

# PREEYA KHANNA

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EDUCATION	<b>Univ. of Calif. Berkeley &amp; Univ. of Calif. San Francisco</b> August 2012 – Dec 2017 <i>Ph.D in Bioengineering</i> , Advisor: Dr. Jose Carmena
	<b>University of Pennsylvania, Philadelphia</b> August 2008 – May 2012 <i>B.S in Bioengineering and Mathematics</i>
	<b>University College London, London</b> August 2010 – Dec 2010 Semester Abroad, Mechanical Engineering Dept.
FUNDING	UC Berkeley EECS, Helen Wills Neuroscience Institute (2023 - 2028) NIH BRAIN Initiative K99/R00 Postdoctoral Career Transition Award (2021-2026) NIH BRAIN Initiative F32 Postdoctoral Scholar Fellowship (2019-2022) National Science Foundation (NSF) Graduate Research Fellow (2014-2017)
AWARDS	Bioengineering Department Admissions Committee Student Representative (2016-17) Outstanding Graduate Student Instructor for UC Berkeley BioE 101 (Spring 2015) Penn Engineering Exceptional Service Award (2012) Penn Graduation Summa cum Laude (2012)
RESEARCH POSITIONS	<b>Univ. of California, Berkeley</b> July 2023 – <i>Assistant Professor</i> : Dept. of Elec. Eng. and Computer Sci., Helen Wills Neuroscience Institute Starting research lab and teaching courses in the EECS and Neuroscience departments at UC Berkeley.
	<b>Univ. of Calif. San Francisco</b> May 2018 – June 2023 <i>Postdoctoral Fellow</i> : Department of Neurology <i>Advisor</i> : Professor Karunesh Ganguly Testing neural modulation approaches to improve grasping deficits in non-human primate models of stroke, developing neural network model of stroke-injured motor cortex, designing optimized stimulation waveforms for enhancing neuromodulation improvements. Also collaboratively working with Dr. Jose Carmena from UC Berkeley and Dr. Ander Ramos - Murguialday from University of Tübingen, Germany, on clinical trial using invasive brain-machine interface controlled exoskeleton for neurorehabilitation in chronic stroke patients.
	<b>University of California, Berkeley</b> Jan 2018-May 2018 <i>Postdoctoral Fellow</i> : Department of Electrical Engineering and Computer Sciences <i>Advisor</i> : Professor Jose M. Carmena Lived in San Sebastian, Spain to run clinical trial using an invasive closed-loop brain-machine interface for rehabilitation of the upper arm and hand in a chronic hemiplegic stroke patient. Performed rehabilitation sessions, developed novel brain-machine interface architectures, conducted sleep studies
	<b>University of California, Berkeley</b> August 2012 - Dec 2017 <i>Ph.D Candidate</i> : Brain-Machine Interface Lab <i>Advisor</i> : Professor Jose M. Carmena Studying the role of local field potential signals (beta band oscillations) on movement initiation in a non-human primates and parkinsonian patients using a neurofeedback behavioral paradigm. Evaluated potential symptom alleviation effects of neurofeedback in parkinsonian patients. Developed software platform for invasive closed-loop brain-machine interface therapies for stroke rehabilitation. Performed cursor-control brain-machine interface (BMI) experiments in non-human primates to study the role of motor cortical dynamics on neural patterns underlying BMI control

**University of Pennsylvania**

Summer 2010

*Undergraduate REU Student: Haptics Lab**Advisor: Professor Katherine J. Kuchenbecker*

Developed a sleeve that provides tactile feedback for stroke patients while they practice upper arm motions during physical therapy sessions. Used magnetic motion capture and arm visualization to provide real-time visual feedback to subjects as they practiced. Conducted 20-subject study to test effect of feedback on motor learning.

**INDUSTRY  
EXPERIENCE****Cortera Neurotechnologies**

October 2016 - March 2017

*Consultant: Data Scientist*

Algorithms development using machine learning and signal processing tools at Bay Area startup.

**Neuromodulation Technology, Medtronic PLC**

Summer 2015

*Graduate Intern: Biomedical Engineering**Advisor: Dr. Timothy Denison*

Prototyped and characterized parameter ranges for closed-loop deep brain stimulation (DBS) algorithms for the fully implantable Nexus - E (embedded) communication system linking sensing channels and stimulation parameters in the Medtronic Active PC + S neurostimulator. Stress tested and validated Nexus-E functionality. Developed real-time visualization tools for testing and validating closed loop performance.

