

**A Virtue Ethics Analysis of the Programmers of the Patriot Missile System**  
**Machine Learning Algorithm for the Analysis of Cardiac Tissue Cross Sections**

A Thesis Prospectus  
In STS 4500  
Presented to  
The Faculty of the  
School of Engineering and Applied Science  
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Bachelor of Science in Biomedical Engineering

By  
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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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## **The Ethical Orders Around the Usage of Nanotechnology**

### **Overview:**

Nanotechnology is derived from the roots of physical, mechanical, and chemical analysis; it uses engineering design to discover new and emerging tools that can be expansive across many fields and disciplines<sup>1</sup>. I am infatuated with the thinking that goes behind the creation of the unique devices in addition to the methodology needed to fundamentally depict it. In this essay, I will discuss this, and development of nanotechnology and the steps taken to the point we are in today. I will be using this as a cross reference to elucidate the risks and benefits of nanotechnology and any safeguards that can be used to ensure safety and examining the overall scrutiny by the public eye<sup>2</sup>.

### **Positionality:**

My personal aspirations stem from my family - more specifically my lifestyle growing up. My identity over the years depended on the area that I lived in. I did not always associate myself with the color of my skin. Born in London, I tended to identify with the culture there the most. However, having spent most of my life in London, Qatar, and Houston - I was consistently exposed to diverse groups of people. I always attempted to absorb the cultures I did not understand and try to adapt to new surroundings. Most of my family worked in engineering, so I always wanted to be amongst them as I saw firsthand the work ethic they had. I soon learned I wanted to be involved in a field more lucrative and directed towards nanotechnology as I wanted to be involved with blood, honoring my late aunt. My educational journey has always been driven by my passion to aid others.

### **Problematization:**

Nanotechnology has offered a plethora of benefits to society, ranging from the usage of highly tailored materials for construction projects to specified hydrogels that contain biological material<sup>3</sup>. Despite this, the gap in knowledge with research and public knowledge growing, which includes distrust in the usage of the technology. This poses a risk to the advancement of the technology, especially in terms of funding, further human clinical trials, or even applicability into real world problems.

### **Guiding Question or Main Argument:**

The question looking to be answered is how does current societal understanding of nanotechnology shape their willingness and perception to support it.

### **Projected Outcomes:**

I will address this problem by doing a literature review throughout the growth of sectors of nanotechnology as well as including societal perspectives by including public discourse from blogs, posts, and review articles. I intend to cross reference each one and contrast the risks and benefits toward the public feelings. This would allow me to incorporate a policy or procedural application that can be added to reduce the gap between trust of the public and the research continued<sup>4</sup>. The benefactors of my research would be primary civilians but also the people continuing this research. It will give them an idea of potential benefits from a civilian standpoint and from a researcher how they can be more transparent with their work.

### **Technical Project Description:**

During my second-year summer, I worked on an extensive research project aimed at developing antibodies for detecting atherosclerosis. I found the work meaningful and innovative at the time but, in retrospect, my team took several risks without fully understanding the implications of our actions. Despite having spent only four months developing the method, we jumped into the lab, eager to make a name for ourselves, which was not the best decision for a group of 12 undergraduate students with little guidance. Although the experience was valuable, I feel that I did not fully comprehend the nature of the work we were doing, such as genetically engineering an antibody for detection purposes. This required creating a complex composition of multiple variable regions that needed to be synthesized separately before being combined. Achieving the necessary sensitivity to avoid contamination or reactivity between molecules required intense training that we did not possess. As a result, I would like to conduct interviews to determine whether the current approach to nanotechnology is correct and appropriate.

