

# Ariel Slepian

## Contact Information

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## Summary

PhD in ECE pioneering scalable full-body, high-resolution tactile skin by co-designing flexible sensors with custom electronics and firmware. My work on data-driven tactile sensing has achieved 18X improvements in sensor scalability, enabling human-level robotic touch sensing and wearable gait analysis. My work has spun out into 2 hardware companies, 6 patent applications, and received \$390K in research funding.

## Education

08/2021 –	PhD in Electrical and Computer Engineering Johns Hopkins University Advisor: Professor Nitish Thakor Thesis: “High-Speed, Large-Area Tactile Sensing through Compressive Sampling”	Baltimore, MD, USA
08/2020 – 08/2021	M.S.E in Biomedical Engineering Johns Hopkins University Advisor: Professor Nitish Thakor Dean’s Master’s Fellowship Thesis: “Scalable Tactile Sensing E-Skins Through Spatial Frequency Encoding”	Baltimore, MD, USA
08/2016 – 05/2020	B.S. in Biomedical Engineering Johns Hopkins University Bloomberg Scholarship	Baltimore, MD, USA

## Experience

06/2020 –	Graduate Student Neuroengineering & Biomedical Instrumentation Lab Johns Hopkins University --Focusing on scalable touch sensing in robotics and wearables	Baltimore, MD, USA
01/2024 –	Co-Founder, CTO Navonic --Wearable sensors for motion tracking and XR	Baltimore, MD, USA
01/2023 – 12/2024	Lead Hardware Engineer CurveAssure Spine --Lead hardware development of a wearable spine monitor	Baltimore, MD, USA
Summer 2019	Summer Researcher Singapore Institute for Neurotechnology --Developed RFID-based wireless touch sensors	Singapore
Summer 2018	Summer Researcher (Visiting Scholar) Interuniversity Microelectronics Centre (IMEC) --Built microfluidic droplet sorter using DEP in silicon chip	Leuven, Belgium
01/2017 – 01/2019	Undergraduate Researcher BioMEMS Lab Johns Hopkins University --Built microfluidic droplet-based platform for measuring enzyme kinetics	Baltimore, MD, USA
Summer 2014/15	Research Intern Groisman Lab University of California, San Diego --Build PDMS chip to investigate thermotaxis of <i>E. coli</i>	La Jolla, CA, USA

## Awards & Honors

2025	Winner of Best Demo Award at NER 2025
2025	Winner of Best Live Demo Award at ISCAS 2025 (1 <sup>st</sup> / 34 demos)
2025	Winner of Pava Center Innovation & Entrepreneurship Award (Navonic, \$15k)
2024	Willard & Marilyn Sweetser ARCS Foundation Scholar (\$15k)
2024	Winner of JHU Fuel Cohort Prize (Navonic-Evoked Haptics, \$8k)
2024	Winner of WSE Excellence in Teaching, Advising, and Mentoring Award
2023	Winner of JHU President's Venture Fellowship (CurveAssure, \$100,000)
2023	Grand Prize Winner of JHU Makerspace Design Challenge
2023	Finalist for IEEE World Haptics Student Innovation Challenge (P1)
2022	Invitee to the Telluride Neuromorphic Cognition Engineering Workshop (1 of 30 international)
2022	Grand Prize Winner of Johns Hopkins ECE Design Day
2022	Finalist in Johns Hopkins Healthcare Design Competition (\$5,000)
2020	Recipient of Dean's Master's Fellowship (1/2 Tuition Scholarship)
2019	Finalist for FastForward Summer Award (\$10,000)
2018	Winner of Johns Hopkins Spark Grant (\$1,000)
2017	2 <sup>nd</sup> place overall winner at MedHacks 2017
2017	Winner of Wolfram Award and Contrary Capital Prize at MedHacks 2017
2016	Recipient of Michael R. Bloomberg Scholarship (Full Tuition 4-year Scholarship)
2016	2 <sup>nd</sup> place in Microbiology at Intel ISEF 2016 (International Science and Engineering Fair)
2016	1 <sup>st</sup> place in Engineering at the New York State Science and Engineering Fair
2015	1 <sup>st</sup> place in Materials Science at the New York State Science and Engineering Fair

