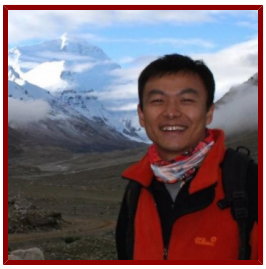
Stanford



Jun Ding

Associate Professor of Neurosurgery and of Neurology

CONTACT INFORMATION

- **Administrative Contact**

  Nichole Zito - Program Administrator

  Email nicholez@stanford.edu

  Tel 6507362817

Bio

ACADEMIC APPOINTMENTS

- Associate Professor, Neurosurgery
- Associate Professor, Neurology
- Member, Bio-X
- Member, Maternal & Child Health Research Institute (MCHRI)
- Member, Wu Tsai Neurosciences Institute

ADMINISTRATIVE APPOINTMENTS

- Department of Neurosurgery, and Department of Neurology and Neurological Sciences, Stanford University School of Medicine, (2012- present)
- Chair of Neuroscience Seminar Committee, Wu Tsai Neuroscience Institute, (2015- present)
- Chair of Admission Committee, Neuroscience PhD Program, (2020- present)

HONORS AND AWARDS

- K99/R00 Pathway to Independence Award, NIH/NINDS (2011)
- Postdoctoral Fellowship, Parkinson’s Disease Foundation (2011)
- Klingenstein Fellowship Awards in Neuroscience, Klingenstein Foundation (2013)
- Kavli Fellow, Kavli Foundation (2014)

PROFESSIONAL EDUCATION

- Ph.D., Interdepartmental Neuroscience PhD Program , Department of Physiology, Northwestern University , Neuroscience (2007)

LINKS

- Ding lab website: http://med.stanford.edu/dinglab.html

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

The interplay between motor cortex, sensory cortex, thalamus and basal ganglia is essential for neural computations involved in generating voluntary movements. Our goal is to dissect the functional organization of motor circuits, particularly cortico-thalamo-basal ganglia networks, using electrophysiology, 2-photon microscopy, optogenetics, and genetic tools. The long-term scientific goal of the lab is to construct functional circuit diagrams and establish causal relationships between activity in specific groups of neurons, circuit function, animal motor behavior and motor learning, and thereby to decipher how the basal ganglia process information and guide motor behavior. We will achieve this by investigating the synaptic organization and function that involve the cortex, thalamus and basal ganglia at the molecular, cellular and circuit level. Currently, we are focusing on several questions:

How are excitatory and inhibitory inputs integrated in the striatum?

How do feed-forward and recurrent local inhibitions balance the excitation in the striatum?

How are functional maps modulated in motor behavior and motor learning?

Our goal is to bridge the gap between molecular or cellular events and the circuit mechanisms that underlie motor behavior. In addition, we aim to further help construct the details of psychomotor disorder ‘circuit diagrams,’ such as the pathophysiological changes in Parkinson’s disease.

Teaching

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Jeewoo Kang, Jayashri Viswanathan

Postdoctoral Faculty Sponsor

Fuu Jiun Hwang, Di Lu, Mengjun Sheng, Qianru Yang

Doctoral Dissertation Co-Advisor (AC)

David Wang

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Neurosciences (Phd Program)

Publications

PUBLICATIONS

- **Postsynaptic synucleins mediate endocannabinoid signaling.** *Nature neuroscience*
  Albarran, E., Sun, Y., Liu, Y., Raju, K., Dong, A., Li, Y., Wang, S., Sudhof, T. C., Ding, J. B.
  2023
- **Dichotomous regulation of striatal plasticity by dynorphin.** *Molecular psychiatry*
  Yang, R., Tuan, R. R., Hwang, F., Bloodgood, D. W., Kong, D., Ding, J. B.
  2022
- **Motor learning selectively strengthens cortical and striatal synapses of motor engram neurons.** *Neuron*
  Hwang, F., Roth, R. H., Wu, Y., Sun, Y., Kwon, D. K., Liu, Y., Ding, J. B.
  2022
- **Enhancing motor learning by increasing the stability of newly formed dendritic spines in the motor cortex.** *Neuron*
  Albarran, E., Raissi, A., Jaidar, O., Shatz, C. J., Ding, J. B.
  2021

