Stanford

Surya Ganguli

Associate Professor of Applied Physics, Senior Fellow at the Stanford Institute for Human-Centered AI and Associate Professor, by courtesy, of Neurobiology and of Electrical Engineering

Curriculum Vitae available Online

Bio

ACADEMIC APPOINTMENTS

- Associate Professor, Applied Physics
- Senior Fellow, Institute for Human-Centered Artificial Intelligence (HAI)
- Associate Professor (By courtesy), Neurobiology
- Associate Professor (By courtesy), Electrical Engineering
- Member, Bio-X
- Member, Wu Tsai Neurosciences Institute

HONORS AND AWARDS

- Schmidt AI2050 Senior Fellowship, Schmidt Foundation (2025)
- Schmidt Science Polymath Award, Schmidt Foundation (2023)
- Outstanding Paper Award, Neural Information Processing Systems Foundation (2022)
- NSF Career Award, National Science Foundation (2019)
- Investigator Award in Mathematical Modeling of Living Systems, Simons Foundation (2016)
- McKnight Scholar Award, McKnight Endowment Fund for Neuroscience (2015)
- Scholar Award in Human Cognition, James S. McDonnell Foundation (2014)
- Outstanding Paper Award, Neural Information Processing Systems Foundation (2014)
- Sloan Research Fellowship, Alfred P. Sloan Foundation (2013)
- Terman Award, Stanford University (2012)
- Career Award at the Scientific Interface, Burroughs Wellcome Foundation (2009)
- Swartz Fellow in Computational Neuroscience, Swartz Foundation (2004)

PROFESSIONAL EDUCATION

- Ph.D., UC Berkeley , Theoretical Physics (2004)
- M.A., UC Berkeley , Physics (2000)
- M.A., UC Berkeley , Mathematics (2004)
- M.Eng., MIT , Electrical Engineering and Computer Science (1998)
- B.S., MIT , Physics (1998)
- B.S., MIT , Mathematics (1998)

- B.S., MIT , Electrical Engineering and Computer Science (1998)

LINKS

- Lab Website: http://ganguli-gang.stanford.edu/index.html
- Personal Website: http://ganguli-gang.stanford.edu/surya.html
- Applied Physics Website: https://web.stanford.edu/dept/app-physics/cgi-bin/person/surya-gangulijanuary-2012/

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Theoretical / computational neuroscience

Teaching

COURSES

2025-26

- A modern explainable AI approach to Theoretical Neuroscience: APPPHYS 293 (Aut)
- Statistical Mechanics of Learning and Computation: APPPHYS 229 (Spr)

2024-25

- Statistical Mechanics of Learning and Computation: APPPHYS 229 (Spr)
- Theoretical Neuroscience: APPPHYS 293 (Aut)

2023-24

- Statistical Mechanics of Learning and Computation: APPPHYS 229 (Spr)
- Theoretical Neuroscience: APPPHYS 293 (Aut)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Vamshi Balanaga, Niharika Gunturu, Ian Ho, Max Kanwal, Vasily Kruzhilin, Adithya Sriram

Postdoctoral Faculty Sponsor

Sam Ocko

Doctoral Dissertation Advisor (AC)

Henry Hunt, Mason Kamb, Jinhee Paeng, Allan Raventos Knohr, Javan Tahir

Doctoral Dissertation Co-Advisor (AC)

Balint Kurgyis, Wanhee Lee, Shenghua Liu, Jakub Smékal, Cameron Sylber

Postdoctoral Research Mentor

Sam Ocko

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Neurosciences (Phd Program)

Publications

PUBLICATIONS

- **A tale of two algorithms: Structured slots explain prefrontal sequence memory and are unified with hippocampal cognitive maps.** *Neuron*
  Whittington, J. C., Dorrell, W., Behrens, T. E., Ganguli, S., El-Gaby, M.
  2024

- **Stochastic collapse: how gradient noise attracts SGD dynamics towards simpler subnetworks** *JOURNAL OF STATISTICAL MECHANICS-THEORY AND EXPERIMENT*
  Chen, F., Kunin, D., Yamamura, A., Ganguli, S.
  2024; 2024 (10)