## Research Grants Awarded (\$390k)

- a2 Pilot Awards: Artificial Intelligence and Technology Collaboratory (AITC) 2025 (\$200,000) – “Re-Kinesis: Wearable Gait Analysis Laboratory for Aging Populations”
- Accelerated Translational Incubator Pilot Program (ATIP) 2025 (\$50,000) – “Re-Kinesis Twin: Democratizing Gait Analysis in Rehabilitation with e-Dermis and AI-Powered Digital Twin.”
- TEDCO MII Technology Assessment Award 2024 (\$115,000) – “High-Density Tactile Sensor Array with a Single Output Wire for Medical Rehabilitation”. (#1 score in cohort 4.167 / 5)
- Space@Hopkins Seed Grant Program 2022 (\$25,000) – “Self-Powered, Electronics-Free Tactile Sensors Immune to the Hazards of Cosmic Radiation”

## Patents and Invention Disclosures

1. “Systems and Methods for Multi-Axis Force Extraction from High-Resolution Tactile Arrays” (JHU Tech ID #C19151)
2. “Wearable Plantar Sensor-Based System for Lower Limb Biomechanics Reconstruction” (JHU Tech ID #C18700)  
Provisional Patent Application Number = 63/992,527
3. “Scalable Distributed Tactile Sensors Without Integrated Circuits Using Resonance Multiplexed Piezoelectric Sensors” (JHU Tech ID #C18042)  
Provisional Patent Application Number = 63/682,440
4. “Method and Apparatus of a High-Density Non-Invasive Neural Stimulator” (JHU Tech ID #C18182)  
Provisional Patent Application Number = 63/655,671
5. “Method of Scalable Sensor Arrays Through Row Column Compressive Sensing” (JHU Tech ID #C18041)  
Provisional Patent Application Number = 63/653,517
6. “Scalable, Event-Based Sensing Using Wireless Sensor Elements Embedded in Flexible Elastomer” (JHU Tech ID #C16118)  
Patent Number = 18/553,717, Published 2022-10-06

## Research Papers

### Under Review

1. A. Slepian\*, D. Li\*, A. Aug, S. Sankar, T. Tran, and N. Thakor, "Adaptive Compressive Tactile Subsampling: Enabling High Spatiotemporal Resolution in Scalable Robotic Skin", *Under Review*, <https://arxiv.org/abs/2410.13847>
2. A. Slepian\*, R. Zhang\*, L. Xing\*, and N. Thakor, "Single-Pixel Tactile Skin via Compressive Sampling", *Under Review*, <https://arxiv.org/abs/2511.16898>
3. A. Slepian, Y. Luo, E. Levenshus, et al, "Analog Dual-Tone Multi-Frequency Signaling for Scalable Tactile Skin with Automatic Data Compression and a Single-Wire Output", *Under Review at IEEE Sensors*.
4. S. Bellow, A. Slepian, J. Chen, et al, "Estimation of Lower Limb Flexion Angles using High-Density Plantar Pressure Sensing", *Under Review at IEEE Trans. Neural Systems & Rehabilitation Engineering*.