- **Aldehyde dehydrogenase 1a1 mediates a GABA synthesis pathway in midbrain dopaminergic neurons.** *Science*
  Kim, J., Ganesan, S., Luo, S. X., Wu, Y., Park, E., Huang, E. J., Chen, L., Ding, J. B.
  2015; 350 (6256): 102-106
- **Dynamic rewiring of neural circuits in the motor cortex in mouse models of Parkinson's disease.** *Nature neuroscience*
  Guo, L., Xiong, H., Kim, J., Wu, Y., Lalchandani, R. R., Cui, Y., Shu, Y., Xu, T., Ding, J. B.
  2015; 18 (9): 1299-1309
- **Adolescent oligodendrogenesis and myelination restrict experience-dependent neuronal plasticity in adult visual cortex.** *bioRxiv : the preprint server for biology*
  Xin, W., Kaneko, M., Roth, R. H., Zhang, A., Nocera, S., Ding, J. B., Stryker, M. P., Chan, J. R.
  2023
- **A neural circuit for male sexual behavior and reward.** *Cell*
  Bayless, D. W., Davis, C. O., Yang, R., Wei, Y., de Andrade Carvalho, V. M., Knoedler, J. R., Yang, T., Livingston, O., Lomvardas, A., Martins, G. J., Vicente, A. M., Ding, J. B., Luo, et al
  2023
- **A positively tuned voltage indicator for extended electrical recordings in the brain.** *Nature methods*
  Evans, S. W., Shi, D., Chavarha, M., Plitt, M. H., Taxidis, J., Madruga, B., Fan, J. L., Hwang, F., van Keulen, S. C., Suomivuori, C., Pang, M. M., Su, S., Lee, et al
  2023; 20 (7): 1104-1113
- **Mettl14-mediated m6A modification ensures the cell-cycle progression of late-born retinal progenitor cells.** *Cell Reports*
  Li, L., Sun, Y., Davis, A. E., Shah, S. H., Hamed, L. K., Wu, M., Lin, C., Ding, J. B., Wang, S.
  2023
- **Locomotion activates PKA through dopamine and adenosine in striatal neurons.** *Nature*
  Ma, L., Day-Cooney, J., Benavides, O. J., Muniak, M. A., Qin, M., Ding, J. B., Mao, T., Zhong, H.
  2022
- **W'axon, wax off: Striatal cholinergic synapses instruct dopamine axon activity.** *Neuron*
  Albarran, E., Ding, J. B.
  2022; 110 (18): 2889-2890
- **Depth random-access two-photon Bessel light-sheet imaging in brain tissue** *OPTICS EXPRESS*
  Xu, D., Ding, J. B., Peng, L.
  2022; 30 (15): 26396-26406
- **Motor Impairments and Dopaminergic Defects Caused by Loss of Leucine-Rich Repeat Kinase 2 Function in Mice.** *The Journal of neuroscience : the official journal of the Society for Neuroscience*
  Huang, G., Bloodgood, D. W., Kang, J., Shahapal, A., Chen, P., Kaganovsky, K., Kim, J., Ding, J., Shen, J.
  2022
- **Identification of cis-regulatory modules for adeno-associated virus-based cell type-specific targeting in the retina and brain.** *The Journal of biological chemistry*
  Lin, C. H., Sun, Y., Chan, C. S., Wu, M. R., Gu, L., Davis, A. E., Gu, B., Zhang, W., Tanasa, B., Zhong, L. R., Emerson, M. M., Chen, L., Ding, et al
  2022: 101674
- **Fluorescence Imaging of Mitochondrial DNA Base Excision Repair Reveals Dynamics of Oxidative Stress Responses.** *Angewandte Chemie (International ed. in English)*
  Jun, Y. W., Albarran, E., Wilson, D. L., Ding, J., Kool, E. T.
  2021
- **A fluorescent sensor for spatiotemporally resolved imaging of endocannabinoid dynamics in vivo.** *Nature biotechnology*
  Dong, A., He, K., Dudok, B., Farrell, J. S., Guan, W., Liput, D. J., Puhl, H. L., Cai, R., Wang, H., Duan, J., Albarran, E., Ding, J., Lovinger, et al
  2021
- **Modulating the Electrical and Mechanical Microenvironment to Guide Neuronal Stem Cell Differentiation.** *Advanced science (Weinheim, Baden-Wurttemberg, Germany)*
  Oh, B., Wu, Y. W., Swaminathan, V., Lam, V., Ding, J., George, P. M.