- **One-shot entorhinal maps enable flexible navigation in novel environments.** *Nature*
  Wen, J. H., Sorscher, B., Aery Jones, E. A., Ganguli, S., Giocomo, L. M.
  2024

- **Adaptation of retinal discriminability to natural scenes.** *bioRxiv : the preprint server for biology*
  Ding, X., Lee, D., Melander, J. B., Ganguli, S., Baccus, S. A.
  2024

- **Geometric Landscape Annealing as an Optimization Principle Underlying the Coherent Ising Machine** *PHYSICAL REVIEW X*
  Yamamura, A., Mabuchi, H., Ganguli, S.
  2024; 14 (3)

- **Entanglement and Replica Symmetry Breaking in a Driven-Dissipative Quantum Spin Glass** *PHYSICAL REVIEW X*
  Marsh, B. P., Kroeze, R. M., Ganguli, S., Gopalakrishnan, S., Keeling, J., Lev, B. L.
  2024; 14 (1)

- **The Limiting Dynamics of SGD: Modified Loss, Phase-Space Oscillations, and Anomalous Diffusion.** *Neural computation*
  Kunin, D., Sagastuy-Brena, J., Gillespie, L., Margalit, E., Tanaka, H., Ganguli, S., Yamins, D. L.
  2023: 1-25

- **Singular vectors of sums of rectangular random matrices and optimal estimation of high-rank signals: The extensive spike model.** *Physical review. E*
  Landau, I. D., Mel, G. C., Ganguli, S.
  2023; 108 (5-1): 054129

- **Interpreting the retinal neural code for natural scenes: From computations to neurons.** *Neuron*
  Maheswaranathan, N., McIntosh, L. T., Tanaka, H., Grant, S., Kastner, D. B., Melander, J. B., Nayebi, A., Brezovec, L. E., Wang, J. H., Ganguli, S., Baccus, S. A.
  2023

- **Universal energy-accuracy tradeoffs in nonequilibrium cellular sensing.** *Physical review. E*
  Harvey, S. E., Lahiri, S., Ganguli, S.
  2023; 108 (1-1): 014403

- **Catalyzing next-generation Artificial Intelligence through NeuroAI.** *Nature communications*
  Zador, A., Escola, S., Richards, B., Olveczky, B., Bengio, Y., Boahen, K., Botvinick, M., Chklovskii, D., Churchland, A., Clopath, C., DiCarlo, J., Ganguli, S., Hawkins, et al
  2023; 14 (1): 1597

- **An approximate line attractor in the hypothalamus encodes an aggressive state.** *Cell*
  Nair, A., Karigo, T., Yang, B., Ganguli, S., Schnitzer, M. J., Linderman, S. W., Anderson, D. J., Kennedy, A.
  2023; 186 (1): 178

- **Pretraining task diversity and the emergence of non-Bayesian in-context learning for regression**
  Raventos, A., Paul, M., Chen, F., Ganguli, S.
  edited by Oh, A., Neumann, T., Globerson, A., Saenko, K., Hardt, M., Levine, S.
  NEURAL INFORMATION PROCESSING SYSTEMS (NIPS).2023

- **Stochastic Collapse: How Gradient Noise Attracts SGD Dynamics Towards Simpler Subnetworks**
  Chen, F., Kunin, D., Yamamura, A., Ganguli, S.
  edited by Oh, A., Neumann, T., Globerson, A., Saenko, K., Hardt, M., Levine, S.
  NEURAL INFORMATION PROCESSING SYSTEMS (NIPS).2023

- **Information Geometry of the Retinal Representation Manifold**
  Ding, X., Lee, D., Melander, J. B., Sivulka, G., Ganguli, S., Baccus, S. A.
  edited by Oh, A., Neumann, T., Globerson, A., Saenko, K., Hardt, M., Levine, S.
  NEURAL INFORMATION PROCESSING SYSTEMS (NIPS).2023