### Published

5. A. Slepian, J. Chen, and N. Thakor, "Scalable Tactile Sensing Skins: Wiring and Data Management" *Proceedings of the IEEE*. 2026. <https://ieeexplore.ieee.org/document/11393898>
6. D. Poppert\*, A. Slepian\*, N. Thakor, T. Tran, "ReLACS: Responsive Learned Adaptive Compressive Subsampling for Efficient Readout of Large-Area Tactile Skins", 2026 Data Compression Conference (DCC). Accepted
7. K. Cheng, M. Wang, A. Slepian, and N. Thakor, "Biomimetic Fingertips: Friction Modulation Through Surface-Responsive Texture Triggered by Micro-Vibration Sensing", *IEEE Sensors Letters*, 2025. <https://ieeexplore.ieee.org/document/11178177>
8. V. Chari, M. Iskarous, D. Li, A. Slepian, N. Thakor, and J. Downey, "Neuromorphic Compression of Tactile Data with Spiking Neural Networks", 12th International IEEE/EMBS Conference on Neural Engineering, 2025. Accepted.
9. A. Pimpalkar, A. Slepian, and N. Thakor, "Vibrations At First Contact Encode Object Stiffness Before Grasp Completion", *IEEE Sensors Letters*. 2025  
<https://ieeexplore.ieee.org/document/11060835>
10. M. Iskarous, Z. Chaudhry, F. Li, S. Bello, S. Sankar, A. Slepian, et al, "Invariant neuromorphic representations of tactile stimuli improve robustness of a real-time texture classification system" *Advanced Intelligent Systems*. 2025,  
<https://advanced.onlinelibrary.wiley.com/doi/10.1002/aisy.202401078e>
11. S. Sankar, W. Cheng, J. Zhang, A. Slepian, et al "A natural biomimetic prosthetic hand with neuromorphic tactile sensing for precise and compliant grasping" *Science Advances*. 2025.  
<https://www.science.org/doi/10.1126/sciadv.adr9300>  
Featured in JHU HUB - <https://hub.jhu.edu/2025/03/05/prosthetic-robotic-hand/>
12. Y. Angkanapiwat, A. Slepian, and N. Thakor, "SensoPatch: a Reconfigurable Haptic Feedback with High-Density Tactile Sensing Glove," 2024 IEEE Biomedical Circuits and Systems Conference (BioCAS), 2024. <https://ieeexplore.ieee.org/document/10798282>
13. A. Slepian, M. Zakariaie, T. Tran, and N. Thakor "Wavelet Transforms Significantly Sparsify and Compress Tactile Interactions" *Sensors*. 2024. <https://www.mdpi.com/1424-8220/24/13/4243>
14. S. Wang, K. Quinn, A. Slepian, et al, "Channel selection and wavelet transformation-based data compression preserve motor unit information" 2024 46th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC). 2024.  
<https://ieeexplore.ieee.org/document/10782539>
15. A. Slepian\*, S. Krishnan\*, T. Li and N. Thakor, "A Multi-Channel, Low-Voltage, High-Frequency Programmable Electrical Stimulator for Sensory Feedback," 2023 IEEE Biomedical Circuits and Systems Conference (BioCAS), 2023. <https://ieeexplore.ieee.org/document/10388769>

16. Z. Ou, Y. Guo, P. Gharibani, **A. Slepian**, et al “Time-frequency analysis of somatosensory evoked high-frequency (600 Hz) oscillations as an early indicator of arousal recovery after hypoxic-ischemic brain injury” Brain Sciences. 2022. <https://www.mdpi.com/2076-3425/13/1/2>
17. Y. Tian, **A. Slepian**, et al, “Real-Time, Dynamic Sensory Feedback Using Neuromorphic Tactile Signals and Transcutaneous Electrical Nerve Stimulation” 2022 IEEE Biomedical Circuits and Systems Conference (BioCAS), 2022. <https://ieeexplore.ieee.org/document/9948609>
18. S. Sankar, **A. Slepian**, et al, “Flexible Multilayer Tactile Sensor on a Soft Robotic Fingertip” 2022 IEEE Sensors, 2022. <https://ieeexplore.ieee.org/document/9967059>
19. A. Aug, **A. Slepian**, E. Levenshus, N. Thakor, “Haptic Touch: A retrofittable tactile sensing glove and haptic feedback armband for scalable and robust tactile sensory feedback”, 2022 9th IEEE International Conference on Biomedical Robotics and Biomechatronics (BioRob), Seoul, Korea, 2022. <https://ieeexplore.ieee.org/document/9925475>
20. **A. Slepian**, S. Sankar, and N. Thakor, “Texture Discrimination Using a Neuromimetic Asynchronous Flexible Tactile Sensor Array with Spatial Frequency Encoding”, 10th International IEEE/EMBS Conference on Neural Engineering, 2021 <https://ieeexplore.ieee.org/document/9441136>
21. **A. Slepian** and N. Thakor, “Towards scalable soft e-skin: Flexible event-based tactile-sensors using wireless sensor elements embedded in soft elastomer”, 2020 8th IEEE International Conference on Biomedical Robotics and Biomechatronics (BioRob), New York, 2020 <https://ieeexplore.ieee.org/document/9224353>

