

# AUDREY LEE

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## RESEARCH INTERESTS

I integrate clinical and technological perspectives at the intersection of surgical robotics and machine learning to develop translational technologies that improve surgical practice. My research focuses on human-robot interaction in robotic surgery, specializing in how high autonomy surgical robots and surgeons can effectively collaborate on tasks to ensure safe integration into procedural workflows, expedite patient care, and enable generalization to new patient anatomies.

## EDUCATION

**Icahn School of Medicine at Mount Sinai** **New York, NY**  
**Medical Scientist Training Program (M.D.-Ph.D. Program)** **2020–Present**

**M.D. Student**

Preclinical training (07/2020–06/2022)

**Ph.D. Candidate in Biomedical Sciences**

GPA: 4.00/4

Advisor: Benjamin Rapoport, M.D., Ph.D.

Thesis: Leveraging Physical Human-Robot Interaction for Surgical Robot Learning in Neurosurgery  
Artificial Intelligence and Emerging Technologies Training Area (07/2022–Present)

Relevant coursework: Machine Learning in Biomedical Data Science, Artificial Intelligence in Medicine, Scientific Computing, Biostatistics

**Columbia University** **New York, NY**  
**The Fu Foundation School of Engineering and Applied Science** **2016–2020**

**B.S. in Biomedical Engineering**

GPA 3.82/4, Dean's List (Fall 2016–Spring 2020), Graduated *cum laude*

Advisor: Samuel Sia, Ph.D.

Relevant coursework: Introduction to Human Space Flight (Human Factors Engineering), Computing for Engineers and Applied Scientists (Python), Biomedical Engineering Design and Lab, Quantitative Physiology, Biostatistics, Applied Mathematics (Linear Algebra and Differential Equations)

## SELECTED HONORS AND AWARDS

**King's Crown Leadership Excellence Award: Civic Responsibility** **2020**  
Recognition of the significant contributions students make to the Columbia community. Honorees in this category best promote civic engagement, responsible citizenship, and global citizenship.

**Thomas "Pop" Harrington Medal** **2020**  
Awarded to that student in the Columbia Engineering graduating class who best exemplifies the qualities of character that Professor Harrington exhibited during his forty years of teaching at the school of Engineering.

**Egleston Scholar** **2016–2020**  
A \$10,000 research grant awarded to the top 1% of Columbia Engineering students for extraordinary achievements and promise as an engineering and applied science student, researcher, and leader.

**New York State Scholarship for Academic Excellence** **2016–2020**

## SELECTED RESEARCH EXPERIENCE

**Sinai BioDesign, Dept. of Neurosurgery, Icahn School of Medicine at Mount Sinai** **New York, NY**  
**Graduate Student Researcher** under Benjamin Rapoport, M.D., Ph.D. **2021–Present**

- ♦ Collaborated with clinical research scientists and data scientists on using natural language processing techniques to mine medical device regulatory documents, build an FDA 510(k) Predicate Device Identification tool, and analyze trends in device regulatory practices.

- ♦ Worked with neurosurgeons and biomedical engineers to design a minimally invasive cranial access device with endoscopy for brain bleed evacuation. Interviewed end-users as part of the National Science Foundation's Innovation Corps program.
- ♦ Conducted interviews with surgeons who practice robotic surgery across the Mount Sinai Health System and assisted in cases across various specialties involving the da Vinci Robotic Surgical System and the ROSA ONE robotic and surgical navigation system to understand needs in the field of surgical robotics.
- ♦ Published a journal paper in *Nature npj Digital Medicine*, 2024.

### **National Aeronautics and Space Administration**

**Research Intern** under Ye Zhang, Ph.D.

**Cape Canaveral, FL  
Summer 2018, Summer 2019**

- ♦ Collaborated with biologists and engineers to invent bright-field and fluorescence microscopy modules for integration on microgravity simulators using computer-aided design, simulation, and 3D printing. Designed wound-healing assays using human cells under simulated microgravity conditions with live-cell imaging. Used image processing techniques to quantitatively analyze cellular changes in microgravity.
- ♦ Published a journal paper in the *Applied Sciences*, 2021.

