Stanford



# Krishna Shenoy

NIH Biosketch available Online  Curriculum Vitae available Online


## CONTACT INFORMATION

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## Bio

### BIO

Krishna V. Shenoy, PhD, is the Hong Seh and Vivian W. M. Lim Professor of Engineering. He is with the Departments of Electrical Engineering (EE) and, by courtesy, of Bioengineering (BioE), Neurobiology and Neurosurgery in the Schools of Engineering (SOE) and Medicine (SOM) at Stanford University. He is also a Howard Hughes Medical Institute (HHMI) Investigator. Prof. Shenoy holds a BS in Electrical and Computer Engineering from UC Irvine (1987-1990), a PhD in Electrical Engineering and Computer Science from MIT (1990-1995), was a postdoctoral fellow in Neurobiology at Caltech (1995-2001), and has been on faculty at Stanford since then (Assistant Prof. 2001-2008, Associate Prof. 2008-2012, Full Prof. 2012-2017, HHMI Investigator 2015 to present (and at least 2028), Endowed Chair 2017 to present). Prof. Shenoy directs the Stanford Neural Prosthetic Systems Lab (basic neuroscience and engineering) and co-directs the Stanford Neural Prosthetics Translational Laboratory (clinical trials), which aim to help restore lost motor function to people with paralysis. Honors and awards include a Burroughs Wellcome Fund Career Award in the Biomedical Sciences, a Sloan Fellow, a McKnight Technological Innovations in Neurosciences Award, an NIH EUREKA Award, an NIH Director’s Pioneer Award, the 2010 Stanford University Postdoc Mentoring Award, election as a Fellow of the American Institute for Medical and Biological Engineering (AIMBE) College of Fellows, and the 2018 recipient of the Andrew Carnegie Mind and Brain Prize from Carnegie Mellon University. In 2022 he was Elected to the National Academy of Medicine (NAM) and as an IEEE Fellow. Prof. Shenoy (1) serves on the Scientific Advisory Boards (SABs) of The University of Washington's Center for Neurotechnology (an NSF Engineering Research Center), MIND-X Inc., Inscopix Inc. and Heal Inc., (2) is also a consultant / advisor for CTRL-Labs and was on the Founding SAB, which was acquired in 2019 by Reality Labs, Meta Platforms (previously Facebook) and (3) is a co-founder and consultant / advisor for Neuralink Corp.

### ACADEMIC APPOINTMENTS

- Member, Bio-X
- Member, Wu Tsai Human Performance Alliance
- Member, Wu Tsai Neurosciences Institute

### ADMINISTRATIVE APPOINTMENTS

- Co-Chair of Diversity, Equity, Inclusion and Belonging (DEIB) Committee, Neurosciences PhD Program, Stanford University, (2020- present)

## HONORS AND AWARDS

- Elected Fellow, IEEE (2022-)
- Elected Member, National Academy of Medicine (NAM) (2022-)
- Recipient, Andrew Carnegie Mind and Brain Prize from Carnegie Mellon Unversity (2018)
- Elected Fellow, American Institute for Medical and Biological Engineering (AIMBE) College of Fellows (2017-)
- Investigator, Howard Hughes Medical Institute (2015-)
- Distinguished Alumnus Award, The Henry Samueli School of Engineering, University of California at Irvine (2013)
- Postdoc Mentoring Award, Stanford University (2010)
- NIH Director's Pioneer Award, National Institutes of Health (2009)
- NIH EUREKA Award, National Institutes of Health (2009)
- Technological Innovations in Neurosciences Award, McKnight Foundation (2007)
- Research Fellow, Alfred P. Sloan Foundation (2002)
- Career Award in the Biomedical Sciences, Burroughs Wellcome Fund (1999)

## BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Scientific Advisory Board, MIND-X Inc. (acquired by Blackrock Microsystems, 2022) (2018 - present)
- Scientific Advisory Board, Inscopix Inc. (merged with Brucker, 2022) (2018 - present)
- Consultant / Advisor (2020-), Scientific Advisory Board (2016-2020), CTRL-Labs Inc (acquired by Facebook Reality Labs, Facebook, 2019; now Reality Labs, Meta Platforms) (2016 - present)
- Consultant / Advisor, co-founder, Neuralink Inc. (2016 - present)
- Scientific Advisory Board, U Washington's Ctr for Sensorimotor Neural Eng (an NSF Eng Research Ctr), 2016-2020 (2016 - present)
- Scientific Advisory Board, Heal Inc., 2015-2020 (2015 - present)

## PROGRAM AFFILIATIONS

- Symbolic Systems Program

## PROFESSIONAL EDUCATION

- Endowed Chair Professorship, Stanford University , Hong Seh and Vivian W. M. Professor of Engineering (2017)
- Investigator, Howard Hughes Medical Institute (HHMI) , Investigator (appointed in 2015) (2015)
- Professor, Stanford University , Departments of Electrical Engineering, Bioengineering & Neurobiology (2012)
- Associate Professor, Stanford University , Departments of Electrical Engineering, Bioengineering & Neurobiology (2008)
- Assistant Professor, Stanford University , Departments of Electrical Engineering, Bioengineering & Neurobiology (2001)
- Senior Postdoc, Caltech , Systems Neuroscience, Division of Biology (2001)
- Postdoc, Caltech , Systems Neuroscience, Division of Biology (1998)
- Ph.D., MIT , Electrical Engineering & Computer Science (1995)
- S.M., MIT , Electrical Engineering & Computer Science (1992)
- B.S., UC Irvine , Electrical Engineering (1990)
- N/A, UCSD , Electrical Engineering (1987)

## PATENTS

- Nir Even-Chen, Krishna V. Shenoy. "United States Patent US 10,949,086 B2 Systems and methods for virtual keyboards for high dimensional controllers", Leland Stanford Junior University, Mar 16, 2021

- Krishna V. Shenoy, Jaimie M. Henderson, Frank Willett. "United States Patent US 2021/0064135 A1 Systems and methods for decoding intended symbols from neural activity", Leland Stanford Junior University, Mar 4, 2021
- Nir Even-Chen, Krishna V. Shenoy, Jonathan C. Kao, Sergey Stavisky. "United States Patent US 10,779,764 B2 Task-outcome error signals and their use in brain-machine interfaces.", Leland Stanford Junior University, Sep 22, 2020
- Sergey Stavisky, Krishna V. Shenoy, Jaimie M. Henderson. "United States Patent US 2019/0333505 A1 Systems and methods for decoding intended speech from neuronal activity", Leland Stanford Junior University, Oct 31, 2019
- David Sussillo, Jonathan C. Kao, Sergey Stavisky, Krishna V. Shenoy.. "United States Patent US 10,223,634 B2 Multiplicative recurrent neural network for fast and robust intracortical brain machine interface decoders", Leland Stanford Junior University, Mar 5, 2019
- Paul Nuyujukian, Jonathan C. Kao, Krishna V. Shenoy.. "United States Patent US 9,373,088 B2 Brain machine interface utilizing a discrete action state decoder in parallel with a continuous decoder for a neural prosthetic device", Leland Stanford Junior University, Jun 21, 2016
- Jonathan C. Kao, Chethan Pandarinath, Paul Nuyujukian, Krishna V. Shenoy. "United States Patent US 2015/0245928 A1 Brain-machine interface utilizing interventions to emphasize aspects of neural variance and decode speed and angle", Leland Stanford Junior University, Sep 3, 2015
- Jonathan C. Kao, Paul Nuyujukian, Mark M. Churchland, John P. Cunningham, Krishna V. Shenoy. "United States Patent US 9,095,455 B2 Brain machine interfaces incorporating neural population dynamics", Leland Stanford Junior University, Aug 4, 2015
- Vikash Gilja, Paul Nuyujukian, Cynthia A. Chestek, John P. Cunningham, Byron M. Yu, Stephen I. Ryu, Krishna V. Shenoy. "United States Patent US 8,792,976 B2 Brain machine interface", Leland Stanford Junior University, Jul 29, 2014
- Krishna V. Shenoy, Richard A. Andersen, Sohaib A. Kureshi. "United States Patent US 6,609,017 B1 Processed neural signals and methods for generating and using them", Caltech, Aug 19, 2003
- Richard A. Andersen, Bijan Pesaran, Partha Mitra, Daniella Meeker, Krishna V. Shenoy, Shiyan Cao, Joel W. Burdick. "United States Patent WO 03/005934 A3 Cognitive state machine for prosthetic systems", Caltech, Jan 23, 2003
- Richard A. Andersen, Bijan Pesaran, Partha Mitra, Daniella Meeker, Krishna V. Shenoy, Shiyan Cao, Joel W. Burdick. "United States Patent US 2003/0023319 A1 Cognitive state machine for prosthetic systems", Caltech, Jun 10, 2001
- Krishna Shenoy. "United States Patent US 7,058,445 B2 Decoding of neural signals for movement control", Jun 6, 2001