- **A unified theory for the computational and mechanistic origins of grid cells.** *Neuron*
  Sorscher, B., Mel, G. C., Ocko, S. A., Giocomo, L. M., Ganguli, S.
  2022

- **Neural representational geometry underlies few-shot concept learning.** *Proceedings of the National Academy of Sciences of the United States of America*
  Sorscher, B., Ganguli, S., Sompolinsky, H.
  2022; 119 (43): e2200800119

- **Measuring the dimensionality of behavior.** *Proceedings of the National Academy of Sciences of the United States of America*
  Ganguli, S.
  2022; 119 (43): e2205791119

- **Optimal noise level for coding with tightly balanced networks of spiking neurons in the presence of transmission delays.** *PLoS computational biology*
  Timcheck, J., Kadmon, J., Boahen, K., Ganguli, S.
  2022; 18 (10): e1010593

- **Synaptic balancing: A biologically plausible local learning rule that provably increases neural network noise robustness without sacrificing task performance.** *PLoS computational biology*
  Stock, C. H., Harvey, S. E., Ocko, S. A., Ganguli, S.
  2022; 18 (9): e1010418

- **Noise correlations in neural ensemble activity limit the accuracy of hippocampal spatial representations.** *Nature communications*
  Hazon, O., Minces, V. H., Tomas, D. P., Ganguli, S., Schnitzer, M. J., Jercog, P. E.
  2022; 13 (1): 4276

- **Recurrent Connections in the Primate Ventral Visual Stream Mediate a Trade-Off between Task Performance and Network Size during Core Object Recognition.** *Neural computation*
  Nayebi, A., Sagastuy-Brena, J., Bear, D. M., Kar, K., Kubilius, J., Ganguli, S., Sussillo, D., DiCarlo, J. J., Yamins, D. L.
  2022: 1-25

- **Emergent reliability in sensory cortical coding and inter-area communication.** *Nature*
  Ebrahimi, S., Lecoq, J., Rumyantsev, O., Tasci, T., Zhang, Y., Irimia, C., Li, J., Ganguli, S., Schnitzer, M. J.
  2022

- **Distinct invivo dynamics of excitatory synapses onto cortical pyramidal neurons and parvalbumin-positive interneurons.** *Cell reports*
  Melander, J. B., Nayebi, A., Jongbloets, B. C., Fortin, D. A., Qin, M., Ganguli, S., Mao, T., Zhong, H.
  2021; 37 (6): 109972

- **Embodied intelligence via learning and evolution.** *Nature communications*
  Gupta, A., Savarese, S., Ganguli, S., Fei-Fei, L.
  2021; 12 (1): 5721

- **A neural circuit state change underlying skilled movements.** *Cell*
  Wagner, M. J., Savall, J., Hernandez, O., Mel, G., Inan, H., Rumyantsev, O., Lecoq, J., Kim, T. H., Li, J. Z., Ramakrishnan, C., Deisseroth, K., Luo, L., Ganguli, et al
  2021

- **Enhancing Associative Memory Recall and Storage Capacity Using Confocal Cavity QED** *PHYSICAL REVIEW X*

Marsh, B. P., Guo, Y., Kroeze, R. M., Gopalakrishnan, S., Ganguli, S., Keeling, J., Lev, B. L.
2021; 11 (2)

- **Coupling of activity, metabolism and behaviour across the Drosophila brain.** *Nature*
  Mann, K., Deny, S., Ganguli, S., Clandinin, T. R.
  2021

- **Distance-tuned neurons drive specialized path integration calculations in medial entorhinal cortex.** *Cell reports*
  Campbell, M. G., Attinger, A., Ocko, S. A., Ganguli, S., Giocomo, L. M.
  2021; 36 (10): 109669

- **Understanding Self-Supervised Learning Dynamics without Contrastive Pairs**
  Tian, Y., Chen, X., Ganguli, S.
  edited by Meila, M., Zhang, T.
  JMLR-JOURNAL MACHINE LEARNING RESEARCH.2021: 7279-7289