### **Sia Lab, Dept. of Biomedical Engineering, Columbia University**

**Undergraduate Student Researcher** under Samuel Sia, Ph.D.

**New York, NY  
2017–2020**

- ♦ Collaborated with graduate students to design a thermally actuated drug-polymer matrix for drug-coated balloon therapy in arterial disease. Developed a blood vessel model and experiments for in vitro evaluation of the novel drug-coated balloons.
- ♦ Investigated the design and fabrication of state-of-the-art microrobots for therapeutics delivery; produced focused ultrasound-actuated drug delivery capsules and microscale machines with moving parts using hydrogels.

### **Integrated Medical Systems Lab**

**Student Researcher** under Aydin Farajidavar, Ph.D.

**New York, NY  
Jun 2014–Jun 2016**

- ♦ Collaborated with a graduate student to develop an implant for recording gastric activities and delivering neurostimulation for gastric motility disorders, which was supported by the NIH (NIBIB-1U18EB021789-01). The device was validated in porcine models and pilot studies.
- ♦ Delivered an oral presentation at the 2016 IEEE Topical Conference on Biomedical Wireless Technologies, Networks, and Sensing Systems (BioWireleSS). Published a paper in the BioWireleSS conference proceedings, 2016.

## **PUBLICATIONS**

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### **Levels of Autonomy in FDA-Cleared Surgical Robots: A Systematic Review**

**A. Lee**, T.S. Baker, J.B. Bederson, B.I. Rapoport.

*Nature npj Digital Medicine*, 2024.

### **Module to Support Real-Time Microscopic Imaging of Living Organisms on Ground-Based Microgravity Analogs**

S. Neelam\*, **A. Lee**\*, M. Lane, C. Udave, H.G. Levine, Y. Zhang. (\* *equal contribution*)

*Applied Sciences*, 2021.

### **Microgravity Simulation Support Facility for Space Research**

Y. Zhang, J.T. Richards, J.J. Torres, S.G. Gilroy, S.J. Swanson, **A. Lee**, S. Neelam, R.I. Wade, R.J. Nacca, H.G. Levine.

*International Space Station Research & Development Conference (ISSRDC)*, 2019.

### **Design and Development of Modules to Support Live Microscopic Imaging on Ground-Based Microgravity Simulators**

**A. Lee.**

*NASA Technical Report*, 2018.

## **A wireless system for gastric slow wave acquisition and gastric electrical stimulation**

**A. Lee**, R. Wang, A. Farajidavar.

*IEEE Topical Conference on Biomedical Wireless Technologies, Networks, and Sensing Systems (BioWireleSS)*, 2016.

## **STUDENTS SUPERVISED**

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**Lily Huo**

**Present**

***Sinai BioDesign, MD Student Fellow***

- ♦ Guiding the student in developing robot controllers that support physical-human robot interaction.
- ♦ Collaborating on a project investigating the relationship between exogenous hormone therapies and meningioma incidence among women.

**Christian Fabian**

**Summer 2024**

***Sinai BioDesign Internship, High School Student***

- ♦ Guided the student in developing video streaming and analysis software for a low-cost wireless endoscope module and collaborative robot end effector.

**Geoffrey Huang**

**Summer 2024**

***Sinai BioDesign Internship, High School Student***

- ♦ Guided the student in using computer-aided design and 3D printing to build an endoscope module for a collaborative robot.

**Julien Peters**

**Summer 2024**

***Sinai BioDesign Internship, High School Student***

- ♦ Guided the student in using computer-aided design and 3D printing to build an endoscope module for a collaborative robot.

## **TEACHING EXPERIENCE**

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**MED 2629: Engineering Medicine**

**Icahn School of Medicine at Mount Sinai**

**Course Director**

**Present**

- ♦ Teaching students basic prototyping skills that can be used to develop innovative software and hardware solutions for medical applications. These include programming, electronics design, computer-aided design, and 3D printing.

