* 19: 1075-1090.

31. Sohn J-W and Lee D (2006) Effects of reward expectancy on sequential eye movements in monkeys. *Neural Networks* 19: 1181-1191.

32. Averbeck BB, and Lee D (2007) Prefrontal neural correlates of memory for sequences. *Journal of Neuroscience* 27: 2204-2211.

33. Lee D, and Seo H (2007) Mechanisms of reinforcement learning and decision making in the primate prefrontal cortex. *Annals of the New York Academy of Sciences* 1104: 108-122.

34. Lee D, Rushworth M, Walton M, Watanabe M, Sakamagi M (2007). Functional specialization of the primate frontal cortex during decision making. *Journal of Neuroscience* 27: 8170-8173.

35. Seo H and Lee D (2007). Temporal filtering of reward signals in the dorsal anterior cingulate cortex during a mixed-strategy game. *Journal of Neuroscience* 27: 8366-8377.

36. Seo H, Barraclough DJ, and LeeD (2007) Dynamic signals related to choices and outcomes in the dorsolateral prefrontal cortex. *Cerebral Cortex* 17: i110-i117.

37. Kim H, Lee D, Shin Y-M, and Chey J (2007) Impaired strategic decision-making in schizophrenia. *Brain Research* 1180:90-100.

38. Kim Y, Huh N, Lee H, Baeg E, Lee D, and Jung MW (2007) Encoding of action history in the rat ventral striatum. *Journal of Neurophysiology* 98: 3548-3556.

39. Sohn J-W, and Lee D (2007) Order-dependent modulation of directional signals in the supplementary and presupplementary motor areas. *Journal of Neuroscience* 27: 13655-13666.

40. Lee D (2008) Game theory and neural basis of social decision making. *Nature Neuroscience* 11: 404-409.

41. Kim S, Hwang J, and Lee D (2008) Prefrontal coding of temporally discounted values during inter-temporal choice. *Neuron* 59: 161-172.

42. Seo H, and Lee D (2008) Cortical mechanisms for reinforcement learning in competitive games. *Philosophical Transactions of the Royal Society B* 363: 3845-3857.

43. Luhmann C, Chun MM, Yi DJ, Lee D, and Wang, XJ (2008) Neural dissociation of delay and uncertainty in inter-temporal choice. *Journal of Neuroscience* 28: 14459-14466.

44. Seo H and Lee D (2009) Behavioral and neural changes following the gains and losses of conditioned reinforcers. *Journal of Neuroscience* 29: 3627-3641.

45. Kim S, Hwang J, Seo H, and Lee D (2009) Valuation of uncertain and delayed rewards in primate prefrontal cortex. *Neural Networks* 22:294-304.

46. Seo H, Barraclough DJ, and Lee D (2009) Lateral intraparietal cortex and reinforcement learning during a mixed-strategy game. *Journal of Neuroscience* 29: 7278-7289.

47. Hwang J, Kim S, and Lee D (2009) Temporal discounting and inter-temporal choice in rhesus monkeys. *Frontiers in Behavioral Neuroscience* 3:9.

48. Kim H, Sul JH, Huh N, Lee D, and Jung MW (2009) Role of striatum in updating values of chosen actions. *Journal of Neuroscience* 29: 14701-14712.

49. Curtis CE and Lee D (2010) Beyond working memory: the role of persistent activity in decision making. *Trends in Cognitive Sciences* 14: 216-222.

50. Sul JH, Kim H, Huh N, Lee D, and Jung MW (2010) Distinct roles of rodent orbitofrontal and medial prefrontal cortex in decision making. *Neuron* 66: 449-460.

51. Cai X, Kim S, and Lee D (2011) Heterogeneous coding of temporally discounted values in the dorsal and ventral striatum during inter-temporal choice. *Neuron* 69: 170-182.

