

Hammad F. Khan

Weldon School of Biomedical Engineering, Purdue University

Email: khan332@purdue.edu

GitHub: github.com/HammadFKhan

Website: www.hammadfkhan.com

Research Interest

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

Education

PhD in Biomedical Engineering, Purdue University, GPA: 3.95/4.00

May 2026

BS in Electrical Engineering, Montana State University, GPA: 3.7/4.00

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)
 - Developed and optimized novel techniques combining two-photon microscopy and high-density electrode recordings in behaving mice.
 - Identified the first subcellular and cellular functional biomarker for early stage Lewy-pathology.
 - Led interdisciplinary projects integrating bioengineering and neuroscience, resulting in US patent applications for scalable neural interface technologies.
- Undergraduate Research Assistant, Montana State University** *June 2018 – June 2020*
Research Advisor: **Dr. Anja Kunze**
 - Developed scalable and biocompatible cell assays revealing a paradoxical change in cytosolic calcium and mitochondrial interactions during cortical network maturation.
 - Presented findings at national BMES conference and subsequently published first-author paper.

Teaching and Mentoring Experience

- Purdue Biomedical Engineering Research Mentor** *July 2021 – Present*
Mentored 13 students including undergraduates, masters, and medical students.
 - Led scientific projects with mentees on neurotechnology and sensorimotor processing in rodents. Projects included two-photon imaging, artificial neural networks, circuit design, and molecular tracing of synapses.
 - Mentee projects led to presentation in national and international conferences as well as publications.
 - Placed highly motivated students in competitive graduate and medical programs, and industry positions related to biomedical engineering.
- Purdue Honors College Undergraduate Mentor** *July 2021 – April 2022*
Mentored two undergraduate students from the Honors college.
 - Developed scientific projects and milestones related to neurotechnology development and testing.
 - Facilitated high-impact research that culminated into conference proceedings for both students.
 - Research experience provided a substrate to place both students in top engineering graduate programs and Fortune 500 companies.
- Purdue BME 301 Bioelectricity Graduate Teaching Assistant** *August 2021 – December 2022*
Responsible for managing and grading homeworks and exams of a class of 150+ students.
 - Organized homework, lab content and coordinated with undergraduate teaching assistants.
 - Maintained weekly office hours for student recitation regarding content and homework problems.
- Montana State University, Communications 201 Teacher Assistant** *September 2018 – December 2019*
Facilitated discussions in a freshman seminar classroom.
 - Developed interactive lesson plans for student discussions.
 - Guided first-year students in adjusting to the academic environment and managing coursework.
 - Conducted group activities to foster collaboration and communication skills among students.

5. Montana State University, Department of Mathematics M121

Co-instructor

September 2017 – December 2017

Lectured three times a week in introductory algebra for non-traditional students.

- Facilitated coursework and quizzes.
- Provided one-on-one support for students during office hours.
- Developed supplemental instructional materials.