### LINKS

- Neural Prosthetic Systems Lab, Director Krishna Shenoy: https://npsl.sites.stanford.edu/
- Neural Prosthetics Translational Lab, Co-Directors Krishna Shenoy & Jaimie Henderson: https://nptl2022.sites.stanford.edu/
- Krishna Shenoy's personal homepage: https://npsl.sites.stanford.edu/krishna-v-shenoy-phd

## Research & Scholarship

### RESEARCH INTERESTS

- Brain and Learning Sciences
- Diversity and Identity
- Elementary Education
- Higher Education
- Math Education
- Poverty and Inequality
- Religion
- Science Education
- Technology and Education

### CURRENT RESEARCH AND SCHOLARLY INTERESTS

Overview. We conduct neuroscience, neuroengineering and translational research to better understand how the brain controls movement, and to design medical systems to assist people with paralysis (see Fig. 1). These medical systems are referred to as brain-machine interfaces (BMIs), brain-computer interfaces (BCIs) and intra-cortical neural prostheses. We conduct this research as part of our Neural Prosthetic Systems Lab (NPSL), which focuses on more basic systems and computational neuroscience and neuroengineering, and as part of our Neural Prosthetics Translational Lab (NPTL), which focuses on translating these advances to people with paralysis via clinical trials, which I co-direct with Prof. Jaimie Henderson, M.D. in Neurosurgery.

Neuroscience. Our neuroscience research investigates the neural basis of movement preparation and generation using a combination of electro- / opto-physiological (e.g., chronic electrode-array recordings and optogenetic stimulation), behavioral, computational and theoretical techniques (e.g., dynamical systems, dimensionality reduction, single-trial neural analyses). For example, how do neurons in premotor (PMd) and primary motor (M1) cortex plan and guide reaching arm movements, which focuses on more translational systems and computational neuroscience and neuroengineering.

Neuroengineering. Our neuroengineering research investigates the design of high-performance and robust intra-cortical neural prostheses. These systems translate neural activity from the brain into control signals for prosthetic devices, which can assist people with paralysis by restoring lost motor functions. This work includes statistical signal processing, machine learning, and real-time system modeling and implementation. For example, how can we design motor prostheses with performance rivaling the natural arm, or communication prostheses rivaling the throughput of spoken language.

Translational. Our translational research including an FDA pilot clinical trial (BrainGate2) is conducted as part of the NPTL. For example, how do pre-clinical laboratory designs actually work with people with paralysis in real-world settings?