### **Preliminary Literature Review & Findings:**

The articles revolve around the field of nanotechnology and its application in healthcare. The article ranges from input from directors of scientific research such as Samer Badya who explores the history of nanoscience and its breakthrough<sup>5</sup>. This is then shared with assistant professors of biotechnology and analytical chemistry such as Sumaira Anjum and Arnaud Pallotta. They both emphasize the significance of healthcare and its innovative developments as well as the importance of nano-systems and the integration with the body in order to treat genetic disease, gene therapy and drug delivery<sup>6</sup>. The articles depict the importance of nanotechnology in healthcare and the various applications it offers, as well as shed light on the evolutionary growth of the field over time while evaluating the potential risk and benefits posed by nanomaterials and devices. They raise questions such as whether we should be more concerned about functionality, or the risk of the devices being made. These articles also highlight potential risk and lack of understanding of the interaction especially with the usage of nanotechnology with the body, examining the failures accumulated by nanomedicine design and the feasibility to redesign it<sup>7</sup>. They provide insight into the challenges and risk associated

as well as the need for more research in these underlying designs. Overall, these findings implore valuable insight for understanding the implications of nanotechnology in healthcare and the potential to transform the field.

### **STS Project Proposal:**

Science and Technology Studies, otherwise known as STS, is a recently developed field. Its basis was in the early interwar period where sociologists and scientists had lingering fascinations about scientific knowledge, technological systems, and society<sup>8</sup>. STS in today's world is essential in academia to merge the constants of research on the nature and practices of science and technology. Typically, the approach of this is based on social institutions that have distinct structures, different sets of commitments, and practices. It also examines the impact and controls that stem from science and technology with a focus on the risks, benefits, and opportunities they pose to society<sup>9</sup>. This is done by asking questions about funding, technological decision-making, patenting of life forms, risk assessment, safety standards, and communication with the public.

STS means cross-disciplinary integration and building connections between different sets of disciplines, which enables students to create more robust understandings of specific problems. This is caused by an emergence of a response to the need for cross-disciplinary integration with civic engagement and critical thinking especially in today's research to prepare us students to reflect more to contemporary challenges<sup>10</sup>.

Overall, STS teaches students how to evaluate analytically and ethically the benefits and risks in science and technology. This allows us to be better equipped to understand the roles they play in society. I believe my project is an STS project because it will help to understand and clarify the risks and benefits of nanotechnology in reference to its history and development. By using literature review it allows me to create construct thoughts into a reformed manner.

I anticipate focusing on the approach of ethics and values. I want to analyze the safety and risk that nanotechnology poses to the world. Similarly, the level of trust that the public has in these materials and the privacy that is hidden in research from them. I also plan to propose policies that could be done by the government to ensure a more publicly envisioned research and applicability of nanotechnology is being presented. Tangentially, in the long run I would like to focus on the capability of continuing such research<sup>11</sup>. Especially in the application using these methods towards healthcare, and the development of elongation the average lifespan. The primary authors I will be using are Samer Badya who explores the history of nanoscience and its breakthrough to assistant professors of biotechnology and analytical chemistry such as Sumaira Anjum and Arnaud Pallotta. They give a vast amount of knowledge about nanotechnology and their applicability which will be useful for healthcare and ethics<sup>12</sup>.

Care ethics theory is the moral decisions based on empathy, responsibility rather than abstract principles and rules<sup>13</sup>. This intertwines with the values of risk analysis. I anticipate using these theories to cross-analyze the risks and benefits with nanotechnology as well as the decisions

that go towards making such devices<sup>14</sup>. This will allow me to gauge the rationale behind the decision people make in terms of nanotechnology and the feats alongside their decision-making skills. I know this may be controversial to use together but understanding perspectives on risks of this technology with what people value in terms of care ethics will allow me to further analyze their concerns and comfortability with such technologies.

For the main method of conducting this research, I plan on using literature review and analysis. By doing so, it will allow me to really dive deep on the risks and benefits of nanotechnology. With the amount of time that I have, this will give me the most amount of analysis over all the information that there is on nanotechnology<sup>15</sup>. Similarly, I plan to conduct interviews to see how the public, students my age, know about nanotechnology and their feelings towards it as of now.

### **Barriers & Boons**

In terms of limitations, I am held back mostly in time constraints. I ideally am only given one full semester worth of research on construction around this project. Secondly, there is also a small amount of bias that will be inputted as it is impossible to not hold any at any given time. I also need to determine which audience I want to target to ensure that my message is not confused amongst other scientific researcher as an attack on their work. Similarly, I do not have that many experiences holding interviews and my method or dissecting literature may not be the most practical. So, what I may get out of reading something maybe misconstrued as wrong or impartial. Though I hope to not let any of my biases get in the way of crafting something clear.

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