

Keqin 'Catherine' Ding

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Summary

- PhD researcher with experience in **neural recording (EEG, EMG)**, **visual-tactile feedback systems**, and **computational modeling** for sensorimotor integration in neural prosthetic interfaces and human-computer interaction
- Developed expertise in multi-channel **neural signal processing**, graph-theoretic analysis of cortical dynamics, and statistical modeling of multimodal sensory integration
- Lead multiple **cross-functional teams** of 10+ researchers across neuroscience, robotics, data science, and clinical domains, and contributing to \$400,000+ in NSF and institutional grants

Education

Johns Hopkins University (JHU) Expected Graduation: 12/2025	Baltimore, MD
Ph.D. in Biomedical Engineering Advisor: Nitish Thakor, PhD GPA: 4.00/4.00	08/2020--present
M.S.E. in Biomedical Engineering GPA: 3.86/4.00	08/2018--08/2020
Smith College	Northampton, MA
B.S. in Engineering Science <i>summa cum laude</i> with high honors GPA: 3.98/4.00	08/2014--05/2018

Research Experience

Graduate Research Assistant JHU	01/2019--present
Neuroengineering and Biomedical Instrumentation Lab	
Advisor: Nitish Thakor, PhD	
Graduate Research Intern National University of Singapore	06/2019--08/2019
Cognitive Engineering Group, The N1 Institute for Health	
Advisors: Andrei Dragomir, PhD, Anastasios Bezerianos, PhD, Nitish Thakor, PhD	
Undergraduate Research Assistant Boston University	05/2017--08/2017
The Skeletal Mechanobiology and Biomechanics Lab	
Advisor: Elise Morgan, PhD	
Undergraduate Research Assistant Smith College	05/2016--08/2016
Advisor: Paramjeet Pati, PhD	

Awards & Fellowships

2025 Travel Award , Brain-Computer Interface Society	
2025 F31 Predoctoral Fellowship (1 year) , funded by the National Institute of Neurological Disorders and Stroke (NINDS), National Institutes of Health	
2024 Trainee Professional Development Award , Society for Neuroscience	
2023 Graduate Student Association Conference Travel Award , JHU School of Medicine	
2021 Graduate Representative Organization Conference Travel Award , JHU	

2018 **The Adeline Devor Penberthy Memorial Prize**, Smith College (This is an award for academic excellence in engineering and outstanding contributions toward building a community of learners within the Picker Engineering Program.)

2016, 2017 **Summer Undergraduate Research Fellowship**, Smith College

2014-2018 **Dean's List**, Smith College

Research Areas

Neuroprostheses, sensory feedback, sensorimotor integration, computational modeling, neural signal processing

Skills

Programming Python, R, MATLAB

Software and Tools Git, Jupyter, Bash, Arduino, LaTeX, Adobe Illustrator

Technical Skills neural signal processing, graph-theoretic network analysis, statistical modeling and testing, machine learning, human subjects research, psychophysics

Systems real-time EMG sensory feedback systems, EEG/EMG acquisition, noninvasive electrical stimulation (Digitimer), haptics

Languages English, Mandarin Chinese, German (Basic)

Key Research Projects

Computational modeling for sensory feedback spatial reliability for long-term use 06/2022--present

- Design and implement a computational hand model to simulate human tactile perceptual information
- Develop a quantitative framework to assess spatial reliability of sensory feedback percept maps
- Validate scalability with data from 3 different stimulation paradigms collected across multi-month to multi-year experimental sessions
- Implement statistical models to improve stimulation electrode selection based on functional use
- Lead a cross-disciplinary team of 4 students with 6 collaborators and consultants

Neural recording and sensory feedback for prosthetic sensorimotor integration 09/2019--08/2023

- Built real-time human-in-the-loop setup for multi-channel neural recording (64-channel EEG, 8-channel EMG) with sensory (tactile, force) and visual feedback, validated with 4 upper limb amputee participants and 14 intact-limb controls
- Applied graph theory algorithms to investigate dynamic functional connectivity in cortical networks under visual-tactile integration
- Collaborated with hardware teams on sensor-stimulation integration, contributing to published work on neuromorphic tactile sensing systems
- Led regulatory compliance managing human subject protocols and IRB documentation

Cortical diagnostic biomarkers for chronic pain 09/2020--12/2024

- Designed and conducted experiments with simultaneous measurements of neural signals (EEG) and behavior (pain responses) (8 chronic pain patients and 8 healthy participants)
- Implemented time-frequency decomposition to identify EEG spectral features as potential biomarkers for chronic pain conditions
- Secured \$25,000 internal funding through collaboration with clinicians

Peer-Reviewed Publications † denotes equal contribution

In Preparation / Under Review

- [1] **Ding, K.**, Iskarous, M.M., D'Almeida, D., Yu, K., Lyu, Z., Osborn, L.E., Christie, B.P., Fifer, M.S., Celnik, P.A., Tenore, F.V., Thakor, N.V. (2025). Quantifying the spatial stability of sensory stimulation projected fields for neuroprostheses. (*In Preparation*).
- [2] Mesik, L., Pham, K.H.T., **Ding, K.**, Huang, Y., Severin, D., Kirkwood, A., Dragomir, A., Thakor, N., Lee, H-K. (2025). Rapid plasticity of default-mode local network architectures following adult-onset blindness. (*Under Review*).