## Research Abstracts / Short Papers

1. **A. Slepian**, A. Orsini, K. Quinn, and N. Thakor “A High-Density Tactile Arena for Neuroengineering Research: Continuous Gait Tracking in Freely Behaving Rodents” 2025 IEEE EMBS 12th Annual International Conference on Neural Engineering (NER 2025).  
*Winner of Best Demo Award*
2. **A. Slepian\***, D. Li\*, T. Tran, and N. Thakor, “Live Demonstration: Compressive Subsampling for High-Speed Large-Area Tactile Sensing” 2025 IEEE International Symposium on Circuits and Systems (ISCAS). 2025. <https://ieeexplore.ieee.org/abstract/document/11043348>  
*Winner of Best Live Demo Award*
3. **A. Slepian** and N. Thakor “PAS: Probabilistic Adaptive Subsampling for Scalable Tactile Skins” 2025 ICRA ViTac Workshop.  
[https://shanluo.github.io/ViTacWorkshops/content/ViTac2025\\_Paper\\_10.pdf](https://shanluo.github.io/ViTacWorkshops/content/ViTac2025_Paper_10.pdf)
4. S. Bello, **A. Slepian**, J. Chen, and N. Thakor “Predicting Kinematics from High-Density Plantar Pressure Sensing” 2025 ICRA ViTac Workshop.  
[https://shanluo.github.io/ViTacWorkshops/content/ViTac2025\\_Paper\\_09.pdf](https://shanluo.github.io/ViTacWorkshops/content/ViTac2025_Paper_09.pdf)
5. **A. Slepian\***, D. Li\*, T. Tran, and N. Thakor, “Compressive Subsampling for Scalable Tactile Skin” 2025 Data Compression Conference (DCC). 2025. <https://ieeexplore.ieee.org/document/10992472>

## Workshop Presentations

1. **A. Slepian**, L. Xing, R. Zhang, and N. Thakor, “Scalable Distributed Tactile Skin via Compressive Sampling” 2025 Northeast Robotics Colloquium
2. **A. Slepian**, D. Li, T. Tran, and N. Thakor, “Compressive Subsampling for Scalable Tactile Sensing Robot Skin” 2024 Workshop on Neuromorphic Principles in Biomedicine and Healthcare
3. **A. Slepian**, M. Iskarous, S. Sankar, and N. Thakor, “Scalable, Biomimetic Sensory Solutions for Dexterous Robotics Hands” 2021 NRI & FRR Principal Investigators' Meeting, 2021
4. **A. Slepian**, R. Acharya, A. Silva, D. Kumar, and N. Thakor, “A Biomimetic Soft Finger for Palpation Applications”, Do Good Robotics Symposium, Maryland, 2019

5. **A. Slepian**, N. Ribeiro, A. Saad-Eldin, A. Blakney, “Rapid development of paper-based microfluidic devices using crayons and coffee filters”, Baltimore Innovation Week Science Conference, 2017

### **Teaching Lead of Original Courses (110+ students)**

EN.520.299	PCB Design and Microcontroller Programming <i>Student feedback – “Arik is extremely helpful, and willing to put in the extra time for both students who are struggling and those who want to go above and beyond. 10/10 instructor!”</i>	Winter 2023 – 2025
EN.580.113	Prosthesis Instrumentation HUB Article – <a href="https://hub.jhu.edu/2023/02/06/intersession-prostheses-instrumentation/">https://hub.jhu.edu/2023/02/06/intersession-prostheses-instrumentation/</a>	Winter 2023