Publications

1. **Hammad F. Khan**, Om Kolhe, Meiseim Habibimatin, and Krishna Jayant. “Traveling Waves Gate Reliable Volitional Movement” *In preparation* Equal contribution by **Hammad F. Khan** and Om Kolhe.
2. Om T. Kolhe, Alec C. Booth, **Hammad F. Khan**, Krishna Jayant. “A chronic multimodel platform for simultaneous electrophysiology and calcium imaging during motor behaviour” *Tranducers 2025 (Accepted)*.
3. Sanket Samal, Shulan Xiao, Samantha Nelson, Om Kolhe, **Hammad F. Khan**, Meiseim Habibimatin, Won-June Lee, Mustafa Ahmed, Decheng Wang, Tianqi Wang, Qing Deng, Elizabeth Parkinson, and Krishna Jayant, Jianguo Mei. “Blood-Catalyzed n-Doped Conducting Polymer for Reversible, Light-Induced Modulation of Neuronal Membranes” *Science (In revision)*, 2025.
4. Sayan Dutta, Jennifer Hensel, Alicia Scott, Rodrigo Mohallem, Leigh-Ana M Rossitto, **Hammad F. Khan**, Teshawn Johnson, Christina R Ferreira, Jackeline F. Marmolejo, Xu Chen, Krishna Jayant, Uma K. Aryal, Laura Volpicelli-Daley, Jean-Christophe Rochet. “Synaptic phosphoproteome modifications and cortical circuit dysfunction are linked to the early-stage progression of alpha-synuclein aggregation” *bioRxiv*, 2025
5. Daniel L. Gonzales, **Hammad F. Khan**, Hayagreev Keri, Saumitra Yadav, Lyle Muller, Scott Pluta, and Krishna Jayant. “A Translaminar Space-Time Code Supports Touch-Evoked Traveling Waves” *Science Advances* **11**, 5, 2025.
6. **Hammad F. Khan**, Sayan Dutta, Alicia N. Scott, Shulan Xiao, Saumitra Yadav, Xiaoling Chen, Tamara L. Kinzer-Ursem, Jean-Christophe Rochet, and Krishna Jayant. “Site-Specific Seeding of Lewy Pathology Induces Distinct Pre-Motor Cellular and Dendritic Vulnerabilities in the Cortex” *Nature Communications* **15**, 10775, 2024. **Featured in the top 50 best papers published in an area.**
7. A. Booth, **Hammad F. Khan**, Om T. Kolhe, and Krishna Jayant. “Implantation of Flexible Electrodes for Simultaneous In-Vivo Extracellular Recording and Two-Photon Imaging” *Proceedings of IMPRS* **6** (1), 2023.
8. Y. Bari, **Hammad F. Khan**, and Krishna Jayant. “Tracking the Neurodegeneration and Behavioral Changes in Mice Model of Prodromal Phase Alpha-Synucleinopathy” *Proceedings of IMPRS* **5** (1), 2022.
9. C. L. Beck, **Hammad F. Khan**, and Anja 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.
10. **Hammad F. Khan**, C. L. Beck, and Anja Kunze. “Multi-Curvature Micropatterns Unveil Distinct Calcium and Mitochondrial Dynamics in Neuronal Networks” *Lab on a Chip*, 2021.

Patents

1. Krishna Jayant, Om T. Kolhe, Daniel L. Gonzales, and **Hammad F. Khan**. “2D and 3D Neural Electrodes and Methods Thereof.” *US Patent #63/542,491*, 2024.
2. Anja Kunze, Connor L. Beck, and **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.

Fellowships

1. **NSF Graduate Research Fellow (DGE-1842166)** July 2022 – July 2027
Project title: Large-scale mapping of somato-dendritic dynamics during memory formation and replay.
2. **NIH Graduate Training Fellow (NIH T32DC016853)** July 2021 – July 2023
Project title: Mapping intracellular rate code in CA1 neurons under auditory spatial cues.
3. **NIH Undergraduate Research Fellow (NIH P20GM103474)** January 2019 – January 2020
Project title: Using Agarose Hydrogel to Mimic Organized Neural Network Response and Mechanical Stimulus In Vitro.

Conference Proceedings

1. **Biomedical Engineering Society Annual Meeting (Poster)**, Baltimore, MD, October 2024.
Lorenzo Cacciapuoti, **Hammad F. Khan**, S. Xiao, Krishna Jayant.
Artificial Brains for Artificial Intelligence: Dendritic Integration Inspired Neural Networks.
2. **SfN Barrels Conference (Talk)**, Chicago, IL, October 2024.
Hammad F. Khan*, Om T. Kolhe*, M. Habibimatin, E. F. Tanase, Krishna Jayant.
Traveling waves support dynamic rerouting of communication subspaces across the motor cortical hierarchy.
3. **SfN Conference (Poster)**, Chicago, IL, October 2024.
Om T. Kolhe*, **Hammad F. Khan***, M. Habibimatin, E. F. Tanase, Krishna Jayant.
Traveling waves enable reliable volitional motor movement.
4. **SfN Conference (Poster)**, Chicago, IL, October 2024.
L. Cacciapuoti, **Hammad F. Khan**, S. Xiao, Krishna Jayant.
Artificial Brains for Artificial Intelligence: Dendritic Integration Inspired Neural Networks.
5. **SfN Barrels Conference (Poster)**, Baltimore, MD, November 2023.
Hammad F. Khan*, Om Kolhe*, Meiseim Habibimatin, Krishna Jayant. Traveling waves gate reliable volitional motor movement.
6. **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.
7. **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.
8. **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.
9. **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.
10. **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.
11. **Annual NCUR Conference (Talk)**, Montana State University, MT, March 2020.
Hammad Khan, Connor Beck, Anja Kunze. Agarose Microchannels to Study Curvature Effects in Neuronal Calcium Signaling.
12. **Annual BMES Conference (Talk)**, Philadelphia, PA, October 2019.
Hammad Khan, Connor Beck, Anja Kunze. Soft-gel Microchannels to Study Curvature Effects in Neuronal Calcium Signaling.
13. **Annual BMES Conference (Poster)**, Philadelphia, PA, October 2019.
Jeneane Jaber, **Hammad Khan**, Anja Kunze. Quantifying Magnetic Nanoparticle Movement Under Micro-magnetic Field Patterns.
14. **NSF NNCI Convocation (Talk)**, Cornell University, NY, August 2019.
Hammad Khan, Connor Beck, Anja Kunze. Agarose microchannels to study curvature effects in neuronal calcium signaling.
15. **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.
16. **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.