Journal Articles

- [1] **Ding, K.**[†], Arginteanu, T.[†], Anderson White, M., Lovell, L., Thakor, N.V., Doshi, T. (2024). Electroencephalographic power ratio and peak frequency difference associate with central sensitization in chronic pain. *Journal of Neural Engineering*, [10.1088/1741-2552/ad995d](https://doi.org/10.1088/1741-2552/ad995d).
- [2] **Ding, K.**, Chen, Y., Bose, R., Osborn, L.E., Dragomir, A., Thakor, N.V. (2022). Sensory stimulation for upper limb amputations modulates adaptability of cortical large-scale systems and combination of somatosensory and visual inputs. *Scientific Reports*, [10.1038/s41598-022-24368-2](https://doi.org/10.1038/s41598-022-24368-2).
- [3] Sankar, S.[†], Balamurugan, D.[†], Brown, A., **Ding, K.**, Xu, X., Low, J.H., Yeow, C.H., Thakor, N. (2021). Texture Discrimination with a Soft Biomimetic Finger through Passive Palpation using a Flexible Neuromorphic Tactile Sensor Array and Sensory Feedback. *Soft Robotics*, [10.1089/soro.2020.0016](https://doi.org/10.1089/soro.2020.0016).
- [4] Osborn, L.E., **Ding, K.**[†], Hays, M.A.[†], Bose, R., Iskarous, M.M., Dragomir, A., Tayeb, Z., Lévy, G.M., Hunt, C.L., Cheng, G., Armiger, R.S., Bezerianos, A., Fifer, M.S., Thakor, N.V. (2020). Sensory stimulation enhances phantom limb perception and movement decoding. *Journal of Neural Engineering*, [10.1088/1741-2552/abb861](https://doi.org/10.1088/1741-2552/abb861).
- [5] **Ding, K.**[†], Dragomir, A.[†], Bose, R., Osborn, L.E., Seet, M.S., Bezerianos, A., Thakor, N.V. (2020). Towards machine to brain interfaces: sensory stimulation enhances sensorimotor dynamic functional connectivity in upper limb amputees. *Journal of Neural Engineering*, [10.1088/1741-2552/ab882d](https://doi.org/10.1088/1741-2552/ab882d).

Review Articles & Book Chapters

- [1] **Ding, K.**, Rakhshan, M., Paredes-Acuña, N., Cheng, G., Thakor, N.V. (2024). Sensory Integration for Neuroprostheses: from Functional Benefits to Neural Correlates. *Medical & Biological Engineering & Computing*, [10.1007/s11517-024-03118-8](https://doi.org/10.1007/s11517-024-03118-8).
- [2] Paredes-Acuña, N., Utpadel-Fischler, D., **Ding, K.**, Thakor, N.V., Cheng, G. (2024). Upper limb intention tremor assessment: opportunities and challenges in wearable technology. *Journal of NeuroEngineering and Rehabilitation*, [10.1186/s12984-023-01302-9](https://doi.org/10.1186/s12984-023-01302-9).
- [3] Masteller, A.[†], Sankar, S.[†], Kim, H.B.[†], **Ding, K.**[†], Liu, X., All, A.H. (2021). Recent Developments in Prosthesis Sensors, Texture Recognition, and Sensory Stimulation for Upper Limb Prostheses. *Annals of Biomedical Engineering*, [10.1007/s10439-020-02678-8](https://doi.org/10.1007/s10439-020-02678-8).
- [4] Bodala, I.P., **Ding, K.**[†], Al-Nashash, H. (2020). Vigilance Assessment and Enhancement. *Handbook of Neuroengineering*, [10.1007/978-981-15-2848-4_75-1](https://doi.org/10.1007/978-981-15-2848-4_75-1).