52. Bernacchia A, Seo D, Lee D, and Wang X-J (2011) A reservoir of time constants for memory traces in cortical neurons. *Nature Neuroscience* 14: 366-372.

53. Abe H, and Lee D (2011) Prefrontal neurons carry signals necessary for learning from both actual and hypothetical outcomes. *Neuron* 70: 731-741.

54. Kim S and Lee D (2011) Prefrontal cortex and impulsive decision making. *Biological Psychiatry* 69: 1140-1146.

55. Wang M, Gamo NJ, Yang Y, Jin LE, Wang XJ, Laubach M, Mazer JA, Lee D, and Arnsten AFT (2011) Neural basis of age-related cognitive decline. *Nature* 476: 210-213.

56. Sul JH, Lee D, and Jung MW (2011) Neural signals for choice and its evaluation in rodent secondary motor cortex. *Nature Neuroscience* 14: 1202-1208.

57. Vickery TJ, Chun MM, and Lee D (2011) Ubiquity and specificity of reward signals throughout the human brain. *Neuron* 72: 166-177.

58. Abe H, Seo H, and Lee D (2011) Prefrontal cortex and hybrid learning during iterative competitive games. *Annals of the New York Academy of Sciences* 1239: 100-108.

59. Seo H, Vickery TJ, and Lee D (2011) Game theory in neuroscience. *Cognitive Critique* 4: 87-120.

60. Kim S, Bobeica I, Gamo N, Arnsten AF, and Lee D (2012). Effects of alpha-2A adrenergic receptor agonist on temporal discounting and risk preference in primates. *Psychopharmacology* 219: 363-375.

61. Lee D, Seo H, and Jung MW (2012) Neural basis of reinforcement learning and decision making. *Annual Review of Neuroscience* 35: 287-308.

62. Kim S, Hwang J, Cai X, and Lee D (2012) Prefrontal activity related to values of objects and locations. *Frontiers in Neuroscience* 6: 108.

63. Lee H, Ghim JW, Kim H, Lee D, and Jung MW (2012) Hippocampal neural correlates for values of experienced events. *Journal of Neuroscience* 32: 15053-15065.

64. Chen LL, Lee D, Fukushima K, and Fukushima J (2012) Submovement composition of head movement. *PLoS One* 7: e47565.

65. Seo H and Lee D (2012) Neural basis of learning and preference during social decision making. *Current Opinion in Neurobiology* 22: 990-995.

66. Kim H, Lee D, Jung MW (2013) Signals for previous goal choice persist in the dorsomedial, but not dorsolateral, striatum of rats. *Journal of Neuroscience* 33: 35-51.

67. Jo S, Kim K, Lee D, and Jung MW (2013) Effect of orbitofrontal lesions on temporal discounting in rats. *Behavioural Brain Research* 245: 22-28.

68. Lee, D (2013) Decision making: from neuroscience to psychiatry. *Neuron* 78: 233-248.

69. Newsome WT, Glimcher PW, Gottlieb J, Lee D, and Platt ML (2013) Comment on "In monkeys making value-based decisions, LIP neurons encode salience and not action value". *Science* 340: 430.

70. Donahue CH, Seo H, and Lee, D (2013) Cortical signals for rewarded actions and strategic exploration. *Neuron* 80: 223-234.

71. Maoz U, Rutishauser U, Kim S, Cai X, Lee D, and Koch C (2013) Predeliberation activity in prefrontal cortex and striatum and the prediction of subsequent value judgment. *Frontiers in Decision Neuroscience* 7: 225.

72. Livingstone MS, Pettine WW, Srihasam K, Moore BS, Morocz IA, and Lee D (2014) Symbol addition by monkeys: evidence for normalized quantity coding. *Proceedings of the National Academy of Sciences of the U.S.A.* 111:6822-6827.

73. Seo H, Cai X, Donahue CH, and Lee D (2014) Neural correlates of strategic reasoning during competitive games. *Science* 346: 340-343.