- **A Theory of High Dimensional Regression with Arbitrary Correlations between Input Features and Target Functions: Sample Complexity, Multiple Descent Curves and a Hierarchy of Phase Transitions**
  Mel, G. C., Ganguli, S.
  edited by Meila, M., Zhang, T.
  JMLR-JOURNAL MACHINE LEARNING RESEARCH.2021

- **Fundamental bounds on the fidelity of sensory cortical coding.** *Nature*
  Rumyantsev, O. I., Lecoq, J. A., Hernandez, O., Zhang, Y., Savall, J., Chrapkiewicz, R., Li, J., Zeng, H., Ganguli, S., Schnitzer, M. J.
  2020; 580 (7801): 100-105

- **Fundamental bounds on the fidelity of sensory cortical coding** *NATURE*
  Rumyantsev, O. I., Lecoq, J. A., Hernandez, O., Zhang, Y., Savall, J., Chrapkiewicz, R., Li, J., Zeng, H., Ganguli, S., Schnitzer, M. J.
  2020

- **Discovering Precise Temporal Patterns in Large-Scale Neural Recordings through Robust and Interpretable Time Warping** *NEURON*
  Williams, A. H., Poole, B., Maheswaranathan, N., Dhawale, A. K., Fisher, T., Wilson, C. D., Brann, D. H., Trautmann, E. M., Ryu, S., Shusterman, R., Rinberg, D., Olveczky, B. P., Shenoy, et al
  2020; 105 (2): 246-+

- **Statistical Mechanics of Deep Learning** *ANNUAL REVIEW OF CONDENSED MATTER PHYSICS, VOL 11, 2020*
  Bahri, Y., Kadmon, J., Pennington, J., Schoenholz, S. S., Sohl-Dickstein, J., Ganguli, S.
  edited by Marchetti, M. C., Mackenzie, A. P.
  2020; 11: 501–28

- **Two Routes to Scalable Credit Assignment without Weight Symmetry**
  Kunin, D., Nayebi, A., Sagastuy-Brena, J., Ganguli, S., Bloom, J. M., Yamins, D. L. K.
  edited by Daume, H., Singh, A.
  JMLR-JOURNAL MACHINE LEARNING RESEARCH.2020

- **GluD2- and Cbln1-mediated competitive interactions shape the dendritic arbors of cerebellar Purkinje cells.** *Neuron*
  Takeo, Y. H., Shuster, S. A., Jiang, L. n., Hu, M. C., Luginbuhl, D. J., Rülicke, T. n., Contreras, X. n., Hippenmeyer, S. n., Wagner, M. J., Ganguli, S. n., Luo, L. n.
  2020

- **Statistical mechanics of low-rank tensor decomposition** *JOURNAL OF STATISTICAL MECHANICS-THEORY AND EXPERIMENT*
  Kadmon, J., Ganguli, S.
  2019; 2019 (12)

- **From deep learning to mechanistic understanding in neuroscience: the structure of retinal prediction.** *Advances in neural information processing systems*
  Tanaka, H., Nayebi, A., Maheswaranathan, N., McIntosh, L., Baccus, S. A., Ganguli, S.
  2019; 32: 8537-8547

- **Discovering Precise Temporal Patterns in Large-Scale Neural Recordings through Robust and Interpretable Time Warping.** *Neuron*

Williams, A. H., Poole, B., Maheswaranathan, N., Dhawale, A. K., Fisher, T., Wilson, C. D., Brann, D. H., Trautmann, E. M., Ryu, S., Shusterman, R., Rinberg, D., Olveczky, B. P., Shenoy, et al
2019

- **A deep learning framework for neuroscience.** *Nature neuroscience*
  Richards, B. A., Lillicrap, T. P., Beaudoin, P., Bengio, Y., Bogacz, R., Christensen, A., Clopath, C., Costa, R. P., de Berker, A., Ganguli, S., Gillon, C. J., Hafner, D., Kepecs, et al
  2019; 22 (11): 1761–70