2021; 8 (7): 2002112

- **From Neurons to Cognition: Technologies for Precise Recording of Neural Activity Underlying Behavior.** *BME frontiers*
  Roth, R. H., Ding, J. B.
  2020; 2020: 7190517
- **Structured illumination imaging with quasi periodic patterns.** *Journal of biophotonics*
  Xu, D., Ding, J., Peng, L.
  2020: e201960209
- **Massively parallel microwire arrays integrated with CMOS chips for neural recording.** *Science advances*
  Obaid, A. n., Hanna, M. E., Wu, Y. W., Kollo, M. n., Racz, R. n., Angle, M. R., Müller, J. n., Brackbill, N. n., Wray, W. n., Franke, F. n., Chichilnisky, E. J., Hierlemann, A. n., Ding, et al
  2020; 6 (12): eaay2789
- **Cerebellar nuclei evolved by repeatedly duplicating a conserved cell-type set.** *Science (New York, N.Y.)*
  Kebschull, J. M., Richman, E. B., Ringach, N. n., Friedmann, D. n., Albarran, E. n., Kolluru, S. S., Jones, R. C., Allen, W. E., Wang, Y. n., Cho, S. W., Zhou, H. n., Ding, J. B., Chang, et al
  2020; 370 (6523)
- **Functional and molecular heterogeneity of D2R neurons along dorsal ventral axis in the striatum.** *Nature communications*
  Puighermanal, E. n., Castell, L. n., Esteve-Codina, A. n., Melser, S. n., Kaganovsky, K. n., Zussy, C. n., Boubaker-Vitre, J. n., Gut, M. n., Rialle, S. n., Kellendonk, C. n., Sanz, E. n., Quintana, A. n., Marsicano, et al
  2020; 11 (1): 1957
- **Ultrafast Two-Photon Imaging of a High-Gain Voltage Indicator in Awake Behaving Mice.** *Cell*
  Villette, V., Chavarha, M., Dimov, I. K., Bradley, J., Pradhan, L., Mathieu, B., Evans, S. W., Chamberland, S., Shi, D., Yang, R., Kim, B. B., Ayon, A., Jalil, et al
  2019; 179 (7): 1590
- **Periodic Remodeling in a Neural Circuit Governs Timing of Female Sexual Behavior.** *Cell*
  Inoue, S., Yang, R., Tantry, A., Davis, C., Yang, T., Knoedler, J. R., Wei, Y., Adams, E. L., Thombare, S., Golf, S. R., Neve, R. L., Tessier-Lavigne, M., Ding, et al
  2019
- **Neuronal O-GlcNAcylation Improves Cognitive Function in the Aged Mouse Brain.** *Current biology : CB*
  Wheatley, E. G., Albarran, E., White, C. W., Bieri, G., Sanchez-Diaz, C., Pratt, K., Snethlage, C. E., Ding, J. B., Villeda, S. A.
  2019
- **Balanced Activity between Kv3 and Nav Channels Determines Fast-Spiking in Mammalian Central Neurons.** *iScience*
  Gu, Y., Servello, D., Han, Z., Lalchandani, R. R., Ding, J. B., Huang, K., Gu, C.
  2018; 9: 120–37
- **The THO Complex Coordinates Transcripts for Synapse Development and Dopamine Neuron Survival.** *Cell*
  Maeder, C. I., Kim, J., Liang, X., Kaganovsky, K., Shen, A., Li, Q., Li, Z., Wang, S., Xu, X. Z., Li, J. B., Xiang, Y. K., Ding, J. B., Shen, et al
  2018
- **Diametric neural ensemble dynamics in parkinsonian and dyskinetic states.** *Nature*
  Parker, J. G., Marshall, J. D., Ahanonu, B. n., Wu, Y. W., Kim, T. H., Grewe, B. F., Zhang, Y. n., Li, J. Z., Ding, J. B., Ehlers, M. D., Schnitzer, M. J.
  2018
- **A cell-type-specific jolt for motor disorders.** *Nature neuroscience*
  Wu, Y., Ding, J. B.
  2017; 20 (6): 763-765
- **Motor Learning in Animal Models of Parkinson's Disease: Aberrant Synaptic Plasticity in the Motor Cortex** *MOVEMENT DISORDERS*
  Xu, T., Wang, S., Lalchandani, R. R., Ding, J. B.
  2017; 32 (4): 487-497
- **The Locomotion Tug-of-War: Cholinergic and Dopaminergic Interactions Outside the Striatum.** *Neuron*
  Kaganovsky, K. n., Ding, J. B.
  2017; 96 (6): 1208–10

