Emma Rutherford

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Education

PhD Candidate in Mechanical Engineering — Cambridge, MA
Massachusetts Institute of Technology
GPA: 5.0/5.0
Relevant Coursework: Compliant Mechanisms, Medical Devices and Implants, Structural Materials, Advanced Measurement and Instrumentation, Sustainable Engineering, Global Engineering: Green Machines

M.S. in Mechanical Engineering — Cambridge, MA
Massachusetts Institute of Technology — Aug 2024
GPA: 5.0/5.0
Relevant Coursework: Medical Device Design, Precision Machine Design, Machine Learning for Engineering Design, Bio-inspired Robotics, Material Science for Sustainable Energy

B.S. in Mechanical Engineering and in Physics with Minor in Design — Cambridge, MA
Massachusetts Institute of Technology — Class of 2023
GPA: 4.9/5.0
Relevant Coursework: Product Engineering, Mechanics and Materials I & II, Dynamics and Control I & II, Thermal Fluids Engineering I & II, Design and Manufacturing I & II, Introduction to Robotics, Numerical Computation, Electronics for Mechanical Systems, Fundamentals of Programming, Quantum Physics, Waves and Vibrations, Electricity and Magnetism, Statistical Mechanics, Relativity, Measurement Techniques and Technologies

Experience

Lead R&D Engineer — Toronto, Ontario, CA
Dragonfleye Therapeutics — Jan 2024 – Present

- Designed and developed five electromechanical ocular surgical instruments spanning minimally invasive retinal detachment repair, subretinal drainage, suprachoroidal space (SCS) drug delivery, glaucoma treatment, and subretinal delivery, bringing each from initial concept through prototyping
- Invented core technology resulting in 5+ patent applications (currently in different stages of being granted) and which allowed us to raise over $10 million to bring the retinal detachment device through clinical trials and to market
- Led end-to-end development of lead device from conception through preclinical animal studies to first-in-human clinical use within approximately 1–2 years and continue driving development toward market.
- Managed preclinical and first-in-human studies, including protocol design, operating room support during 10+ procedures, data analysis, and direct collaboration with surgeons to iterate on instrument design.
- Contributing to regulatory submissions including IDE and IRB filings to support clinical studies.
- Managed 4+ contract manufacturers across different specializations to advance commercialization of the 5 devices.
- Wrote paper on retinal detachment device design and surgical method which is under review in *Nature Biomedical Engineering*

Da Vinci Endoscope Mechanical Design Intern — Sunnyvale, CA
Intuitive Surgical — Jun 2023 – Aug 2023

- Designed and built a test apparatus to characterize effectiveness of prototypes for a new endoscope product feature, integrating mechanical and electrical components for control through a custom GUI.
- Analyzed tolerances of parts and adjusted designs for manufacturing.
- Conceptualized and prototyped new instrument features to improve surgeon experience.

Advanced Energy Instruments Mechanical Design Intern — Orange, CT
Intuitive Surgical — May 2022 – Aug 2022

- Developed an automated manufacturing rig prototype to streamline assembly of a complicated instrument and demonstrated feasibility of the design for large scale manufacturing.
- Assisted in a series of clinical labs to test a surgical bipolar energy instrument and analyzed data to employ optimized performance through modified energy delivery algorithms.

Research

Design of an Ultrasound Guided Endovascular Surgery Instrument — Cambridge, MA
Researcher in Therapeutic Technology Device Design Lab — Dec 2022 – Dec 2024

- Worked to conceptualize and build a system to control a semi-autonomous robotically steerable catheter for endovascular interventions, guided by a state-of-the-art 3D ultrasound instrument from Philips.
- Designed the most critical modules that allowed the catheter to bend using pull wire tendons controlled by DC motors, which I wrote my senior thesis on.

High Speed Underwater Camera Development — Cambridge, MA
Researcher in MIT Sea Grant — Dec 2022 – Jun 2023

- Conducted thermal analysis to inform my design of a water-proof housing to allow a high-speed camera to photograph marine life, and manufactured parts using a variety of machines and techniques, including the waterjet, CNC lathe, and CNC mill.
- Wrote a conference paper for IEEE Oceans 2023 conference and presented my work in Ireland.

- Won 1st place in MechE department's De Florez Awards for Undergraduate Science and Design.

Soft Robotic Benchtop Heart Actuation — Cambridge, MA
Researcher in Therapeutic Technology Device Design Lab — Dec 2022 – Present

- Used CAD to modify scans of patient heart ventricles, adding channels for handmade soft robotic pneumatic actuators which cause the chambers of a 3D printed heart to contract, mimicking a real heart.
- Manufactured soft pneumatic actuators for the entire lab using custom techniques.

NASA Langley Deployable Lunar Tower Project — Cambridge, MA
Researcher with MIT Aero/Astro — May 2021 – Nov 2021

- Improved the deployment system for a 13m tall carbon fiber lunar tower through a series of tests and design of new parts.
- Coded the control system for deploying the tower and tightening guy wire supports, which demanded simultaneous movement of five motors and integrated data from multiple load cells and accelerometers.
- Ran a series of experiments using photogrammetry to test which configurations of guy wires prevent tower collapse and dampen frequency responses in preparation for co-authoring a conference paper.

Biomimetic Robotics Laboratory — Cambridge, MA
Researcher with MIT Mechanical Engineering — June 2021 – Aug 2021

- Used CAD to design an interface between a human hand and a robot arm for easy control in multiple degrees of freedom.