- **A mathematical theory of semantic development in deep neural networks.** *Proceedings of the National Academy of Sciences of the United States of America*
  Saxe, A. M., McClelland, J. L., Ganguli, S.
  2019

- **Shared Cortex-Cerebellum Dynamics in the Execution and Learning of a Motor Task** *CELL*
  Wagner, M. J., Kim, T., Kadmon, J., Nguyen, N. D., Ganguli, S., Schnitzer, M. J., Luo, L.
  2019; 177 (3): 669-+

- **Cortical layer-specific critical dynamics triggering perception.** *Science (New York, N.Y.)*
  Marshel, J. H., Kim, Y. S., Machado, T. A., Quirin, S. n., Benson, B. n., Kadmon, J. n., Raja, C. n., Chibukhchyan, A. n., Ramakrishnan, C. n., Inoue, M. n., Shane, J. C., McKnight, D. J., Yoshizawa, et al
  2019

- **Reverse engineering recurrent networks for sentiment classification reveals line attractor dynamics**
  Maheswaranathan, N., Williams, A. H., Golub, M. D., Ganguli, S., Sussillo, D.
  edited by Wallach, H., Larochelle, H., Beygelzimer, A., d'Alche-Buc, F., Fox, E., Garnett, R.
  NEURAL INFORMATION PROCESSING SYSTEMS (NIPS).2019

- **From deep learning to mechanistic understanding in neuroscience: the structure of retinal prediction**
  Tanaka, H., Nayebi, A., Maheswaranathan, N., McIntosh, L., Baccus, S. A., Ganguli, S.
  edited by Wallach, H., Larochelle, H., Beygelzimer, A., d'Alche-Buc, F., Fox, E., Garnett, R.
  NEURAL INFORMATION PROCESSING SYSTEMS (NIPS).2019

- **A Unified Theory of Early Visual Representations from Retina to Cortex through Anatomically Constrained Deep CNNs** *International Conference on Learning Representations (ICLR)*
  Lindsay, J., Ocko, S., Ganguli, S., Deny, S.
  2019

- **An analytic theory of generalization dynamics and transfer learning in deep linear networks** *International Conference on Learning Representations (ICLR)*
  Lampinen, A., Ganguli, S.
  2019

- **Accurate Estimation of Neural Population Dynamics without Spike Sorting.** *Neuron*
  Trautmann, E. M., Stavisky, S. D., Lahiri, S. n., Ames, K. C., Kaufman, M. T., O'Shea, D. J., Vyas, S. n., Sun, X. n., Ryu, S. I., Ganguli, S. n., Shenoy, K. V.
  2019

- **Accurate estimation of neural population dynamics without spike sorting** *Neuron*
  Trautmann, E. M., Stavisky, S. D., Lahiri, S., Ames, K. C., Kauffman, M. T., O'Shea, D. J., Vyas, S., Sun, X., Ryu, S. I., Ganguli, S., Shenoy, K. V.
  2019; 103: 1-17