### CLINICAL TRIALS

- BrainGate2: Feasibility Study of an Intracortical Neural Interface System for Persons With Tetraplegia, Recruiting

### PROJECTS

- Overview - Stanford University & HHMI

## Teaching

### GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Bioengineering (PhD Program)
- Neurosciences (PhD Program)

## Publications

### PUBLICATIONS

- **Large-scale neural recordings with single neuron resolution using Neuropixels probes in human cortex.** *Nature neuroscience*
  Paulk, A. C., Kfir, Y., Khanna, A. R., Mustroph, M. L., Trautmann, E. M., Soper, D. J., Stavisky, S. D., Welkenhuysen, M., Dutta, B., Shenoy, K. V., Hochberg, L. R., Richardson, R. M., Williams, et al
  1800
- **Cortical preparatory activity indexes learned motor memories.** *Nature*
  Sun, X., O'Shea, D. J., Golub, M. D., Trautmann, E. M., Vyas, S., Ryu, S. I., Shenoy, K. V.
  1800
- **Effects of Peripheral Haptic Feedback on Intracortical Brain-Computer Interface Control and Associated Sensory Responses in Motor Cortex** *IEEE TRANSACTIONS ON HAPTICS*
  Deo, D. R., Rezaii, P., Hochberg, L. R., Okamura, A. M., Shenoy, K., Henderson, J. M.
  2021; 14 (4): 762-775
- **Non-linear dimensionality reduction on extracellular waveforms reveals cell type diversity in premotor cortex.** *eLife*
  Lee, E. K., Balasubramanian, H., Tsolias, A., Anakwe, S. U., Medalla, M., Shenoy, K. V., Chandrasekaran, C.
  2021; 10
- **Home Use of a Percutaneous Wireless Intracortical Brain-Computer Interface by Individuals With Tetraplegia** *IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING*
  Simeral, J. D., Hosman, T., Saab, J., Flesher, S. N., Vilela, M., Franco, B., Kelemen, J. N., Brandman, D. M., Ciancibello, J. G., Rezaii, P. G., Eskandar, E. N., Rosler, D. M., Shenoy, et al

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- **High-performance brain-to-text communication via handwriting.** *Nature*
  Willett, F. R., Avansino, D. T., Hochberg, L. R., Henderson, J. M., Shenoy, K. V.
  2021; 593 (7858): 249–54
- **The Neural Representation of Force across Grasp Types in Motor Cortex of Humans with Tetraplegia.** *eNeuro*
  Rastogi, A., Willett, F. R., Abreu, J., Crowder, D. C., Murphy, B. A., Memberg, W. D., Vargas-Irwin, C. E., Miller, J. P., Sweet, J., Walter, B. L., Rezaii, P. G., Stavisky, S. D., Hochberg, et al
  2021
- **Decoding and perturbing decision states in real time.** *Nature*
