

## **Thesis Project Portfolio**

### **Dual Injection Syringe for Ultrasound-Guided Musculoskeletal Injections**

(Technical Report)

### **The Triple Helix Model of Innovation and its Impact on Academic Entrepreneurship**

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science  
University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree  
Bachelor of Science, School of Engineering

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## **Sociotechnical Synthesis**

Ultrasound-guided musculoskeletal injections are a common procedure administered in both family medicine and sports medicine. However, this process is arduous for both the physician administering them and the patients receiving them. These procedures are plagued by inefficiency and discomfort experienced by both parties involved. These shortcomings call for a device that can alleviate these pain points and advance both fields.

The Triple Helix Model of Innovation portrays the interrelatedness of academia, the government, and the economy and how they work together to market academic innovation. The Triple Helix is a framework that can be utilized to reveal the frequency and fashion of academic entrepreneurship within a university setting. Through academic entrepreneurship, technologies and innovations can be produced to aid procedures like ultrasound-guided musculoskeletal injections and further schools of thought.

For my capstone project, my team and I were tasked with creating a double-barreled syringe to improve the administration of ultrasound-guided musculoskeletal injections. We were aiming to create a device that would enable one hand injections, to aspirate different media into each barrel, and to inject different media out of each barrel, all without mixing. Furthermore, we intended to let physicians in the field try our device, and to obtain a provisional patent for our device.

My STS thesis examined the Triple Helix Model of Innovation and the role it played on encouraging or discouraging academic innovation to be commercialized.

In particular, academic entrepreneurship outside the US was investigated, an interview with an academic entrepreneur was conducted, and the Michigan State University Bioeconomy Institute was inspected. These case studies were chosen to shed light on how other countries approach academic entrepreneurship, to gain valuable insight on the thoughts and feelings of an innovator inside academia, and to give an example of a successful entity that turns academic knowledge into transferable goods. All of this was done in hopes of comparing what other entities did well to apply to the current system in the U.S.

Ultimately, my capstone team and I got stuck in a loop of prototyping our double-barreled syringe device. Because of the pandemic, we weren't able to meet and 3D print as much as we had hoped for, and as a result we didn't arrive at a final device. Without a device, we weren't able to test our device with physicians, nor were we able to obtain a provisional patent. If one were to continue my STS research, I would suggest conducting interviews and research with key stakeholders within the university setting (professors, researchers, deans, etc.). My research suggests encouragement from academia and the actors inside it is one of the most crucial factors to catalyze the production of academia-based innovation.

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