Hammad F. Khan

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Research Interest

Neuroengineering, calcium imaging, electrophysiology, bio-integrated devices, motor cortical circuits.

Education

PhD in Biomedical Engineering, Purdue University *Expected May 2026*
BS in Electrical Engineering, Montana State University *Graduated May 2020*

Research Experience

Graduate Research Assistant, Purdue University *August 2020 – Present*
Research Advisors: **Dr. Krishna Jayant** (Primary) and **Dr. Tamara L. Kinzer-Ursem** (Co-advised)

Developing scalable bioelectronic interfaces for multimodel mapping of neural activity.
Studying mechanisms underlying volitional movement under healthy and diseased cortical circuits in mice.

Undergraduate Research Assistant, Montana State University *June 2018 – June 2020*
Research Advisor: **Dr. Anja Kunze**

Developed scalable and biocompatible cell assays to investigate cytosolic calcium signaling during cortical neurite maturation in vitro.

Publications & Patents

1. **Krishna Jayant, Om T. Kolhe, Daniel L. Gonzales, Hammad F. Khan.** 2D and 3D neural electrodes and methods thereof. US Patent #63/542,491. 2024.
2. **Hammad F. Khan*, Om Kolhe*, Meiseim Habibimatin, Krishna Jayant.** Traveling waves gate reliable volitional movement. In preparation. (*Equal Contribution)
3. **Daniel L. Gonzales, Hammad F. Khan, Hayagreev Keri, Saumitra Yadav, Lyle Muller, Scott Pluta, Krishna Jayant.** A translaminar space-time code supports touch-evoked traveling waves. In review.
4. **Hammad F. Khan, Sayan Dutta, Alicia N. Scott, Shulan Xiao, Saumitra Yadav, Xiaoling Chen, Tamara L. Kinzer-Ursem, Jean-Christophe Rochet, Krishna Jayant.** Site-specific seeding of Lewy pathology induces distinct pre-motor cellular and dendritic vulnerabilities in the cortex. In review.
5. **C. L. Beck, H. F. Khan, A Kunze.** Biomechanical modulation of calcium event rates in soft matter neuro patterns. Proceedings of the 25th International Conference on Miniaturized Systems for Chemistry and Life Science, 2022.
6. **H. F. Khan, C. L. Beck, A. Kunze.** Multi-curvature micropatterns unveil distinct calcium and mitochondrial dynamics in neuronal networks. Lab on a Chip, 2021.
7. **Anja Kunze, Connor L. Beck, Hammad F. Khan.** Multi-curvature soft matter patterns and methods for lab-on-chip pharmaceutical testing and neurobiology studies. US Patent #63/143.701, 2021.

Research Grants

NSF Graduate Research Fellowship (GRFP) *July 2022 – July 2027*
Project title: Large-scale mapping of somato-dendritic dynamics during memory formation and replay.
NIH T32DC016853 *July 2021 – July 2023*
Project title: Mapping intracellular rate code in CA1 neurons under auditory spatial cues.
NIH P20GM103474 *January 2019 – January 2020*
Project title: Using Agarose Hydrogel to Mimic Organized Neural Network Response and Mechanical Stimulus In Vitro.

Presentations

1. **SfN Barrels Conference (Poster)**, Baltimore, MD, November 2023.
   Hammad F. Khan, Om Kolhe*, Meiseim Habibimatin, Krishna Jayant.* Traveling waves gate reliable volitional motor movement.

2. **SfN Conference (Poster)**, San Diego, CA, November 2022.
   Hammad F. Khan, Sayan Dutta, Saumitra Yadav, Xiaoling Chen, Tamara L. Kinzer-Ursem, Jean-Christophe Rochet, Krishna Jayant. Prodromal phase alpha synucleinopathy-induced motor circuit dysfunction in vivo.

3. **SfN Conference (Poster)**, San Diego, CA, November 2022.
   Daniel L. Gonzales, Hammad F. Khan, Hayagreev V. S. Keri, Saumitra Yadav, Scott R. Pluta, Krishna Jayant. Mapping the cellular and sub-cellular circuit motifs underlying sensory-driven traveling waves from the cortical surface.

4. **SfN Conference (Poster)**, San Diego, CA, November 2022.
   Nico Masala, Gergely Tarcsay, Hammad F. Khan, Daniel L. Gonzales, Laura A. Ewell, Krishna Jayant. Chronic dual optical-voltage recordings from hippocampus of awake head-fixed mice.

5. **CSHL Neuronal Circuits Conference (Poster)**, Cold Spring Harbor, NY, March 2022.
   Hammad F. Khan, Sayan Dutta, Saumitra Yadav, Xiaoling Chen, Tamara L. Kinzer-Ursem, Jean-Christophe Rochet, Krishna Jayant. Examining the coupling between beta oscillations and functional cortical ensembles in an alpha-synuclein mouse model of dementia.

6. **CSHL Neuronal Circuits Conference (Poster)**, Cold Spring Harbor, NY, March 2022.
   Daniel L. Gonzales, Hammad F. Khan, Scott R. Pluta, Krishna Jayant. Transparent, flexible electrodes for mapping sensory-driven activity from the cortical surface in awake animals.

7. **Annual NCUR Conference (Invited Talk)**, Montana State University, MT, March 2020.
   Hammad Khan, Connor Beck, Anja Kunze. Agarose Microchannels to Study Curvature Effects in Neuronal Calcium Signaling.

8. **Annual BMES Conference (Invited Talk)**, Philadelphia, PA, October 2019.
   Hammad Khan, Connor Beck, Anja Kunze. Soft-gel Microchannels to Study Curvature Effects in Neuronal Calcium Signaling.

9. **Annual BMES Conference (Poster)**, Philadelphia, PA, October 2019.
   Jeneane Jaber, Hammad Khan, Anja Kunze. Quantifying Magnetic Nanoparticle Movement Under Micromagnetic Field Patterns.

10. **NSF NNCI Convocation (Invited Talk)**, Cornell University, NY, August 2019.
    Hammad Khan, Connor Beck, Anja Kunze. Agarose microchannels to study curvature effects in neuronal calcium signaling.

11. **NIH INBRE Convocation (Poster)**, Montana State University, MT, August 2019.
    Hammad Khan, Connor Beck, Anja Kunze. Agarose microchannels to study curvature effects in neuronal calcium signaling.

12. **Undergraduate Scholars Research Celebration (Poster)**, Montana State University, MT, May 2019.
Hammad Khan, Anja Kunze. Fine-tuning Agarose Concentrations towards Soft-gel based Neuro-microfluidics.

13. **IEEE Neuroengineering Conference (Poster)**, San Francisco, CA, March 2019.
Derek Judge, Hammad Khan, Anja Kunze. Neural network growth under heterogeneous magnetic gradient patterns.

Awards

1. Society of Neuroscience Professional Development Award, October 2022.

2. Stephan Ash Fellowship, August 2020.

Leadership Experience

Purdue BME GSA

1. Treasurer *July 2021 – Present*

2. First Year Representative *August 2020 – July 2021*

Sophomore Surge Program *August 2017 – June 2020*
Mentor for incoming students, guiding on academic resources and researching high-impact practices.