  Peixoto, D., Verhein, J. R., Kiani, R., Kao, J. C., Nuyujukian, P., Chandrasekaran, C., Brown, J., Fong, S., Ryu, S. I., Shenoy, K. V., Newsome, W. T.
  2021
- **Measurement, manipulation and modeling of brain-wide neural population dynamics.** *Nature communications*
  Shenoy, K. V., Kao, J. C.
  2021; 12 (1): 633
- **Dendritic calcium signals in rhesus macaque motor cortex drive an optical brain-computer interface.** *Nature communications*
  Trautmann, E. M., O'Shea, D. J., Sun, X., Marshel, J. H., Crow, A., Hsueh, B., Vesuna, S., Cofer, L., Bohner, G., Allen, W., Kauvar, I., Quirin, S., MacDougall, et al
  2021; 12 (1): 3689
- **Decoding spoken English from intracortical electrode arrays in dorsal precentral gyrus.** *Journal of neural engineering*
  Wilson, G. H., Stavisky, S. D., Willett, F. R., Avansino, D. T., Kelemen, J. N., Hochberg, L. R., Henderson, J. M., Druckmann, S., Shenoy, K. V.
  2020; 17 (6): 066007
- **Structure in Neural Activity during Observed and Executed Movements Is Shared at the Neural Population Level, Not in Single Neurons.** *Cell reports*
  Jiang, X., Saggar, H., Ryu, S. I., Shenoy, K. V., Kao, J. C.
  2020; 32 (6): 108006
- **Power-saving design opportunities for wireless intracortical brain-computer interfaces.** *Nature biomedical engineering*
  Even-Chen, N., Muratore, D. G., Stavisky, S. D., Hochberg, L. R., Henderson, J. M., Murmann, B., Shenoy, K. V.
  2020
- **Computation Through Neural Population Dynamics.** *Annual review of neuroscience*
  Vyas, S., Golub, M. D., Sussillo, D., Shenoy, K. V.
  2020; 43: 249–75
- **Hand Knob Area of Premotor Cortex Represents the Whole Body in a Compositional Way.** *Cell*
  Willett, F. R., Deo, D. R., Avansino, D. T., Rezaii, P., Hochberg, L. R., Henderson, J. M., Shenoy, K. V.
  2020
- **Speech-related dorsal motor cortex activity does not interfere with iBCI cursor control.** *Journal of neural engineering*
  Stavisky, S. D., Willett, F. R., Avansino, D. T., Hochberg, L. R., Shenoy, K. V., Henderson, J. M.
  2020; 17 (1): 016049
- **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-+
- **Neural Representation of Observed, Imagined, and Attempted Grasping Force in Motor Cortex of Individuals with Chronic Tetraplegia.** *Scientific reports*
  Rastogi, A. n., Vargas-Irwin, C. E., Willett, F. R., Abreu, J. n., Crowder, D. C., Murphy, B. A., Memberg, W. D., Miller, J. P., Sweet, J. A., Walter, B. L., Cash, S. S., Rezaii, P. G., Franco, et al
  2020; 10 (1): 1429
- **An Open Resource for Non-human Primate Optogenetics.** *Neuron*

