

Gabriella M. Shull

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EDUCATION

PhD. in Biomedical Engineering,

- Duke University, Durham, North Carolina, USA Aug 2018 – Present
 - Working in the translational neuroengineering lab with Prof. Jonathan Viventi to develop high bandwidth electrodes for applications in ECoG.
 - Cumulative GPA: 4.00 / 4.00

M.S. in Biomedical Engineering,

- University of Minnesota, Twin Cities, Minneapolis, Minnesota, USA Aug 2016 – Aug 2018
 - Minor: Neuroengineering
 - Cumulative GPA: 3.89 / 4.00

B.S. in Biomedical Engineering,

- State University of New York, Binghamton, Binghamton, New York, USA Aug 2013 – May 2016
 - Minor in computational biosystems, and medical devices
 - Graduated with College Honors, Magna Cum Laude.
 - Cumulative GPA: 3.54 / 4.00

RESEARCH EXPERIENCE

Translational Neuroengineering Lab, Dept. of Biomedical Engineering, Duke

- Graduate Research Student Aug 2018 – Present
- The end goal of this project is to create a chronic, high channel count, flexible, bidirectional neural interface to record new features of brain activity including sensing action potentials from the surface of the brain.
- I am using full custom integrated circuit design software to leverage CMOS foundry fabrication to create and simulate new circuit architectures of ECoG arrays for recording/simulating the brain. This allows us to minimize noise, increase gain, decrease power, increase sampling rate, etc... using a scaleable fabrication platform.
- Adviser: Prof. Jonathan Viventi

Biosensing and Biorobotics Research Group, Dept. of Mechanical Engineering, UMN

- Graduate Research Student Jan 2017 – Jul 2018
- Thesis project: Computer vision guided robotic cell microinjector
 - Developed robotic microinjector to inject single cells in the developing neocortex with sub micron resolution using computer vision through microscope images.
- Actuable woven neural probes
 - I developed electrode arrays for chronic intracortical recording, functionalized electrodes with shape memory alloys, and demonstrated their use *in vivo*. I gained experience in PCB design, electroplating, fabrication, and characterization.
- Adviser: Prof. Suhasa Kodandaramiah

Max Planck Institute of Molecular Cell Biology and Genetics, Dresden, Germany

- Visiting Graduate Research Student Jun 2017 – Aug 2017, May 2018 – Jun 2018
 - Tested the automated microinjector in collaborators lab and gained experience working with a cross disciplinary team in an unfamiliar environment.
 - The system I built increased yield of microinjection by 46x relative to manual microinjection which allows new scientific questions to be explored through the use of this tool.
 - Advisers: Prof. Wieland Huttner and Dr. Elena Taverna

Cellular Preservation Services Incorporated Biotechnology, Owego, NY

- Team Leader, Engineer Aug 2015 – May 2016
 - Led a team of engineers to develop a thermoregulatory balloon device for surgical cryoablation procedures, and tissue engineered model to test device. We won an award for this work and presented at a regional conference.
 - I made the overall design of the hardware, and connected electronic components into closed loop control system using microcontroller programming.
 - Optimized my leadership skills through discretizing project objectives into concrete goals, identifying team members strengths, and managing the project under frequent corporate deadlines.
 - Supervisor: Dr. Kristi Snyder

Organs-on-Chip Lab, Dept. of Biomedical Engineering, SUNY Binghamton

- Undergraduate Research Student Mar 2014 – May 2016
 - Developed and characterized novel *in vitro* model of gastrointestinal epithelium and investigated the influence of nanoparticle ingestion on gut barrier function.

- Discovered that a common food additive alters gene expression and cell viability, and that the presence of beneficial bacteria mitigates these effects.
- Adviser: Prof. Gretchen Mahler

Institute for Nanotechnology, Dept. of Chemistry, Northwestern University

- REU Student Jun 2015 – Aug 2015
 - Synthesized di-copper complex to minimize t2 relaxation time for use as a MRI contrast agent in the brain.
 - Adapted to unfamiliar field/lab, and developed a desire to use nanotechnology to interface with the brain.
 - Advisers: Prof. David Harris, Kang Du.