### **Teaching Assistantships (17 classes)**

EN.580.471	Principles of the Design of Biomedical Instrumentation	Fall 2020 – 2025
EN.520.448	Advanced Electronics Design Lab	Spring 2023 – 2024
EN.580.571	Honors Instrumentation	Spring 2021 – 2025
EN.580.456 n/a	Introduction to Rehabilitation Engineering BME Design Studio TA	Fall 2022 – 2023 2021 – 2022
EN.580.457	Rehabilitation Engineering: Design Lab	Spring 2021
EN.580.477	Biomedical Data Science Lab	Fall 2019

### **Leadership Experience**

2023 – 2025	Co-President of ECE Graduate Student Association
2023	ECE representative for the Graduate Student Organization (GRO)

### **Student Mentorship (40 students), (13 published \*)**

Master's Students: Dian Li\* (2024 – 2025), Kai Cheng\* (2024 – 2025), Anway Pimpalkar\* (2024 – 2025), Dheeraj Gudluru (2024), Diego Gomez (2024), Junjun Chen\* (2024 – ), Priyanka Fernandes (2023 – 2024), Tianao Li\* (2023 – 2025), Siddharth Krishnan\* (2022 – 2023), Michael Zakariaie\* (2022 – 2023), Arnab Chatterjee (2022), Yucheng “Jacky” Tian\* (2022)

Undergraduate Students: Colman Barth (2025), Joshua Pike (2025 – ), Ryan McGovern (2025), Jacobo Tello (2025 – ), Colm Doley (2025 – ), Ian Tran (2025), Ashley Luo (2024 – 2025), Keya Agrawal (2024), Rudy Zhang\* (2024 – 2025), Amanda Butler (2024), Mathew Schricker (2023 – 2024), Laura Xing\* (2023 – 2025), Yanisa “Belle” Angkanapiwat\* (2022 – 2025), Guangyan “Molly” Li (2022 – 2023), Eli Levenshus\* (2021 – 2023), Aidan Aug\* (2021 – 2023), Dylan Zhu (2022 – 2023), Neeti Prasad (2022), Aryaman Shodhan (2021), Martin Prados de Haro (2021)

High School Students: El Donald (2024), Srinitha Kondapaneni (2023), Ian Tran (2023), Upanshu Bajaj, Shriya Sane, and Kimaya Basu (2022 – 2023), Pratham Mathapati, Pranavaa Elangovan, Sahil Mada (2020 – 2021),

### **Collaborators**

- Professor Chen Li (JHU) – Using tactile sensors for developing animal-inspired robots
- Professor Yu She (Purdue) – Using tactile sensors for bimanual dexterous manipulation with LEAP hands
- Dr. Haoshu Fang (MIT) – Using tactile sensors for sensorizing human hands to learn from human demonstration
- Dr. Cristiana de Farias and Mr. Niklas Funk (TU Darmstadt) – Using tactile sensors with UMI grippers for high-speed grasping
- Dr. Kenneth Cameron and Dr. Jamie Morris (United States Military Academy - Westpoint) – Using tactile sensors to study gait of cadets

### **Professional Activities**

- Reviewer for 2026 IEEE International Symposium on Circuits and Systems (ISCAS)
- Reviewer for IEEE Transactions on Very Large Scale Integration Systems
- Reviewer for 2025 IEEE International Conference on Intelligent Robots and Systems (IROS)
- Reviewer for 2025 IEEE World Haptics Conference (WHC)
- Reviewer for 2025, 2024, 2022 IEEE International Conference on Electronics, Circuits & Systems (ICECS)

- Reviewer for 2024, 2022 IEEE International Conference on Biomedical Robotics and Biomechatronics (BioRob)

### Consulting Work

- Hardware Design for [Somnair](#)  
Developed a multi-channel non-invasive neurostimulator (electrode array + stimulator)
- PCB Design for [OmniSense Surgical, Inc](#)  
Developed a "smart retractor" providing real-time surgical guidance with a focus on mastectomy procedures and plastic & reconstructive surgery. Startup spun out of the Texas Biodesign program.