Tremblay, S. n., Acker, L. n., Afraz, A. n., Albaugh, D. L., Amita, H. n., Andrei, A. R., Angelucci, A. n., Aschner, A. n., Balan, P. F., Basso, M. A., Benvenuti, G. n., Bohlen, M. O., Caiola, et al
2020

- **Causal Role of Motor Preparation during Error-Driven Learning.** *Neuron*
  Vyas, S. n., O'Shea, D. J., Ryu, S. I., Shenoy, K. V.
  2020
- **A low-power band of neuronal spiking activity dominated by local single units improves the performance of brain-machine interfaces.** *Nature biomedical engineering*
  Nason, S. R., Vaskov, A. K., Willsey, M. S., Welle, E. J., An, H. n., Vu, P. P., Bullard, A. J., Nu, C. S., Kao, J. C., Shenoy, K. V., Jang, T. n., Kim, H. S., Blaauw, et al
  2020
- **High-fidelity musculoskeletal modeling reveals a motor planning contribution to the speed-accuracy tradeoff.** *eLife*
  Al Borno, M. n., Vyas, S. n., Shenoy, K. V., Delp, S. L.
  2020; 9
- **Neural ensemble dynamics in dorsal motor cortex during speech in people with paralysis.** *eLife*
  Stavisky, S. D., Willett, F. R., Wilson, G. H., Murphy, B. A., Rezaii, P., Avansino, D. T., Memberg, W. D., Miller, J. P., Kirsch, R. F., Hochberg, L. R., Ajiboye, A. B., Druckmann, S., Shenoy, et al
  2019; 8
- **Publisher Correction: Development of an optogenetic toolkit for neural circuit dissection in squirrel monkeys.** *Scientific reports*
  O'Shea, D. J., Kalanithi, P., Ferenczi, E. A., Hsueh, B., Chandrasekaran, C., Goo, W., Diester, I., Ramakrishnan, C., Kaufman, M. T., Ryu, S. I., Yeom, K. W., Deisseroth, K., Shenoy, et al
  2019; 9 (1): 18775
- **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
- **Simultaneous motor preparation and execution in a last-moment reach correction task.** *Nature communications*
  Ames, K. C., Ryu, S. I., Shenoy, K. V.
  2019; 10 (1): 2718
- **Macaque dorsal premotor cortex exhibits decision-related activity only when specific stimulus-response associations are known** *NATURE COMMUNICATIONS*
  Wang, M., Montanede, C., Chandrasekaran, C., Peixoto, D., Shenoy, K. V., Kalaska, J. F.
  2019; 10
- **Macaque dorsal premotor cortex exhibits decision-related activity only when specific stimulus-response associations are known.** *Nature communications*
  Wang, M., Montanede, C., Chandrasekaran, C., Peixoto, D., Shenoy, K. V., Kalaska, J. F.
  2019; 10 (1): 1793
- **Volitional control of single-electrode high gamma local field potentials by people with paralysis** *JOURNAL OF NEUROPHYSIOLOGY*
  Milekovic, T., Bacher, D., Sarma, A. A., Simeral, J. D., Saab, J., Pandarinath, C., Yvert, B., Sorice, B. L., Blabe, C., Oakley, E. M., Tringale, K. R., Eskandar, E., Cash, et al
  2019; 121 (4): 1428–50
- **Brain-machine interface cursor position only weakly affects monkey and human motor cortical activity in the absence of arm movements (vol 8, 16357, 2018)** *SCIENTIFIC REPORTS*
  Stavisky, S. D., Kao, J. C., Nuyujukian, P., Pandarinath, C., Blabe, C., Ryu, S. I., Hochberg, L. R., Henderson, J. M., Shenoy, K. V.
  2019; 9
- **Publisher Correction: Brain-machine interface cursor position only weakly affects monkey and human motor cortical activity in the absence of arm movements.** *Scientific reports*
  Stavisky, S. D., Kao, J. C., Nuyujukian, P., Pandarinath, C., Blabe, C., Ryu, S. I., Hochberg, L. R., Henderson, J. M., Shenoy, K. V.
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- **Structure and variability of delay activity in premotor cortex.** *PLoS computational biology*
  Even-Chen, N., Sheffer, B., Vyas, S., Ryu, S. I., Shenoy, K. V.
  2019; 15 (2): e1006808

- **Volitional control of single-electrode high gamma local field potentials (LFPs) by people with paralysis.** *Journal of neurophysiology*
  Milekovic, T., Bacher, D., Sarma, A. A., Simeral, J. D., Saab, J., Pandarinath, C., Yvert, B., Sorice, B. L., Blabe, C., Oakley, E. M., Tringale, K. R., Eskandar, E., Cash, et al
  2019

- **Frequency shifts and depth dependence of premotor beta band activity during perceptual decision-making.** *The Journal of neuroscience : the official journal of the Society for Neuroscience*
  Chandrasekaran, C., Bray, I. E., Shenoy, K. V.
  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

- **Principled BCI Decoder Design and Parameter Selection Using a Feedback Control Model.** *Scientific reports*
  Willett, F. R., Young, D. R., Murphy, B. A., Memberg, W. D., Blabe, C. H., Pandarinath, C. n., Stavisky, S. D., Rezaii, P. n., Saab, J. n., Walter, B. L., Sweet, J. A., Miller, J. P., Henderson, et al
  2019; 9 (1): 8881

- **Closed-loop cortical control of virtual reach and posture using cartesian and joint velocity commands.** *Journal of neural engineering*
  Young, D., Willett, F., Memberg, W. D., Murphy, B. A., Rezaii, P., Walter, B., Sweet, J. A., Miller, J., Shenoy, K. V., Hochberg, L., Kirsch, R. F., Ajiboye, A. B.
  2018