**LEADERSHIP
EXPERIENCE**

Duke Angel Network, Durham, NC

- Associate Mar 2019 – Present
 - As an associate at the Duke Angel Network I am responsible for managing and executing due diligence on prospective investments within the medical device industry.

Duke Innovation & Entrepreneurship Initiative, Durham, NC

- I&E Fellow Oct 2018 – Present
 - Selected as one of three graduate students to serve as the first group of I&E fellows. Our role is to connect Duke students with resources at the I&E, and expand the impact I&E has on the student body.
 - I organize and lead internal meetings, follow up with group to ensure our objectives are met and the momentum persists throughout the year. Also, I meet with I&E leadership regularly to execute/advise their goals.
 - I helped create plans/events to increase I&E exposure on campus including student outreach campaign, and I&E coffee hours. We were able to use these to collect data about student awareness of I&E.

Hive Mine LLC, Minneapolis, MN

- Co-founder, Owner Dec 2017 – Feb 2019
 - Created small business to create cryptocurrency mining farm.
 - Gained experience in acquiring \$50k in investment, creating business documents, working with accountants, lawyers, insurance agents, and land lords.

Interdisciplinary Studio for Learning and Design (ISLAND), SUNY Binghamton

- President of External Affairs, Co-Founder, Web Master Aug 2015 – May 2016
 - Created a student organization to host design challenges using projects that benefit the community locally, and and globally including participation in design competitions.
 - Ran workshops teaching MATLAB, Arduino, and R and oversaw development of the website.

Biomedical Engineering Society (BMES) Student Chapter, SUNY Binghamton

- Vice President Aug 2014 – May 2016
 - Pioneered the growth of the chapter from 8 to 58 students.
 - Created a mentorship program to connect upper level students/grads to underclassmen in order to ensure sustained student success across their careers, and created lab tour event to connect students with research.
 - Created outreach event to engage young students underrepresented in STEM in experiments.

**COMMUNITY
OUTREACH**

The Science for All Outreach Program, UMN

- Webmaster, Volunteer Aug 2017 – Jun 2018
 - Provide middle school students with tangible understanding of STEM concepts via experiments (e.x. I made an EMG controlled race car and had the students race one another via EMG)

Medical Devices Center, UMN

- Graduate Team Leader, Volunteer Aug 2016 – May 2017
 - Mentored a group of undergraduate students to develop a surgical catheter device for Dr. Marcos Molina, MD.
 - Presented our work at a prominent surgical conference.

FELLOWSHIPS

- **National Science Foundation Graduate Research Fellowship** awarded in Apr 2018
Awarded to students "with demonstrated potential to enhance the vitality of the US science and engineering enterprise".
- **NSF IGERT Fellowship in Neuroengineering** Aug 2016 - Aug 2017
University of Minnesota, Twin Cities
Awarded to graduate students engaged in interdisciplinary approaches to neuroengineering.
- **Small Scale Systems Integration Center Undergraduate Fellowship** Jan 2016 - May 2016
SUNY Binghamton
Won this to fund my independent research project.