74. Murray JD, Bernacchia A, Freedman DJ, Romo R, Wallis JD, Cai X, Padoa-Schioppa C, Pasternak T, Seo H, Lee D, and Wang XJ (2014) A hierarchy of intrinsic timescales across primate cortex. *Nature Neursocience* 17: 1661-1663.

75. Donahue CH and Lee D (2015) Dynamic routing of task-relevant signals for decision making in dorsolateral prefrontal cortex. *Nature Neuroscience* 18: 295-301.

76. Kim K, Huh N, Jang Y, Lee D, and Jung MW (2015) Effect of fictive reward on rat's choice behavior. Scientific Reports 5:8040.

77. Vickery TJ, Kleinman MR, Chun MM, and Lee D (2015) Opponent identity influences value learning in simple games. *Journal of Neuroscience* 35: 11133-11143.

78. Gamo NJ, Lur G, Higley MJ, Wang M, Paspalas CD, Vijayraghavan S, Yang Y, Ramos BP, Peng K, Kata A, Boven L, Lin F, Roman L, Lee D, and Arnsten AFT (2015) Stress impairs prefrontal cortical function through D1 dopamine receptor interactions with HCN channels. *Biological Psychiatry* 78: 860-870.

79. Lee D and Seo H (2016) Neural basis of strategic decision making. *Trends in Neuroscience* 39: 40-48.

80. Gruner P, Anticevic A, Lee D, and Pittenger C (2016) Arbitration between action strategies in obsessive-compulsive disorder. *Neuroscientist* 22: 188-198.

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3. Ehrlich DB, Peng HL, Zheng Z, Lee D, and Murray JD. Neural kernel model captures generalization in human category learning. Manuscript in preparation.

4. Kleinmann MR, and Lee D. Prefrontal encoding of concurrent temporal intervals. Manuscript in preparation.

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Book Chapters:

1. Lee D, Port NL, Kruse W, and Georgopoulos AP (1998) Neuronal population coding: Multielectrode recordings in primate cerebral cortex. In H. Eichenbaum and J. Davis (eds), *Neuronal Ensembles : Strategies for Recording and Decoding*, New York: Wiley. pp 117-136.
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4. Lee D and Wang X-J (2008) Neural circuit mechanisms for stochastic decision making in the primate frontal cortex. In: Glimcher PW, Camerer CF, Fehr E, and Poldrack RA (eds) *Neuroeconomics: decision making and the brain*. pp 481-501.
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9. Wang S and Chang C (2023) Complex topology meets simple statistics. *Nature Neuroscience* 26: 732-734.

PLANERY LECTURES & INVITED CONFERENCE PRESENTATIONS

2003 *Decisions, games, and stochastic behavior*
Annual Meeting of Society for Neuroscience, Symposium: "Neural Correlates of Primate Decision Making"

Decision making and prefrontal cortex
Annual Meeting of the Korean Society for Brain and Neural Science, Symposium: "Current Trends in Systematic Neuroscience"

2004 *Decision making and prefrontal cortex*
Pre-COSYNE Workshop, "Neurobiology of Decision Making", Cold Spring Harbor Laboratory

Decision making and prefrontal cortex
Tamagawa-COE International Symposium on Attention and Decision
Tamagawa University, Japan

Neural mechanisms of reinforcement learning and decision making
Neurobiology Session, 61st Annual Meeting of Korean Biochemistry Society

Decision making and prefrontal cortex
New and Alternative Directions in Learning Conference, Carnegie Mellon University

2005 *Computation of values in primate frontal cortex*
Neurobiology of Decision-Making, Banbury Center, Cold Spring Harbor Laboratory

2006 *Neural basis of decision making in primates*
Workshop on Prefrontal Cortex, Cosyne.