- **A Unified Theory of Early Visual Representations from Retina to Cortex through Anatomically Constrained Deep CNNs** *International Conference on Learning Representations (ICLR)*
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  Lampinen, A., Ganguli, S.
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  Trautmann, E. M., Stavisky, S. D., Lahiri, S. n., Ames, K. C., Kaufman, M. T., O'Shea, D. J., Vyas, S. n., Sun, X. n., Ryu, S. I., Ganguli, S. n., Shenoy, K. V.
  2019
- **Accurate estimation of neural population dynamics without spike sorting** *Neuron*
  Trautmann, E. M., Stavisky, S. D., Lahiri, S., Ames, K. C., Kauffman, M. T., O'Shea, D. J., Vyas, S., Sun, X., Ryu, S. I., Ganguli, S., Shenoy, K. V.
  2019; 103: 1-17
- **Emergent elasticity in the neural code for space.** *Proceedings of the National Academy of Sciences of the United States of America*
  Ocko, S. A., Hardcastle, K., Giocomo, L. M., Ganguli, S.
  2018
- **Inferring hidden structure in multilayered neural circuits.** *PLoS computational biology*
  Maheswaranathan, N., Kastner, D. B., Baccus, S. A., Ganguli, S.
  2018; 14 (8): e1006291
- **Principles governing the integration of landmark and self-motion cues in entorhinal cortical codes for navigation.** *Nature neuroscience*
  Campbell, M. G., Ocko, S. A., Mallory, C. S., Low, I. I., Ganguli, S., Giocomo, L. M.
  2018
- **SuperSpike: Supervised Learning in Multilayer Spiking Neural Networks.** *Neural computation*
  Zenke, F. n., Ganguli, S. n.
  2018: 1–28
- **Task-Driven Convolutional Recurrent Models of the Visual System**
  Nayebi, A., Bear, D., Kubilius, J., Kar, K., Ganguli, S., Sussillo, D., DiCarlo, J. J., Yamins, D. L. K.
  edited by Bengio, S., Wallach, H., Larochelle, H., Grauman, K., CesaBianchi, N., Garnett, R.
  NEURAL INFORMATION PROCESSING SYSTEMS (NIPS).2018
- **The emergence of multiple retinal cell types through efficient coding of natural movies**
  Ocko, S. A., Lindsey, J., Ganguli, S., Deny, S.
  edited by Bengio, S., Wallach, H., Larochelle, H., Grauman, K., CesaBianchi, N., Garnett, R.
  NEURAL INFORMATION PROCESSING SYSTEMS (NIPS).2018
- **Statistical mechanics of low-rank tensor decomposition**
  Kadmon, J., Ganguli, S.
  edited by Bengio, S., Wallach, H., Larochelle, H., Grauman, K., CesaBianchi, N., Garnett, R.
  NEURAL INFORMATION PROCESSING SYSTEMS (NIPS).2018
- **The emergence of multiple retinal cell types through efficient coding of natural movies** *Neural Information Processing Systems (NIPS)*
  Deny, S., Lindsey, J., Ganguli, S., Ocko, S.
  2018
- **Task-Driven Convolutional Recurrent Models of the Visual System** *Neural Information Processing Systems (NIPS)*
  Nayebi, A., Bear, D., Kubulius, J., Kar, K., Ganguli, S., Di Carlo, J., Sussillo, D., Yamins, D.
  2018
- **Statistical mechanics of low-rank tensor decomposition** *Neural Information Processing Systems (NIPS)*
  Kadmon, J., Ganguli, S.
  2018
- **Unsupervised Discovery of Demixed, Low-Dimensional Neural Dynamics across Multiple Timescales through Tensor Component Analysis.** *Neuron*
  Williams, A. H., Kim, T. H., Wang, F. n., Vyas, S. n., Ryu, S. I., Shenoy, K. V., Schnitzer, M. n., Kolda, T. G., Ganguli, S. n.
  2018
- **The emergence of spectral universality in deep networks** *Artificial Intelligence and Statistics (AISTATS)*
  Pennington, J., Schoenholz, S., Ganguli, S.
  2018