**Johnson & Johnson**

Summers 2011, 2012

*Intern: Research and Development Group**Advisor: Dr. Russel Walters*

Analyzed in-house data set consisting of skin and ocular irritation results from application of novel consumer product formulations. Identified ocular and skin irritability trends based on individual ingredients, classes of preservative systems, subject demographics, and seasonality. Contributed to development of 'Bedtime (R)' iPhone app, which makes data-driven recommendations for subjects experiencing difficulty with their child's sleep patterns.

**SKILLS**

- Clinical: Multi-session patient electrophysiology
- Animal models: Non-human primates, rodents
- Aseptic Technique: Cranial implants for chronic electrophysiology, craniotomy, durotomy, implant maintenance
- Experiment Techniques: Closed-loop brain-machine interface experiments, large-scale neurophysiology, electrical stimulation and recording, instrumentation and task design, rapid prototyping and CAD, structural MRI
- Neural network Techniques: Spiking neural network simulations in Brian2
- Programming and Data Analysis: Python, MATLAB, R,  $\text{\LaTeX}$
- Languages: Proficient Spanish

**TEACHING****UCSF, PT419C Guest Lecturer,**

Fall 2019, 2020, 2021, 2022

Led a single 2-hour guest lecture and discussion with physical therapy graduate students on approaches to neuromodulation for stroke rehabilitation.

**Grad Student Instructor, Bioinstrumentation Lab, BioE 101**

Jan 2015 - May 2015

- Spring 2015 graduate student instructor for BioE101
- Recognized with **Outstanding Graduate Student Instructor Award**
- Developed lab assignments, prepared for lab sections, and instructed lab sections
- Guided students through 1-month final group design project in which they designed and implemented their own approach to monitor a biosignal of interest

**Neural Data Analysis Workshop Series,** April 2018  
Designed three 2-hour neural data analysis workshops consisting of i) presentation of material and ii) exercises using ipython notebook code allowing attendees to easily explore concepts. Materials made publicly available on Github .

**Guest Lecturer, EE 290P: Advanced Topics in Bioelectronics,** Fall 2017  
Led a single 2-hour lecture and discussion with EECS undergraduate and graduate students on using brain-machine interfaces as scientific tools and their translation to the clinic.

**Prison University Project Instructor** Fall 2012, Summer 2013, Summer 2014, Spring 2016

- Was a primary co-instructor of Patten University classes (Intermediate Algebra, Chemistry, Pre-College Mathematics) for the entire semester
- Delivered in-person 2-hour lectures once per week, graded homework assignments, developed exams, and gave final grades.
- Students were enrolled at Patten University through the Prison University Project at San Quentin Prison

#### SERVICE AND OUTREACH

**Ad Hoc Reviewer** eLife, PLoS Biology, IEEE Engineering in Medicine and Biology Society

**American Assoc. of Univ. Women, Bay Area Science Festival Volunteer,** Spring 2022  
Demonstrating movement tracking algorithms at an outreach booth on scientific research

**UCSF, Brain Outreach Bay Area,** Fall 2021, Fall 2022  
Mentoring SFSU masters students through the grad school application process

**BioEngineering High School Competition Judge,** Spring 2021  
Judge for a 7-week bioengineering research design competition in which high school students are mentored, and the culmination of their work is judged at a research symposium

**Justice in STEM journal club,** Summer - Fall 2020  
Founder and leader of lab journal club to review literature about diversity, equity, and representation in STEM academic fields.

**Big Bears** September 2012- December 2017  
Mentoring undergraduate bioengineering students considering applying to graduate school.

#### PUBLICATIONS

##### **In Preparation:**

1. Ramos-Murguialday, A., Irasotzra-Landa, N., **Khanna, P.**, Sarasola-Sanz, A., et. al. "A novel brain-machine-interface (BMI) system for motor rehabilitation in a severely impaired chronic stroke patient."

##### **In Review:**

1. Athalye V.R.\*, **Khanna P.\***, Gowda S.R., Orsborn A.O., Costa R.M., and Carmena J.M. (2021) "The brain uses invariant dynamics to generalize outputs across movements" *In review. biorxiv* doi: 10.1101/2021.08.27.457931, \*co-authors
2. **Khanna P.\***, Oppenheim T.\*, Tu-Chan A., Abrams G., Ganguly K. (2022) "Measuring arm and hand joint kinematics to estimate impairment during a functional reach and grasp task in stroke patients." *In review.*, \*co-authors

##### **Published Journal Articles and Peer-Reviewed Conference Proceedings:**

1. Ganguly K., **Khanna P.**, Morecraft R. J., Lin D. (2022) "Modulation of neural co-firing to enhance network transmission and to improve motor function after stroke" *Neuron*. doi: 10.1016/j.neuron.2022.06.024