CFD Analysis of COVID-19 Aerosol Transmission — Cambridge, MA
Researcher with MIT Mechanical Engineering and Architecture Departments — Aug 2020 – Jun 2021

- Analyzed numerous configurations of people in classrooms and offices using computational fluid dynamic (CFD) to determine the best way to ventilate a building and provide clean air without wasting energy.
- Coauthored paper "Pattern of SARS-CoV-2 aerosol spread in typical classrooms", published in *Buildings and Environment*.

Projects

Restoration of Comunelli Dam Proposal — Sicily, Italy
MIT MISTI Global Classroom Teaching Assistant — Jul 2024

- Led team of 5 students to develop a detailed engineering proposal to restore and maintain a sediment-filled dam in Sicily which was needed for agricultural water storage.

Making Venice Resilient to Sea Level Rise — Venice, Italy
MIT MISTI Global Classroom — Jul 2023

- Traveled to Venice, Italy to collaborate with local university students and professors on research related to sea level rise threatening to leave most of Venice underwater in the next century.
- Learned in depth about soil mechanics and used this knowledge to develop a strategy to enhance salt marshes in the Venice lagoon, which provide a buffer from high tides.

Diagnostic Device for Popliteal Artery Entrapment Syndrome — Cambridge, MA
MIT 2.75 Medical Device Design Class — Feb 2023 – May 2023

- Collaborated with a surgeon at Beth Israel Hospital to design and develop a device that made diagnosing PAES easier for doctors while providing quantitative data to aid in much needed research of the syndrome.
- Device utilized a pneumatic cylinder and other mechanical subsystems which were successfully integrated and tested in a clinical setting.
- Wrote and published journal article, "Design of a Device to Ease and Improve the Diagnosis of Popliteal Artery Entrapment Syndrome" in *ASME Journal of Engineering and Science in Medical Diagnostics and Therapy*, which outlined the design and initial test results.

Fire Hose Cleaning System — Cambridge, MA
MIT 2.009 Product Design Class — Sep 2022 – Dec 2022

- Worked on a team of 18 students to ideate, design, and build a polished prototype of a firehose cleaner that was presented to an audience of thousands.
- As part of the engineering team, worked with two other students to create fully water powered spinning brushes by building a hydraulic circuit and welded water wheels.

Stellwagen Bank Public Outreach Project — Cambridge, MA
Researcher with MIT Sea Grant — May 2020 – July 2022

- Collaborated with esteemed underwater photographer Keith Ellenbogen to document wildlife in Stellwagen Bank National Marine Sanctuary as part of his project to bring awareness to some of the most biodiverse waters on Earth.
- Led the scientific side of the project, creating eye-capturing visualizations of chlorophyll-a and phytoplankton concentrations using NASA satellite data, coding an interactive website, and designing an exhibit at the Boston aquarium on display from May to November 2022.

Robot Competition — Cambridge, MA
MIT 2.007 Design and Manufacturing Student — Feb 2021 – May 2021

- Designed and built a multifunctional robot with integrated electronics from a constrained set of equipment and materials to compete against 150 other students in a final competition, receiving the highest award for the class (International Design Competition Prize).

Leadership

SciFro Ethiopia — Addis Ababa, Ethiopia
Teaching Assistant — Sep 2025

- Helped run alongside 7 other teaching assistants a weeklong engineering intensive program for 45 undergraduate and graduate students from across Ethiopia
- Gave lectures on science of spectroscopy, assisted in design of hands-on activities, and led students through understanding the course

MIT MakerWorkshop Cambridge, MA
President Jun 2023 – Present
- Lead ~50 other mentors to keep the shop running, organizing shifts, outreach initiatives, machine maintenance, and more.

Machine Shop Mentor Feb 2022 – Present
- Held shifts and trainings every week at the student run machine shop on campus, where I supervise and teach students how to use a wide variety of machines for their personal and research projects.
- Required proficiency and safety knowledge of mill, lathe, waterjet, bandsaw, hand tools, laser cutter, CNC, and many more.

Little Beavers Running Club Cambridge, MA
Athlete Coordinator Sep 2019 – May 2022
- Part of the leadership team for organization promoting friendship and exercise for children with autism in the Boston area.

Gordon Engineering Leadership Program (GEL) Cambridge, MA
Gordon Engineering Leader Sep 2021 – Dec 2021
- Participated in selective leader development program focused on training to be effective leaders of industry engineering teams.

TA and Mentor in Mechanics and Electricity and Magnetism Cambridge, MA
MIT Physics Department Mentor Feb 2020 – Present
- Mentored three to five first year students per semester, meeting with them on a weekly basis and often drastically improving their grades in the class over the semester.

Awards

International Design Competition Prize 2021
De Florez Competition 1st Place in Undergraduate Science and Design 2023
Dean Horn Award for Undergraduate Study in Marine Research 2023
Sigma Pi Sigma – Physics and Astronomy Honors Society
EUSPEN Heidenhain Scholarship 2025

Skills and Extracurriculars

Varsity Soccer Sep 2019 – Nov 2022
Varsity Openweight Rowing Oct 2022 – Nov 2023
Technical Skills: CAD (SolidWorks, Fusion 360, Rhino and Grasshopper), FEA, CAM, CFD, MATLAB, Arduino, Python, Java, Web Development, Machining
Other Activities: TA for Thermal Fluids Engineering I, Resident Peer Mentor, Front Desk Worker, Dorm Floor Leader