- **An International Laboratory for Systems and Computational Neuroscience** *NEURON*
  Abbott, L. F., Angelaki, D. E., Carandini, M., Churchland, A. K., Dan, Y., Dayan, P., Deneve, S., Fiete, I., Ganguli, S., Harris, K. D., Hausser, M., Hofer, S., Latham, et al
  2017; 96 (6): 1213–18
- **Cell types for our sense of location: where we are and where we are going** *NATURE NEUROSCIENCE*
  Hardcastle, K., Ganguli, S., Giocomo, L. M.
  2017; 20 (11): 1474–82
- **A Multiplexed, Heterogeneous, and Adaptive Code for Navigation in Medial Entorhinal Cortex** *NEURON*
  Hardcastle, K., Maheswaranathan, N., Ganguli, S., Giocomo, L. M.
  2017; 94 (2): 375-?
- **The temporal paradox of Hebbian learning and homeostatic plasticity.** *Current opinion in neurobiology*
  Zenke, F., Gerstner, W., Ganguli, S.
  2017; 43: 166-176
- **A saturation hypothesis to explain both enhanced and impaired learning with enhanced plasticity.** *eLife*
  Nguyen-Vu, T. B., Zhao, G. Q., Lahiri, S., Kimpo, R. R., Lee, H., Ganguli, S., Shatz, C. J., Raymond, J. L.
  2017; 6
- **Social Control of Hypothalamus-Mediated Male Aggression.** *Neuron*
  Yang, T. n., Yang, C. F., Chizari, M. D., Maheswaranathan, N. n., Burke, K. J., Borius, M. n., Inoue, S. n., Chiang, M. C., Bender, K. J., Ganguli, S. n., Shah, N. M.
  2017; 95 (4): 955–70.e4
- **On the expressive power of deep neural networks** *International Conference on Machine Learning (ICML)*
  Raghu, M., Poole, B., Kleinberg, J., Ganguli, S., Sohl-Dickstein, J.
  2017
- **Resurrecting the sigmoid in deep learning through dynamical isometry: theory and practice** *Neural Information Processing Systems (NIPS)*
  Pennington, J., Schoenholz, S., Ganguli, S.
  2017
- **Variational Walkback: Learning a Transition Operator as a Stochastic Recurrent Net** *Neural Information Processing Systems (NIPS)*
  Ke, R., Goyal, A., Ganguli, S., Bengio, Y.
  2017
- **Continual Learning with Intelligent Synapses** *International Conference on Machine Learning (ICML)*
  Zenke, F., Poole, B., Ganguli, S.
  2017
- **Deep information propagation** *International Conference on Learning Representations (ICLR)*
  Schoenholz, S., Gilmer, J., Ganguli, S., Sohl-Dickstein, J.
  2017
- **Statistical Mechanics of Optimal Convex Inference in High Dimensions** *PHYSICAL REVIEW X*
  Advani, M., Ganguli, S.
  2016; 6 (3)
- **Direction Selectivity in Drosophila Emerges from Preferred-Direction Enhancement and Null-Direction Suppression.** *journal of neuroscience*
  Leong, J. C., Esch, J. J., Poole, B., Ganguli, S., Clandinin, T. R.
  2016; 36 (31): 8078-8092
- **An equivalence between high dimensional Bayes optimal inference and M-estimation** *Neural Information Processing Systems (NIPS)*
  Advani, M., Ganguli, S.
  2016
- **Deep Learning Models of the Retinal Response to Natural Scenes.** *Advances in neural information processing systems*
  McIntosh, L. T., Maheswaranathan, N. n., Nayebi, A. n., Ganguli, S. n., Baccus, S. A.