2. Kondapavulur S., Lemke S.D., Darevsky D., Guo, L., **Khanna P.**, Ganguly, K. (2022) "Transition from predictable to variable motor cortex and striatal ensemble patterning during behavioral exploration." *Nature communications*. doi: 10.1038/s41467-022-30069-1
3. **Khanna P.**, Totten D., Novik L., Roberts J., Morecraft R.J., Ganguly K. (2021). "Low-frequency stimulation enhances ensemble co-firing and dexterity after stroke." *Cell*. doi: 10.1016/j.cell.2021.01.023
4. **Khanna P.**, and Carmena J.M. (2017). "Beta Band Oscillations Drive Population Signals that Inhibit Movement in the Motor System." *ELife* doi: 10.7554/eLife.24573.

• **F1000Prime Recommended**

5. **Khanna P.**, Swann N. C., Hemptinne C., Miller, A., Starr P. A., and Carmena J.M. (2016). "Volitional Control of Beta Band Power Using the Medtronic Activa PC + S and Nexus-D Streaming." *IEEE Transactions on Neural Systems and Rehabilitation Engineering*. doi: 10.1109/TNSRE.2016.2597243
6. **Khanna P.**, Athalye V.R., Gowda S., Costa R.M., Carmena J.C. (2016) "Modeling distinct sources of neural variability driving neuroprosthetic control." *IEEE Engineering in Medicine and Biology Conference, Orlando*
7. Walters R., **Khanna P.**, Chu M., and Mack M. C. (2016). "Developmental changes in skin barrier and structure during the first 5 years of life." *Skin Pharmacol Physiol*, DOI: 10.1159/000444805.
8. **Khanna P.**, Stanslaski S., Xiao Y., Ahrens T., Bourget D., Swann N., Starr P., Carmena J.M., Denison T. (2015). "Enabling Closed-Loop Neurostimulation with Downloadable Firmware Upgrades." *IEEE Biomedical Circuits And Systems Conference*, Atlanta
9. **Khanna P.** and Carmena J.M. (2015). "Neural oscillations: beta band activity across motor networks." *Current Opinion in Neurobiology*, 32: 60-67.
10. **Khanna P.** and Carmena J.M. (2015). "Changes in Reaching Reaction Times Due to Volitional Modulation of Beta Oscillations." *IEEE Neural Engineering Conference*, Montpellier (France).
11. Walters R., **Khanna P.**, Hamilton M., Mays D., and Telofski L. (2015). "Human cumulative irritation tests of common preservatives used in personal care products: a retrospective analysis of over 45,000 subjects". *Toxicological Sciences*. doi:10.1093/toxsci/kfv158
12. **Khanna P.**, So K., and Carmena J.M. (2012). "Volitional phase control of neural oscillations using a brain-machine interface". *IEEE Neural Engineering Conference*, San Diego.
13. **Khanna P.**, Mack M. C., Walczak V. R., Robillard A., Hamilton M. T., Composto J., Martin, K. M., et al. (n.d.). "Human ocular response to instillation of surfactant solutions and water across 10, 000 subjects". In Proc. *ALTEX 8th World Conference*, p127 - 132.
14. Bark K., **Khanna P.**, Irwin R., Kapur P., Jax S., Buxbaum L., Kuchenbecker K.J., (2011). "Lessons in using vibrotactile feedback to guide fast arm motions". In Proc. *IEEE World Haptics Conference*. p355 - 360.

**Presented Abstracts:**

1. Choi, H., **Khanna, P.**, Novik, L., Roberts, J., Morecraft, R. J., Ganguly, K. (2021), "Changes in neural population dynamics during stroke recovery in non-human primates." Society for Neuroscience annual meeting, Virtual (poster).
2. **Khanna, P.**, Totten, D., Novik, L., Roberts, J., Morecraft, R. J., Ganguly, K. (2021), "Towards neuromodulation approaches for restoring dexterous control following cortical stroke." BRAIN Initiative Meeting, virtual meeting. (poster)
3. **Khanna, P.**, Totten, D., Novik, L., Roberts, J., Morecraft, R. J., Ganguly, K. (2020), "Perilesional motor cortex dynamics with recovery of dexterous function after cortical strokes in non-human primates." BRAIN Initiative Meeting, virtual meeting (poster)