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

Selected Awards and Honors

1. Max Planck Florida Institute NeuroMEETS trainee
One of only six trainees selected nationwide. *January 2025*
2. Nature Communication Highlight 50 best papers in Brain to Behaviour. *January 2025*
3. Purdue Institute for Integrative Neuroscience Travel Award. *October 2024*
4. BME Research Symposium Best Oral Presentation. *April 2024*
5. Society of Neuroscience Professional Development Award. *October 2022*
6. Purdue Stephan Ash Fellow.
Only one student selected in the department. *August 2020*
7. Montana State College of Engineering Travel Award. *November 2019*
8. Montana State IM Flash Technology Scholarship.
One student selected in the department based on scholarly merit. *August 2018*

Leadership & Community Service

1. **Purdue Medical, Innovation, Networking, and Design (MIND) Graduate Mentor** *August 2024 – Present*
 - Responsible for overseeing project development and milestone completion
 - Assisted BME students in project ideation and execution.
 - Managed project expenditures and logistics between administration and project group leaders.
2. **Purdue Institute for Integrative Neuroscience (PIINS) Spring Fest Booth Coordinator** *July 2024*
 - Responsible for planning PIINS representation for Purdue Annual Spring Fest
 - Coordinated with PIINS administration and student volunteers for neuroscience themed booth.
 - Interacted with greater Lafayette area during event, receiving over 1000 visitors.
3. **Auditory Neuroscience Association at Purdue (ANAP) Treasurer** *July 2023 – 2024*
 - Responsible for managing organization budget, tracking expenditures, and overseeing financial decisions.
 - Submitted funding grants to plan professional development events.
 - Provided detailed financial reports for department administration.
4. **Purdue BME Graduate Student Association (GSA) Treasurer** *July 2021 – 2023*
 - Responsible for managing the budget, tracking expenditures, and overseeing financial decisions.
 - Organized fundraising events and managed sponsorships for the association.
 - Developed detailed financial reports for department and intercollegiate activities.

First Year Representative *August 2020 – July 2021*

 - Assisted in planning events and representing first-year students in organizational meetings.
 - Acted as a liaison between first-year students and the faculty, addressing concerns and suggestions.
 - Facilitated integration and onboarding sessions for new graduate students.
5. **Sophomore Surge Program**
A new and impactful program aimed to increase Freshman retention in University
Program Team Lead *August 2019 – June 2020*
 - Discussed program directive with associate dean, program coordinator, and other team leads.
 - Mentored a Sophomore Surge Mentors on mentoring undergraduate students.
 - Coordinated with instructors on integrating students in the Department of University Studies.

Undergraduate Mentor *August 2017 – June 2019*

 - Mentored a total of 120 incoming students on academic resources, registration, and class selection.
 - Provided personalized guidance to help students adapt to the academic and social environment.
 - Organized study groups and tutoring sessions to enhance student success.

6. **Biomedical Engineering Journal Club**

Student Member

May 2018 – May 2019

- Presented on various biomedical and neuroengineering topics.
- Reviewed and discussed new developments in the field.
- Led group discussions and presented on journal articles.
- Coordinated guest speakers and special presentations on cutting-edge research topics.

7. **Residence Hall Association (RHA) Student Senator**

August 2016 – May 2017

- Advocated for community needs within residence halls involving Hall coordinators and administration.
- Coordinated budgets and activities with multiple student organizations.
- Coordinated logistics for residence hall events, enhancing student engagement and participation.
- Worked with Residence hall administration to improve student community and address student concerns.