2016; 29: 1369–77

- **Exponential expressivity in deep neural networks through transient chaos** *Neural Information Processing Systems (NIPS)*
  Poole, B., Subhaneil, L., Raghu, M., Sohl-Dickstein, J., Ganguli, S.
  2016: 3360–3368
- **Role of the site of synaptic competition and the balance of learning forces for Hebbian encoding of probabilistic Markov sequences** *FRONTIERS IN COMPUTATIONAL NEUROSCIENCE*
  Bouchard, K. E., Ganguli, S., Brainard, M. S.
  2015; 9
- **On simplicity and complexity in the brave new world of large-scale neuroscience** *CURRENT OPINION IN NEUROBIOLOGY*
  Gao, P., Ganguli, S.
  2015; 32: 148-155
- **Environmental Boundaries as an Error Correction Mechanism for Grid Cells** *NEURON*
  Hardcastle, K., Ganguli, S., Giocomo, L. M.
  2015; 86 (3): 827-839
- **Evidence for a causal inverse model in an avian cortico-basal ganglia circuit** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Giret, N., Kornfeld, J., Ganguli, S., Hahnloser, R. H.
  2014; 111 (16): 6063-6068
- **Fast large scale optimization by unifying stochastic gradient and quasi-Newton methods** *International Conference on Machine Learning (ICML)*
  Dickstein, J. S., Poole, B., Ganguli, S.
  2014
- **Exact solutions to the nonlinear dynamics of learning in deep neural networks** *International Conference on Learning Representations (ICLR)*
  Saxe, A., McClelland, J., Ganguli, S.
  2014
- **Identifying and attacking the saddle point problem in high-dimensional non-convex optimization** *Neural Information Processing Systems (NIPS)*
  Dauphin, Y., Pascanu, R., Gulchere, C., Cho, K., Ganguli, S., Bengio, Y.
  2014
- **Investigating the role of firing-rate normalization and dimensionality reduction in brain-machine interface robustness.** *Conference proceedings : ... Annual International Conference of the IEEE Engineering in Medicine and Biology Society. IEEE Engineering in Medicine and Biology Society. Conference*
  Kao, J. C., Nuyujukian, P., Stavisky, S., Ryu, S. I., Ganguli, S., Shenoy, K. V.
  2013; 2013: 293-298
- **A Hebbian learning rule gives rise to mirror neurons and links them to control theoretic inverse models** *FRONTIERS IN NEURAL CIRCUITS*
  Hanuschkin, A., Ganguli, S., Hahnloser, R. H.
  2013; 7
- **Statistical mechanics of complex neural systems and high dimensional data** *JOURNAL OF STATISTICAL MECHANICS-THEORY AND EXPERIMENT*
  Advani, M., Lahiri, S., Ganguli, S.
  2013
- **A memory frontier for complex synapses** *Neural Information Processing Systems (NIPS)*
  Lahiri, S., Ganguli, S.
  2013
- **Learning hierarchical category structure in deep neural networks** *Proceedings of the Cognitive Science Society*
  Saxe, A., McClelland, J., Ganguli, S.
  2013: 1271–1276

- **Vocal learning with inverse models** *Principles of Neural Coding*
  Hahnloser, R., Ganguli, S.
  CRC Press.2013
- **Spatial Information Outflow from the Hippocampal Circuit: Distributed Spatial Coding and Phase Precession in the Subiculum** *JOURNAL OF NEUROSCIENCE*
  Kim, S. M., Ganguli, S., Frank, L. M.
  2012; 32 (34): 11539-11558
- **Compressed Sensing, Sparsity, and Dimensionality in Neuronal Information Processing and Data Analysis** *ANNUAL REVIEW OF NEUROSCIENCE, VOL 35*
  Ganguli, S., Sompolinsky, H.
  2012; 35: 485-508
- **Short-term memory in neuronal networks through dynamical compressed sensing** *Neural Information Processing Systems (NIPS)*
  Gangui, S., Sompolinsky, H.
  2010
- **Feedforward to the Past: The Relation between Neuronal Connectivity, Amplification, and Short-Term Memory** *NEURON*
  Ganguli, S., Latham, P.
  2009; 61 (4): 499-501
- **Memory traces in dynamical systems** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Ganguli, S., Huh, D., Sompolinsky, H.
  2008; 105 (48): 18970-18975
- **One-dimensional dynamics of attention and decision making in LIP** *NEURON*
  Ganguli, S., Bisley, J. W., Roitman, J. D., Shadlen, M. N., Goldberg, M. E., Miller, K. D.
  2008; 58 (1): 15-25
- **Function constrains network architecture and dynamics: A case study on the yeast cell cycle Boolean network** *PHYSICAL REVIEW E*
  Lau, K., Ganguli, S., Tang, C.
  2007; 75 (5)
- **E10 Orbifolds** *Journal of High Energy Physics*
  Brown, J., Ganguli, S., Ganor, O., Helfgott, C.
  2005; 06 (057)
- **Twisted six dimensional gauge theories on tori, matrix models, and integrable systems** *JOURNAL OF HIGH ENERGY PHYSICS*
  Ganguli, S., Ganor, O. J., Gill, J.
  2004
- **Holographic protection of chronology in universes of the Godel type** *PHYSICAL REVIEW D*
  Boyda, E. K., Ganguli, S., Horava, P., Varadarajan, U.
  2003; 67 (10)