4. **Khanna, P.**, Totten, D., Morecraft, R. J., Ganguly, K. (2019), "Perilesional motor cortex dynamics with recovery of dexterous function after cortical strokes in non-human primates." Society for Neuroscience annual meeting, Chicago (poster).
5. Ramos-Murguialday, A., **Khanna, P.**, Sarasola-Sanz, A., Irasotzra-Landa, N., Klein, J., Jung J. H., Santisteban, L., Chueca C., Carrasco, A., Carbayo, G., Diaz, N., Pomposo, I., Lopez de Munain, A., Birbaumer, N., Bengoetxea, A., Ramos, E., Carmena, J. (2018). "A novel brain-machine-interface (BMI) system for motor rehabilitation in severely impaired chronic stroke patients." Society for Neuroscience annual meeting, San Diego (poster).
6. Totten, D., **Khanna, P.**, Carmena, J. M., Morecraft, R. J., Ganguly, K. (2018). "Perilesional recordings and epidural stimulation in a non-human primate stroke model." Society for Neuroscience annual meeting, San Diego (poster).
7. **Khanna P.**, Swann N.C., Starr P.A., and Carmena J.M. (2017). "Effects of Neurofeedback Control of Beta Band Oscillations in Motor Cortex on Finger Tapping in PD Patients." Society for Neuroscience annual meeting, Washington DC (poster).
8. You, A., Athalye, V., Gowda, S., **Khanna P.**, Moorman, H., and Carmena J.M. (2017). "Neural patterns in control of kinematically redundant brain-machine interface" Society for Neuroscience annual meeting, Washington DC (poster).
9. **Khanna P.**, Athalye V. R., Costa R. M., Carmena J. M. (2017). "Distinct neural encoding schemes emerge for actions generated by the same effector." Computational and Systems Neuroscience, Salt Lake City UT (poster).
10. **Khanna P.**, Athalye V. R., Gowda S., Costa R. M., Carmena J. M. (2016). "Distinct subspaces emerge in neuroprosthetic control during different tasks." Society for Neuroscience annual meeting, San Diego CA (poster).
11. **Khanna P.**, Swann N.C., Hemptinne C.d., Miocinovic, S., Miller, A., Starr P.A., and Carmena J.M. (2016). "Volitional Control of Beta Band Power Using the Medtronic Activa PC + S and Nexus-D Streaming." International BCI meeting, Pacific Grove, CA (poster).
12. **Khanna P.**, and Carmena J.M. (2015). 'Effects of Volitional Modulation of Beta Oscillations on Reaching Tasks.' Society for Neuroscience annual meeting, Chicago IL (poster)
13. Summerson S.R., **Khanna P.**, Rich, E.L, Wallis, J.D., and Carmena J.M. (2015). 'Stimulation in primate caudate nucleus modulates action selection in probabilistic reward task.' Society for Neuroscience annual meeting, Chicago IL (poster)

#### **Patents:**

1. Ganguly K., **Khanna P.**, Kim, K. Methods and Apparatuses for Treating Stroke Using Low Frequency Stimulation. PCT/US2022/015876. Published Aug 18, 2022

#### **INVITED TALKS**

1. October 2022, UC Berkeley Neuroscience Retreat, Asilomar, CA
2. October 2022, India Institute of Sciences, Bangalore, IN
3. March 2022, University of California, Davis, Davis, CA
4. February 2022, University of California, Berkeley, virtual
5. March 2021, Wisconsin Institute for Translational Neuroengineering (WITNE), virtual
6. February 2021, Computational and Systems Neuroscience (COSYNE), virtual, 4.6 percent of submissions accepted for talk
7. December 2019, Center for Neural Engineering and Prostheses annual retreat, University of California, Berkeley
8. December 2018, Center for Neural Engineering and Prostheses annual retreat, University of California, San Francisco
9. May 2018, Columbia University, New York, NY
10. April 2018, Max Planck Institute for Intelligent Systems, Stuttgart, Germany

11. April 2018, University of Tübingen, Tübingen, Germany
12. March 2017, FDA Experiential Learning Program (ELP) at Medtronic – I was one of the seven presenters invited to Medtronic headquarters for a two-day session designed to educate the FDA on future uses of neural interface technologies
13. August 2016, IEEE Engineering in Medicine and Biology Society Conference, Orlando, FL
14. December 2015, Center for Neural Engineering and Prostheses annual retreat, University of California Berkeley
15. October 2015, Live Demo Session: IEEE Biomedical Circuits and Systems Conference, Atlanta, GA.
16. October 2015, IEEE Biomedical Circuits and Systems Conference, Atlanta, GA.
17. October 2015, Bioengineering Annual Retreat and Conference, Asilomar, CA.
18. March 2015, UC Berkeley Cortex Club, Berkeley, CA.
19. October 2014, Undergraduate Cognitive Science Association, University of California, Berkeley.

#### REFERENCES

Dr. Karunesh Ganguly  
 Dr. Jose M. Carmena  
 Dr. Rui Costa  
 Dr. Ander Ramos-Murguialday