- **Selective activation of parvalbumin interneurons prevents stress-induced synapse loss and perceptual defects.** *Molecular psychiatry*
  Chen, C. C., Lu, J. n., Yang, R. n., Ding, J. B., Zuo, Y. n.
  2017
- **Cell-type-specific inhibition of the dendritic plateau potential in striatal spiny projection neurons.** *Proceedings of the National Academy of Sciences of the United States of America*
  Du, K. n., Wu, Y. W., Lindroos, R. n., Liu, Y. n., Rózsa, B. n., Katona, G. n., Ding, J. B., Kotaleski, J. H.
  2017; 114 (36): E7612–E7621
- **TGF-beta Signaling in Dopaminergic Neurons Regulates Dendritic Growth, Excitatory-Inhibitory Synaptic Balance, and Reversal Learning** *CELL REPORTS*
  Luo, S. X., Timbang, L., Kim, J., Shang, Y., Sandoval, K., Tang, A. A., Whistler, J. L., Ding, J. B., Huang, E. J.
  2016; 17 (12): 3233-3245
- **Input- and Cell-Type-Specific Endocannabinoid-Dependent LTD in the Striatum.** *Cell reports*
  Wu, Y., Kim, J., Tawfik, V. L., Lalchandani, R. R., Scherrer, G., Ding, J. B.
  2015; 10 (1): 75-87
- **Live-Cell Superresolution Imaging by Pulsed STED Two-Photon Excitation Microscopy** *BIOPHYSICAL JOURNAL*
  Takasaki, K. T., Ding, J. B., Sabatini, B. L.
  2013; 104 (4): 770-777
- **Dopaminergic neurons inhibit striatal output through non-canonical release of GABA** *NATURE*
  Tritsch, N. X., Ding, J. B., Sabatini, B. L.
  2012; 490 (7419): 262-?
- **Fasting Activation of AgRP Neurons Requires NMDA Receptors and Involves Spinogenesis and Increased Excitatory Tone** *NEURON*
  Liu, T., Kong, D., Shah, B. P., Ye, C., Koda, S., Saunders, A., Ding, J. B., Yang, Z., Sabatini, B. L., Lowell, B. B.
  2012; 73 (3): 511-522
- **Semaphorin 3E-Plexin-D1 signaling controls pathway-specific synapse formation in the striatum.** *Nature neuroscience*
  Ding, J. B., Oh, W., Sabatini, B. L., Gu, C.
  2012; 15 (2): 215-223
- **Muscarinic modulation of striatal function and circuitry.** *Handbook of experimental pharmacology*
  Goldberg, J. A., Ding, J. B., Surmeier, D. J.
  2012: 223-241
- **Cholinergic modulation of synaptic integration and dendritic excitability in the striatum** *CURRENT OPINION IN NEUROBIOLOGY*
  Oldenburg, I. A., Ding, J. B.
  2011; 21 (3): 425-432
- **Thalamic Gating of Corticostriatal Signaling by Cholinergic Interneurons** *NEURON*
  Ding, J. B., Guzman, J. N., Peterson, J. D., Goldberg, J. A., Surmeier, D. J.
  2010; 67 (2): 294-307
- **Supraresolution Imaging in Brain Slices using Stimulated-Emission Depletion Two-Photon Laser Scanning Microscopy** *NEURON*
  Ding, J. B., Takasaki, K. T., Sabatini, B. L.
  2009; 63 (4): 429-437
- **Corticostriatal and thalamostriatal synapses have distinctive properties** *JOURNAL OF NEUROSCIENCE*
  Ding, J., Peterson, J. D., Surmeier, D. J.
  2008; 28 (25): 6483-6492
- **Re-emergence of striatal cholinergic interneurons in movement disorders** *TRENDS IN NEUROSCIENCES*
  Pisani, A., Bernardi, G., Ding, J., Surmeier, D. J.
  2007; 30 (10): 545-553
- **D1 and D2 dopamine-receptor modulation of striatal glutamatergic signaling in striatal medium spiny neurons** *TRENDS IN NEUROSCIENCES*
  Surmeier, D. J., Ding, J., Day, M., Wang, Z., Shen, W.

2007; 30 (5): 228-235

- **RGS4-dependent attenuation of M-4 autoreceptor function in striatal cholinergic interneurons following dopamine depletion** *NATURE NEUROSCIENCE*
  Ding, J., Guzman, J. N., Tkatch, T., chen, s., Goldberg, J. A., Ebert, P. J., Levitt, P., Wilson, C. J., Hamm, H. E., Surmeier, D. J.
  2006; 9 (6): 832-842

- **Dopaminergic control of corticostriatal long-term synaptic depression in medium spiny neurons is mediated by cholinergic interneurons** *NEURON*
  Wang, Z., Kai, L., Day, M., Ronesi, J., Yin, H. H., Ding, J., Tkatch, T., Lovinger, D. M., Surmeier, D. J.
  2006; 50 (3): 443-452

- **Selective elimination of glutamatergic synapses on striatopallidal neurons in Parkinson disease models** *NATURE NEUROSCIENCE*
  Day, M., Wang, Z. F., Ding, J., An, X. H., Ingham, C. A., Shering, A. F., Wokosin, D., Ilijic, E., Sun, Z. X., Sampson, A. R., Mugnaini, E., Deutch, A. Y., Sesack, et al
  2006; 9 (2): 251-259