- **Brain-machine interface cursor position only weakly affects monkey and human motor cortical activity in the absence of arm movements.** *Scientific reports*
  Stavisky, S. D., Kao, J. C., Nuyujukian, P., Pandarinath, C., Blabe, C., Ryu, S. I., Hochberg, L. R., Henderson, J. M., Shenoy, K. V.
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  Pandarinath, C., O'Shea, D. J., Collins, J., Jozefowicz, R., Stavisky, S. D., Kao, J. C., Trautmann, E. M., Kaufman, M. T., Ryu, S. I., Hochberg, L. R., Henderson, J. M., Shenoy, K. V., Abbott, et al
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- **A Comparison of Intention Estimation Methods for Decoder Calibration in Intracortical Brain-Computer Interfaces** *IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING*
  Willett, F. R., Murphy, B. A., Young, D., Memberg, W. D., Blabe, C. H., Pandarinath, C., Franco, B., Saab, J., Walter, B. L., Sweet, J. A., Miller, J. P., Henderson, J. M., Shenoy, et al
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  Jiang, X., Ryu, S. I., Shenoy, K. V., Kao, J. C.
  2018; 2018: 981–86

- **Development of an optogenetic toolkit for neural circuit dissection in squirrel monkeys** *SCIENTIFIC REPORTS*
  O'Shea, D. J., Kalanithi, P., Ferenczi, E. A., Hsueh, B., Chandrasekaran, C., Goo, W., Diester, I., Ramakrishnan, C., Kaufman, M. T., Ryu, S. I., Yeom, K. W., Deisseroth, K., Shenoy, et al
  2018; 8: 6775

- **ERAASR: an algorithm for removing electrical stimulation artifacts from multielectrode array recordings** *JOURNAL OF NEURAL ENGINEERING*
  O'Shea, D. J., Shenoy, K. V.
  2018; 15 (2): 026020

- **Neural Population Dynamics Underlying Motor Learning Transfer** *NEURON*
  Vyas, S., Even-Chen, N., Stavisky, S. D., Ryu, S. I., Nuyujukian, P., Shenoy, K. V.
  2018; 97 (5): 1177-+
- **Feasibility of Automatic Error Detect-and-Undo System in Human Intracortical Brain-Computer Interfaces.** *IEEE transactions on bio-medical engineering*
  Even-Chen, N. n., Stavisky, S. D., Pandarinath, C. n., Nuyujukian, P. n., Blabe, C. H., Hochberg, L. R., Henderson, J. M., Shenoy, K. V.
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- **Cortical control of a tablet computer by people with paralysis.** *PloS one*
  Nuyujukian, P., Albites Sanabria, J., Saab, J., Pandarinath, C., Jarosiewicz, B., Blabe, C. H., Franco, B., Mernoff, S. T., Eskandar, E. N., Simeral, J. D., Hochberg, L. R., Shenoy, K. V., Henderson, et al
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- **Stable long-term BCI-enabled communication in ALS and locked-in syndrome using LFP signals.** *Journal of neurophysiology*
  Milekovic, T. n., Sarma, A. A., Bacher, D. n., Simeral, J. D., Saab, J. n., Pandarinath, C. n., Sorice, B. L., Blabe, C. n., Oakley, E. M., Tringale, K. R., Eskandar, E. n., Cash, S. S., Henderson, et al
  2018
- **Rapid calibration of an intracortical brain-computer interface for people with tetraplegia.** *Journal of neural engineering*
  Brandman, D. M., Hosman, T. n., Saab, J. n., Burkhart, M. C., Shanahan, B. E., Ciancibello, J. G., Sarma, A. A., Milstein, D. J., Vargas-Irwin, C. E., Franco, B. n., Kelemen, J. n., Blabe, C. n., Murphy, et al
  2018; 15 (2): 026007
- **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
- **Laminar differences in decision-related neural activity in dorsal premotor cortex** *NATURE COMMUNICATIONS*
  Chandrasekaran, C., Peixoto, D., Newsome, W. T., Shenoy, K. V.
  2017; 8: 614
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  Kao, J. C., Nuyujukian, P., Ryu, S. I., Shenoy, K. V.
  2017; 64 (4): 935-945
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