Neural basis of decision making in primates
"Prefrontal cortex, working memory, flexible behavior" (in memoriam of Patricia S. Goldman-Rakic), Yale University

Neural mechanisms of reinforcement learning and decision making
Korean Academy of Science and Technology (KAST), International Symposium on Learning

Neural basis of decision making in primates
American Psychological Society 18th Convention, New York.

Neural basis of decision making in primates
Symposium on reward and decision making, UCLA.

Neural basis of social interactions
Mini-symposium on Choices and the Brain, Caltech.

Neural basis of social interactions
22nd International Symposium on Attention and Performance, Macon, France.

2007 *Primate prefrontal cortex and economic decision making*
Cosyne 2007 Workshop, "Asking why - normative models in neuroscience"

Primate prefrontal cortex and economic decision making
10th Tamagawa-Riken Dynamic Brain Forum 07, Hakuba, Japan.

Primate prefrontal cortex and economic decision making
OIST Workshop on Cognitive Neurobiology, Okinawa, Japan

Economic decision making in primate brains
Mini-symposium, "Use of non-human primate in medical research", Seoul National University College of Medicine, Korea

Neural basis of time preference and decision making under uncertainty
Neural bases of reward and decision making, Institute Gulbenkian de Ciencia (IGC) Portugal

2008 *Neural circuit mechanisms for stochastic decision making in the primate brain*
Center for Neural Science 9-th Biennial Symposium, New York University.

Neural basis of time preference and decision making under uncertainty
Symposium on the Neural Basis of Reward and Economic Decision Making,
Physiological Society Meeting, Cambridge, UK

Neuroscience becomes a social science: neuroeconomics and neuro-marketing
World Science Forum 2008, Seoul, Korea

Neural basis of time discounting: critical evaluation of multiple-self approach
Mind, Brain, and Society: Neurocognitive Approaches to the Social Sciences
Yale University

Neural basis of time preference and decision making under uncertainty
Symposium on Decision Making and the Brain
International Conference of Cognitive Sciences, Yonsei University, Korea

Temporal discounting and conditioned reinforcement in the primate brain
International Symposium on Brain and Society, Korea University, Seoul, Korea

Discounted utilities, gains, and losses in the primate brain

Mini-symposium on New Approaches to Decision Sciences: from Artificial Intelligence to Neuroeconomics, Seoul National University, Seoul, Korea

Order and chaos of decision making
16th Annual Dynamical Neuroscience Satellite Symposium,
"Neuronal Variability and Its Functional Significance"

2009 *From Macaca economicus to Homo economicus*
A symposium on economic decision making, Harvard University

Single-neuron basis of goal-directed decision making in primates
Workshop on "Goal-directed decision making: behavior, neuroscience and computation"
Department of Psychology, Princeton University

2010 *Prefrontal cortex and decision making*
"Reward and Decision Making in the Brain"
Institute for Advanced Studies, Hebrew University of Jerusalem

Prefrontal cortex and decision making
Frontal lobes 2010 conference, Toronto, Canada

Prefrontal cortex and decision making
Workshop on "Natural Environment, Tasks and Intelligence",
University of Texas, Austin

Prefrontal cortex and decision making
Workshop on "Computations, Decisions, and Movement"
Castle of Rauischholzhausen, Germany

2011 *Signle neurons and decision making in primate brain*
Neural circuits of decision-making, Janelia Farm Research Campus

Prefrontal cortex and hybrid learning during competitive games
Critical contribution of the orbitofrontal cortex to behavior
New York Academy of Sciences

Prefrontal cortex and hybrid learning during competitive games
Decision making and neuroeconomics workshop, National Institute of Mathematical Sciences, Daejon, Korea

2012 *Neural basis of temporal decision making*
Decision making and neuroeconomics workshop, KAIST, Korea.

Reinforcement learning and decision making in the primate brain
Computational Foundations of Perception and Action
28th Center for Visual Science Symposium, University of Rochester.