Research Grants

Computational Models of Multisensory Integration by Upper Limb in Humanoids and Amputees

PI: Nitish Thakor, PhD

09/2021--04/2025

NSF Collaborative Research in Computational Neuroscience (CRCNS)

Contributions: assisted in writing (literature review, visualization, preliminary results, study protocol, and data analysis methods)

Neurodiagnostic Biomarkers of Central Sensitization in Chronic Pain

PI: Tina Doshi, MD; Co-I: Nitish Thakor, PhD

2021

Blaustein Pain Grant -- Johns Hopkins Medicine Internal Research Fund

Contributions: aim development, literature review, proposed approach, and study protocol

Invited Talks

2025 Introduction to Biomedical Engineering (EGR 351, Upper Class Engineering Seminar), Smith College

2024 Hopkins Engineering Applications & Research Tutorials (HEART) Course: Exploring Arm Movement Control, JHU

Conference Presentations + talks, * posters, † equal contribution

Workshop

+ [1] **Ding, K.†**, Dragomir, A.† (2024). Spatial Stability and Cortical Responses of Sensory Stimulation in Upper Limb Prostheses. *TUM-IAS-JHU Workshop Sensory Integration in Neuroprostheses and Rehabilitation*, Technical University of Munich (TUM), Munich, Germany.

Conference Papers

- * [1] Hunt, C.L.†, **Ding, K.†**, Wagner, C.S., Berberich, N., Yilmazer, K., Gonzalez-Fernandez, M., Cheng, G., Thakor, N.V. (2023). Investigating the relationship between cue immersion and the strength of motor imagery during hand and wrist movements. *2023 11th International IEEE/EMBS Conference on Neural Engineering (NER)*, Baltimore, Maryland, USA.
- + [2] **Ding, K.**, Dragomir, A., Bose, R., Osborn, L., Seet, M., Bezerianos, A., Thakor, N. (2021). Sensory Stimulation Enhances Functional Connectivity towards the Somatosensory Cortex in Upper Limb Amputation. *2021 10th International IEEE/EMBS Conference on Neural Engineering (NER)*, virtual.
- + [3] Bose, R., **Ding, K.**, Seet, M., Osborn, L., Bezerianos, A., Thakor, N., Dragomir, A. (2020) Sensory Feedback in Upper Limb Amputees Impacts Cortical Activity as Revealed by Multiscale Connectivity Analysis. *2020 42nd Annual International Conference of the IEEE Engineering in Medicine Biology Society (EMBC)*, virtual.

Posters & Talks (presenting author)

- * [1] **Ding, K.**, Iskarous, M.M., Osborn, L.E., Christie, B.P., D'Almeida, D., Yu, K., Fifer, M.S., Celnik, P.A., Tenore, F.V., Caffo, B.S., Thakor, N.V. (2025). Quantifying the spatial stability of sensory stimulation projected fields for neuroprostheses. *Neural Interfaces 2025*, Arlington, VA, USA.
- * [2] **Ding, K.**, Iskarous, M.M., Osborn, L.E., Christie, B.P., D'Almeida, D., Yu, K., Fifer, M.S., Celnik, P.A., Tenore, F.V., Caffo, B.S., Thakor, N.V. (2025). Quantifying the spatial stability of sensory stimulation projected fields for neuroprostheses. *BCI Society Meeting*, Banff, AB, Canada.

- *[3] **Ding, K.**, Iskarous, M.M., Osborn, L.E., Christie, B.P., Fifer, M.S., Celnik, P.A., Tenore, F.V., Thakor, N.V. (2024). Quantifying the spatial stability of sensory stimulation projected fields for neuroprostheses. *Society for Neuroscience*, Chicago, IL, USA.
- *[4] **Ding, K.**, Chen, Y., Bose, R., Osborn, L.E., Dragomir, A., Thakor, N.V. (2024). Sensory stimulation for upper limb amputations modulates adaptability of cortical large-scale systems and combination of somatosensory and visual inputs. *10th Annual BRAIN Initiative Conference*, Rockville, MD, USA.
- *[5] **Ding, K.**, Iskarous, M.M., Osborn, L.E., Christie, B.P., Fifer, M.S., Celnik, P.A., Tenore, F.V., Thakor, N.V. (2023). A network-inspired method to quantify sensory mapping stability for neuroprosthesis. *Society for Neuroscience*, Washington D.C., USA.
- *[6] **Ding, K.**, Arginteanu T., Anderson White, M., Thakor, N.V., Doshi, T. (2023). Resting-state electroencephalographic correlates of central sensitization in chronic pain. *2023 11th International IEEE EMBS Conference on Neural Engineering (NER)*, Baltimore, MD, USA.
- *[7] **Ding, K.**, Iskarous, M.M., Osborn, L.E., Thakor, N.V. (2022). Long-term sensory mapping and detection sensitivity of targeted transcutaneous electrical nerve stimulation. *Society for Neuroscience*, San Diego, CA, USA.
- + [8] **Ding, K.[†]**, Dragomir, A.[†], Bose, R., Osborn, L.E., Seet, M.S., Bezerianos, A., Thakor, N.V. (2020). Towards machine to brain interfaces: sensory stimulation enhances sensorimotor dynamic functional connectivity in upper limb amputees. *Neuromatch 3*, virtual, [\[Recording\]](#).