	<ul style="list-style-type: none"> ▪ NSF Research Experience for Undergraduate Fellowship Jun 2015 - Aug 2015 Chemistry Department, Northwestern University Competitive research fellowship awarded to students with high potential for impact in future career. ▪ Howard Hughes Medical Institute Undergraduate Research Fellowship Jun 2014 - Aug 2014 SUNY Binghamton Awarded to students engaged in interdisciplinary research projects.
AWARDS	<ul style="list-style-type: none"> ▪ Second Place (out of 30 teams), Nov 2017 Blockchain for Social Impact Hackathon, Brooklyn, NY. For developing ethereum blockchain based platform to incentivise ex felons to engage in therapy. ▪ Second Place (out of 7 teams), Oct 2017 Code Switch Hackathon, St. Paul, MN For developing ethereum blockchain based platform for community building. ▪ NSF IGERT Travel Award, Jun 2017 University of Minnesota, Twin Cities Awarded for international travel for collaboration. ▪ Best Biomedical Engineering Senior Capstone Project, May 2016 Biomedical Engineering Department, SUNY Binghamton Won best capstone project out of 9 teams in department. ▪ Undergraduate Travel Award (won award twice), Sep 2014, Aug 2015 Biomedical Engineering Department, SUNY Binghamton Travel costs to present research were covered by this award.
SKILLS	<p>Programming/CAD - Python, MATLAB, C++, Cadence Virtuoso/Spectre/Calibre, Mentor Graphics Pyxis, Eagle PCB Designer, Solidworks, ANSYS, Arduino, R, Adobe Photoshop/Illustrator, MS Word/Excel/PowerPoint.</p> <p>Characterization - 2-photon/confocal/fluorescent/wide field microscopy, EIS, IHC, qPCR, SEM</p> <p>Fabrication - chemical synthesis, electroplating, fine-soldering, paralyene-C deposition, platinum sputtering</p> <p>In Vitro - 3D bioprinting, mammalian/bacteria cell culture, single cell microinjection</p> <p>In Vivo - automated patch clamp, extracellular recording, mouse craniotomy/surgery, virus injection</p> <p>Machining - 3D printing, CNC milling, laser cutting</p> <p>Languages - Spanish (intermediate), English (native)</p>
PUBLICATIONS	<ul style="list-style-type: none"> [1] <u>G. Shull</u>, W. Huttner, E. Taverna, S. Kodandaramaiah “Robotic platform for microinjection into single cells in intact tissue,” <i>In Revision at EMBO Reports</i>, [doi.org/10.1101/480004] [2] L.Ghanbari, M. Rynes, J. Hu, D. Schulman, G.W. Johnson, M. Laroque, <u>G.M. Shull</u>, and S.B. Kodandaramaiah, “Craniobot: A computer numerical controlled robot for cranial microsurgies,” <i>Scientific Reports</i>, 9.1.1023, Jan 2019. [doi.org/10.1038/s41598-018-37073-w] [3] <u>G. Shull</u>, J. J Hu, J. Buschnyj, H. Koon, J. Abel, S.B. Kodandaramaiah, “Shape Memory Alloy Actuatable Woven Neural Probes,” <i>ASME 2018 Conference on Smart Materials, Adaptive Structures and Intelligent Systems</i>, Aug 2018. [doi:10.1115/SMASIS2018-8169] [4] J. Richter, <u>G. Shull</u>, J. Fountain, Z. Guo, L. Musselman, A. Fiumera, and G. Mahler, “Titanium dioxide nanoparticle exposure alters metabolic homeostasis in a cell culture model of the intestinal epithelium and Drosophila melanogaster,” <i>Nanotoxicology</i>, pp. 1-17, Mar 2018. [doi.org/10.1080/17435390.2018.1457189]
PATENTS	<ul style="list-style-type: none"> [1] <u>G. Shull</u>, W. Huttner, E. Taverna, S. Kodandaramaiah, “Robotic Platform for High Throughput Single Cell Gene Manipulation in Intact Tissue,” Patent 20180069. (provisional filed Sept 7, 2017, Full filed September 8, 2018 with U.S. Patent and Trademark Office).
INVITED TALKS	<ul style="list-style-type: none"> [1] <u>G. Shull</u>, “The Autoinjector” Design of Medical Devices Conference. Minneapolis, MN April 2018
PEER REVIEWED CONFERENCE PRESENTATIONS	<ul style="list-style-type: none"> [1] <u>G. Shull</u>, Chia-Han Ken Chiang, Enming Song, John A. Rogers, Jonathan Viventi “Design and simulation of an active 4,096 channel micro-electrocorticography (μECoG) array” <i>Society For Neuroscience Annual Meeting</i>, Chicago, IL. USA, Oct 2019.