**MSN 5019: Structures (Gross Anatomy)**

**Icahn School of Medicine at Mount Sinai**

**Senior Teaching Assistant**

**Fall 2021, Fall 2022, Fall 2023**

- ♦ Taught medical students dissection techniques and anatomical concepts, and assisted in teaching robotic surgery skills on the da Vinci Surgical Skills Simulator and da Vinci Robotic Surgical System.
- ♦ Created, administered, and graded biweekly assessments for facilitating learning of human anatomy and function.

## **SELECTED OUTREACH EXPERIENCE**

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**GOALS (Greater Opportunities Advancing Leadership and Science) for Girls Program, Intrepid Sea, Air & Space Museum**

**STEM Mentor**

**2018–2020**

- ♦ Led outreach initiatives in collaboration with NYC cultural institutions and community organizations for educational opportunities and career development.
- ♦ Mentored a team of high school girls on a yearlong research project to mitigate plastic waste in biomedical research, with a focus on the United Nations Sustainable Development Goals (UN SDGs).
- ♦ Managed and guided mentees through collaborative ideation, research and grant proposal writing, experiment design, data analysis, and presentation to a diverse range of audiences.

**Global STEM Alliance  
Junior Mentor**

**The New York Academy of Sciences  
2016–2020**

- ♦ Created and executed workshops on leadership and science for the Global STEM Alliance network engagement.
- ♦ Collaborated with peers and mentors globally on design challenges focused on the United Nations Sustainable Development Goals and STEM advancements.
- ♦ Awarded the Distinguished Student Award for women in science advocacy and peer mentorship.

**Columbia Organization of Rising Entrepreneurs  
Operating Committee Leader**

**Columbia University  
Sept 2017–May 2020**

- ♦ Organized and facilitated conferences, startup pitch competitions, panels, and speaker events to engage the Columbia community and local high school students in entrepreneurship.
- ♦ Collaborated with team members to plan and launch the first annual Sustainable Youth Initiatives (SYI) High School Conference to inspire students to develop solutions in healthcare, education, and sustainable development. Reached out to startup founders and underserved NYC high schools to recruit mentors, sponsors, and student participants.

**GOALS for Girls Program  
Education Intern**

**Intrepid Sea, Air & Space Museum  
Nov 2013–Jun 2018**

- ♦ Mentored over 250 high school girls in leadership and STEM. Developed engineering educational curriculum and led workshops for training technical and soft skills.
- ♦ Presented engineering research as guest speaker and panelist at the GOALS for Girls Summer Intensive program, and the annual Girls in Science & Engineering Day and GOALS Technology & Engineering Day.
- ♦ Led interactive science activities for children on the autism spectrum and adults with developmental disabilities.

**SELECTED SERVICE AND EXTRACURRICULAR ACTIVITIES**

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<b>Retreat Planning Committee, Mount Sinai MSTP</b>	<b>2022–Present</b>
<b>Admissions Committee, Mount Sinai Graduate School of Biomedical Sciences</b>	<b>2023–Present</b>
<b>MSTP Admissions Committee, Mount Sinai MSTP</b>	<b>2023–Present</b>
<b>Mentorship &amp; Outreach Chair, Women in MSTP</b>	<b>2020–2023</b>
<b>Junior Clinician, East Harlem Health Outreach Project</b>	<b>2021</b>
<b>Medical Assistant, Advanced Women Health OB/GYN Clinic</b>	<b>2019</b>
<b>Zero-G Research Division, Columbia Space Initiative</b>	<b>2018–2020</b>
<b>Quality Improvement Pre-Medical Committee, Dept. of Surgery, Mount Sinai Health System</b>	<b>2019</b>
<b>Recreation Volunteer, ArchCare at Terence Cardinal Cooke Health Care Center</b>	<b>2018</b>
<b>3D-printed Assistive Robotic Arm, [<a href="#">Link to Project Website</a>]</b>	<b>2015–2016</b>