Mentoring * published or presented

I have mentored 16 undergraduate and master's students, 5 of whom are currently pursuing a Ph.D.

Master's Zihan Lyu (2025--), Yiyang Huang* (2024--), Kaichen Yu* (2024--), Mingfeng Cao (2022--2023), Jin Dai (2022--2023), Zhuojun Yu (2023), Shuming Xu (2020--2021), Yunru Chen* (2019--2022)

Undergraduate Dayann D'almeida* (2023--), Stephen Ebaseh-Onofa (2024), Christoph Wagner* (2022--2023), Kings Jiang (2022--2023), Ruixiang Li* (2021--2023), Sharanya Parvathaneni (2021--2023), Ze Ou* (2020--2023), Jinghua Zhang (2020--2021)

Teaching

Introduction to Rehabilitation Engineering EN.580.456/656, BME, JHU Fall 2021--2025

Lab creator and instructor

Neural Implants and Interfaces EN.580.742, BME, JHU Spring 2022, 2023

Teaching assistant and grader

Principles of the Design of Biomedical Instrumentation EN.580.471/771, BME, JHU Fall 2019

Teaching assistant

Engineering Circuit Theory EGR220, Picker Engineering Program, Smith College Spring 2017, 2018

Teaching and lab assistant

Engineering Thermodynamics EGR290, Picker Engineering Program, Smith College Spring 2017

Teaching assistant

Introductory Physics I PHY117, Physics, Smith College Fall 2015

Teaching assistant

Leadership

- Co-Organizer** IAS-TUM-JHU Workshop: "Sensory Integration in Neuroprostheses and Rehabilitation" 2024
 Technical University of Munich (TUM), Munich, Germany
 Assembled 7 professors for research talks and discussions; collaborated with TUM colleagues to design session themes, itinerary, and ensure logistics. [\[Webpage\]](#)
- Founding Member** Neural Engineering Cross University Student Society (NEXUS²) 2024--present
 JHU, Baltimore, MD
- President** Translational Neuroengineering Technologies (TNT) Network 2023--2024
- Co-Treasurer** TNT Network 2021--2023
 JHU, Baltimore, MD
 Established the financial infrastructure, secured funding and assisted in organizing academic, professional development, and social events. Over \$10k was raised between the TNT Network's industry partner, graduate student organizations, and professor support.
- Co-Organizer** Workshop: "Machine-Brain Interfaces: Improving the Human and Machine Interactions" 2023
 IEEE NER 2023, Baltimore, MD
- Vice President** Society of Women Engineers Chapter 2017--2018
 Smith College, Northampton, MA

Professional Activities & Service

Professional Societies

- Graduate student member** Brain-Computer Interface (BCI) Society; Society for Neuroscience (SfN); Institute of Electrical and Electronics Engineers (IEEE); IEEE Engineering in Medicine and Biology Society (EMBS); Society of Women Engineers (SWE)
- Honor societies** Sigma Xi, Phi Beta Kappa, Tau Beta Kappa

Peer Review

Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)
 IEEE Transactions on Neural Systems and Rehabilitation Engineering (TNSRE)
 Journal of Neural Engineering
 Journal of NeuroEngineering and Rehabilitation
 Medical & Biological Engineering & Computing
 Neurophysiologie Clinique (Elsevier)
 Physiological Measurement (IOPscience)
 Scientific Reports

Volunteering & Outreach

- Volunteer Judge** Principles of the Design of Biomedical Instrumentation, JHU 2022, 2024
 Judged wearable device and biogaming projects, in which students developed devices based on measured biosignals.
- Podcast Guest** Design Clinic Download Podcast, Smith College 2022
 Interviewed for the Design Clinic 20th Anniversary podcast. Design Clinic is the capstone engineering design course at Smith College. [\[Podcast episode 4\]](#)

- Mentor** SWE@Smith Alumni Network 2022
Shared experience and offered advice on topics such as work-life balance, communication, and setting goals during monthly meetings with a graduating senior.
- Speaker** SWE@Smith Alumni Network 2021
Participated in a panel on courses at Smith, graduate school application, and determining professional interest.
- Volunteer** SWE@Smith College 2017
Assisted organizing the annual "Introduce a Girl to Engineering Day", with hands-on workshops to create more exposure to STEM fields for middle-school-aged students.