- [2] G. Shull, J. Viventi “Circuit simulation and layout of 16,384 channel active micro-electrocorticography (μ ECoG) array,” *Brain Initiative Investigators Annual Meeting*, Washington, D.C.USA, Apr 2019.
- [3] G. Shull, C. Haffner, W. Huttner, E. Taverna, S.B. Kodandaramaiah, “Automated microinjection of neural progenitors,” *Society For Neuroscience Annual Meeting*, San Diego, CA, USA, Nov 2018.
- [4] G. Shull, J. J. Hu, J. Buschnyj, H. Koon, J. Abel, S.B. Kodandaramaiah, “Shape Memory Alloy Actuatable Woven Neural Probes,” *Conference on Smart Materials, Adaptive Structures and Intelligent Systems*, San Antonio, Texas, USA, Sep 2018.
- [5] R.G. Smith, R. A. Johnson, G. Shull, D. Sorby, C. J. Modl, A. Panoskaltsis-Mortari, T. M. Kowalewski, “Towards Robotic Bioprinting Directly ont Moving, Stretching Anatomy,” *Hamlyn Symposium on Medical Robotics*, South Kensington, London, UK, Jun 2018.
- [6] G. Shull, C. Haffner, W. Huttner, S. Kodandaramiah, E. Taverna, “The Autoinjector: An Image Guided Robot for Single Cells Microinjection,” *Neuromodulation Symposium*, Minneapolis, Minnesota, USA, Apr 2018.
- [7] G. Shull, C. Haffner, W. Huttner, S. Kodandaramiah, E. Taverna, “Image Guided Robot for Microinjection into Single Cells in Organotypic Slices of Mouse Telencephalon,” *Institute for Engineering in Medicine Annual Symposium*, Minneapolis, Minnesota, USA, Nov 2017.
- [8] G. Shull, C. Haffner, W. Huttner, S. Kodandaramiah, E. Taverna, “A robot for high throughput analysis of neural stem cells in intact tissue,” *EMBO Conference: Gene regulatory mechanisms in neural fate decisions*, Alicante, Spain, Sep 2017.
- [9] M. Molina, G. Shull, G. Jacobs, T. Woodcock, C. Phillips, D. Srishyla, “Keeping the staple line safe: re-engineering the nasogastric tube and the use of direct visual guidance for its safe deployment,” *Society of American Gastrointestinal and Endoscopic Surgeons Annual Meeting*, Houston, Texas, USA. Mar 2017.
- [10] G. Shull, J. Richter, G Mahler, “TiO₂ Nanoparticle Exposure Alters Glucose Transport and Expression in an In Vitro model of the Intestinal Epithelium,” *42nd Annual Northeast Biomedical Engineering Conference (NEBEC)*, Binghamton, New York, USA. Apr 2016.
- [11] G. Shull, D. Liacona, N. Martucci, I. Wang, K. Snyder, “Thermoregulatory Balloon Device and Tissue Engineered Model for Thermal Ablation Applications,” *42nd Annual Northeast Biomedical Engineering Conference (NEBEC)*, Binghamton, New York, USA. Apr 2016.
- [12] G. Shull, J. Richter, G Mahler, “Nanoparticle Ingestion Affects Glucose Transport in in Vitro Model of the Intestinal Epithelium,” *Biomedical Engineering Society Annual Meeting (BMES)*, Tampa, Florida, USA. Oct 2015.
- [13] J. Richter, G. Shull, G Mahler, “TiO₂ Nanoparticle Ingestion Alters Glucose Absorption in an in Vitro Model of the Intestinal Epithelium,” *41st Annual Northeast Biomedical Engineering Conference (NEBEC)*, Troy, New York, USA. Apr 2015.
- [14] G. Shull, J. Richter, G Mahler, “The Effects of Nanoparticle Ingestion on Glucose Transport and Uptake in the Gut Microbiome,” *Biomedical Engineering Society Annual Meeting (BMES)*, San Antonio, Texas, USA. Oct 2014.

CONTACT REFERENCES

Prof. Jonathan Viventi

Assistant Professor, Department of Biomedical Engineering, Duke University

- Relationship - PhD PI (2018 - present)
- Email - j.viventi@duke.edu

Prof. Suhasa B. Kodandaramaiah

Assistant Professor, Department of Mechanical Engineering, University of Minnesota, Twin Cities

- Relationship - Masters thesis PI (2016 - 2018)
- Email - suhasabk@umn.edu

Dr. Elena Taverna

Researcher, Department of Evolutionary Genetics, Max Planck Institute for Evolutionary Anthropology

- Relationship - Collaborator for masters thesis (2017 - 2018)
- Email - elena_taverna@eva.mpg.de