My mission as a researcher and teacher is to help people see beauty in the mundane through science as I do. I often find myself surprised by how much can be explained through mechanics, one of my academic interests since high school. The thrills of finding elegant solutions to complex problems and simple explanations for everyday phenomena are what continue to attract me to the field today.

Set tone of personal

Mechanics has been the common thread in my research over the past four years, but the breadth of the field has allowed me to take on projects ranging from micromechanics to biomedical engineering. My work in these relatively new and exciting areas along with encouraging supervisors have allowed me to push myself beyond the conventional undergraduate education and make great contributions to both basic and translational research. One such contribution was helping bridge the gap between micro- and macrotribology and understanding how small scale effects can manifest in large-scale applications such as the James Webb Space Telescope (JWST). Under the supervision of Prof. [redacted] and Dr. [redacted] at the University of [redacted], my project was to characterize the adhesion between AISI 440C stainless steel and an MoS_2 -based lubricant used on spacecraft. I developed a protocol for functionalizing atomic force microscopy (AFM) probes with stainless steel microbeads as small as 10 µm, then used them to experimentally measure adhesion forces between the microbeads and MoS_2 . Dr. [redacted] and I then used MATLAB to geometrically interpenetrate 3D AFM images of the microbeads and MoS_2 to model the experiment, allowing us to extract the work of adhesion from the measured adhesion forces. This quantity was then used by our collaborators in France to simulate the wear of the lubricant. Altogether, the work of adhesion and the simulations it informed enabled the engineers working on the JWST to better understand the properties of the lubricant. This helped them appropriately coat bearings and joints in the JWST to keep it running smoothly for the duration of its mission. In addition, the geometric interpenetration method Dr. Colas and I developed can be applied to almost any pair of engineering materials, which enables researchers to study practical, macroscopic systems on the micro-scale. I first presented this project at Undergraduate Engineering Research Day (UnERD) [redacted] and won runner-up in my category. I was also grateful to receive grants from both my department (MIE Summer Research Award) and the Natural Sciences and Engineering Research Council of Canada (NSERC USRA). Ultimately, I first-authored a paper on this project in *Advanced Engineering Materials* in [redacted]. [1]

Unifying theme for

Specificity and walks through the types of work performed

Outcome of work

Merits of work highlighted through

Connects with previous experience, tells a story

The research skills I developed through my MoS_2 project served as a springboard for my Professional Experience Year (PEY), a co-op program which gave me the opportunity to work full time as a researcher. Here, I tackled the problem of medication compliance by applying mechanics to design and prototype two self-deploying structures that reconfigure at engineered temperatures by changing their mechanical properties. I was supervised by Prof. [redacted], Dr. [redacted], and Prof. [redacted] at MIT, whose previous work on therapeutic drug delivery in the GI tract laid the groundwork for this project. In particular, the devices I worked on can reside in the stomach for days or even weeks and release medication, then reconfigure for safe passage after the patient drinks a prescribed volume of warm water. Thus, the devices minimize the burden on patients to remember to take their medication by giving them a single dose that lasts a relatively long time. This is especially helpful for patients living in developing countries or diagnosed

Shows knowledge of technical details and impacts of work

Highlights key discovery of work →

Walks through design process

with debilitating mental illnesses. Our design process involved initially brainstorming a few designs, then rapidly prototyping them using a wide variety of techniques to converge on a method that was fast and produced high-quality parts. I then performed mechanical tests on those parts and discovered that they weakened much more in response to instantaneous temperature changes than to being submerged in simulated gastric fluid for up to two weeks. This proved the principle of operation of our devices—we could indeed design them to deploy at body temperature, then weaken and thereby reconfigure at a higher (but still safe) temperature. Eventually, we tested prototypes *in vivo* using a large animal model, which is still one of the most unique experiences I have had as a mechanical engineer. Yet the most rewarding part of the *in vivo* tests was finally showing that our devices, driven by basic mechanical principles, work and thereby represent a major step toward solving a serious problem in medicine. I am also proud to second-author a paper on this project currently under review for *Science Translational Medicine.* 2

Paints a picture, is memorable

Looking toward my future, I believe that graduate studies at MIT would foster my passion for understanding the world we live in through the lens of mechanical engineering. In particular, Prof. Bischofberger's work deeply speaks to me given that it has to do with patterns in nature and scientific beauty, even more so because it is anchored in fluid mechanics and soft matter. That being said, I could also see myself working with Prof. Chen or Prof. Wang, whose research on nanomaterials stands to benefit society in a direct way through improving the way we extract, convert, and use energy. In my opinion, materials are the cornerstone of any good technology, so I would be eager to develop and characterize a new class of materials with their guidance.

Answers what do you expect from your PhD? and why MIT is a good fit

Lays down groups of interest and why

Presents a compelling vision/opinion that justifies interest

Above all else, a MIT PhD would help me achieve my long term career goal of becoming a professor, the position in which I can best see myself accomplishing my mission to show others the hidden beauty in everyday life through science. I feel ready to step into a challenging PhD program, and I owe it to those who have helped me reach my potential thus far—my community of family, teachers, and friends—to continue improving myself, make my mark in science, and inspire other through my unique worldview. I would be honoured to make MIT a part of that community yet again.

Long term trajectory/ vision connected to initial paragraph