Reinforcement learning and decision making in the primate brain
Gordon Research Conference on Neurobiology of Cognition, Lucca, Italy

2013 *Reinforcement, Punishment, and Basal Ganglia*
5th Reward and Decision meeting, Hawaii.

2014 *Neural basis of strategic decision making*
International Workshop on Neuroeconomics: Recent Advances and Future Directions, Sicily, Italy

Exploring how the brain makes decisions
International Symposium on New Frontiers in Scientific Innovation
Korea Foundation for Advanced Studies, Seoul, Korea.

2015 *Neural basis of strategic decision making*
Neuro-computational approaches to decision making: from perception to social cognition
Donders Institute for Brain, Cognition and Behavior, Netherlands

Brain and reasoning
Korean Academy of Science and Technology, Seoul, Korea.

How the Genes and the Brain see the World
TEDxKFAS. Korea Foundation for Advanced Studies. Seoul, Korea.

2016 *Neural mechanisms for multiple decision-making strategies*
National Cognitive Science Conference "Metamorphosis of the Mind", UC San Diego

Specificity of reward-dependent modulation in the prefrontal cortex
Persistent, Maladaptive Behaviors: Why We Make Bad Choices. University of Rochester.

How reward and uncertainty alters non-reward signals in the prefrontal cortex
Arrowhead 10 years on. University of New South Wales. Australia.

2017 *Reward and uncertainty in the prefrontal cortex*
Keynote Lecture for NYU Computational Neuroscience Symposium.

Evolution of Human and Artificial Intelligence
Plenary Lecture for the Icheon Forum, Icheon, Korea

2018 *Neural mechanism of strategic decision making*
Summer School in Social Neuroscience and Neuroeconomics, Duke University.

Life and Future of Intelligence
Symposium on Human vs. Machine: Psychology Now.
Annual Conference of Korean Psychology Association.

Brain and Self-Intelligence
TEDxKFAS. Korea Foundation for Advanced Studies. Seoul, Korea.

2019 *Brain and Decision Making*
Chey Institute Scientific Innovation Conference, Seoul, Korea

Prefrontal cortex and decision making
Symposium on Neural circuit and spatial complexity for memory and decisions
Institute for Basic Sciences, Daejon, Korea

Neural basis of planning

CRCNS 2019 PI Meeting, University of Texas, Austin

Neuroscience & AI: Looking into the Future of Brain Industry
World Knowledge Forum, Seoul, Korea

AI and the Brain
Cell Press-Beijing Conference, Beijing, China

2021 *Neural Basis of Planning*
Annual Meeting of the Cognitive Science Society (CogSci 2021 Hybrid Conference)

Human Brain and Artificial Intelligence
Artificial Intelligence Forum 2021 (virtual), Sisa Journal, Seoul, Korea

Spatial and Temporal Scales of Social Brain
Korean Human Brain Mapping Society Annual Meeting (virtual), Seoul, Korea

Negative Emotions and Self Control
Presidential Special Lecture, Annual Meeting of the Association of Korean Neuroscientists (virtual)

2022 *In the Beginning of a New Thought*
Reward and Decision Making Conference, Lake Arrowhead, CA.

Brain and AI
Keynote Lecture for AI World 2022: Tech & Future. Seoul, Korea.

The Road to Normal Neuroscience
The Next 50 Years in Scientific Innovation, Chey Institute, Korea

Timescales of Learning and Brain Dynamics
2022 IBS symposium on Learning and Memory (virtual), IBS, Korea

Meta-learning and Flexibility of Decision Making
Center for Cognitive Neuroscience Workshop 2022: Flexible reward learning and decision Making, Dartmouth College

2024 *Timescales of cognition and cortical activity*
Cognitive Representation in the Brain and AI, KAIST, Korea

Playing Games in the Brain
Annual Delaware Neuroscience Research Symposium

Virtual Reality vs. Intracranial Reality
Grand Quest 2025 Open Forum, Seoul, Korea