

## **Thesis Project Portfolio**

Exploration of the Structure and Integrity of Keratin Molecules in Conditions Created by  
Irradiated Wound Beds  
(Technical Report)

Exploration of the Disruptive Effects of Brain Computer Interfaces in the Context of Body  
Modification  
(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science  
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In Fulfillment of the Requirements for the Degree  
Bachelor of Science, School of Engineering

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## **Socio-technical Synthesis: naturally derived biomaterials and brain-computer interfaces**

My technical project and my sts research are connected primarily through the application of biomaterials and its derivatives on medical and recreational uses. My technical project explores implantable materials and my research project extrapolates the application of implantable materials in an increasingly technological world. My technical project works with the bioactive molecule keratin, and how it is able to enhance the way the body heals itself when implanted or placed inside the wound bed. My sts research project takes the idea of implanting an object or material, but evaluates the addition of electrical components and its role as a disruptive technology. Specifically my research project discusses what impacts Brain-computer interfaces (BCIs) would have on personal rights and the greater society. There is a small connection between the two in the aspect of implanting foreign objects into the human body, with the key difference being keratins application medically and BCIs application recreationally.

In recent years, the nanotechnology industry has exploded, and medical nanoparticles are changing the way in which we treat patients and regenerate tissue. My technical project explores the use of bioactive keratin nanoparticles to treat radiation dermatitis normally present in cancer patients that receive radiotherapy. Radiation Dermatitis is a common side effect of radiation therapy, and most commonly results in aggravated and inflamed skin, but here is a minority of patients who experience severe symptoms such as skin atrophy, desquamation, and skin ulcers. Keratin is already used for a variety of chronic wounds but my team was tasked by molecular biologicals to evaluate its effectiveness against radiation. We had to determine a few key differences between chronic and irradiated wounds and test keratin when subjected to those differences. With evidence from past literature we were able to support keratins use and encourage further testing such as animal trials.

My sts research paper takes the idea of implantable materials from my technical project but considers the objects effects when it is not medically necessary. The topic of BCIs is brought up by detailing a brief history of body modification and our societies inevitable tendency to lean into technological integration. BCIs are being popularized with the support of the company Neuralink which

aims to treat paralysis and create second method of communication with smartphones, but the potential effects of BCI creation make this technology extremely unpredictable and therefore disruptive. In my research paper I discuss the inherent and use politics of this technology and how I believe it is a disruptive technology. The paper considers the fact that disruptive technologies completely change the way we do things and touches on the changes in the actor network due to these changes. I conclude that the most important consideration before the popularization of BCIs is the positive and negative effects that the technology will have on a person's bodily autonomy.

Working on both of these projects at the same time only benefited my sts research. This is because the findings and limitations I received from the technical project were able to provide examples and give realistic limitations for technologies like BCIs. My sts research had little to no effect on my technical project because I was unable to apply the recreational use of implants from my research to the strictly medical applications required by my technical report. My technical report was also heavily focused on biochemical interactions, while my research project was focused on electrical and social impacts in addition to the biochemical impacts. In summary, working on my technical project allowed me to become extremely well informed on the medical aspect of BCI integration, while the motivation for studying the remaining effects of BCIs was mainly curiosity.