

Thesis Project Portfolio

Production of Adalimumab: A Humira® Biosimilar
(Technical Report)

**The Attractions of Homeopathy: Understanding the Factors Contributing to Medical
Misinformation**
(STS Research Paper)

An Undergraduate Thesis

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Brandon Hudson

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Department of Chemical Engineering

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Sociotechnical Synthesis

The presence of a system to care for the sick and vulnerable members of a society is a mark of any civilization. In the United States, this system takes many forms, but all are concentrated around reducing the prevalence of disease. This portfolio details a technical project and a research paper that are mutually centered around meeting the needs of a patient, both in medical effectiveness and in the trust associated with the therapy. In this, the technical project documents the design of a facility for the manufacture of an adalimumab biosimilar and the research paper shows the factors that promote disinformation in the field of medicine. Through demonstration of the design of an adalimumab biosimilar manufacturing plant, it is shown that the process of making this medicine can be made cheaper and more effective through the use of a fully continuous process, as opposed to a batch process. The research paper will answer the question: What factors cause disinformation to contribute to homeopathy use in the United States? From answering this question, the future of medicine can work towards building a trusting relationship between patients and medical practitioners.

Adalimumab is a monoclonal antibody (mAb) produced by AbbVie under the brand name Humira®. This mAb is used to treat inflammation and autoimmune disorders through blocking TNF- α , a certain chemical signal that is overproduced in people with those disorders. Humira is consistently one of the highest grossing pharmaceuticals and this can put a serious financial strain on the patients that desperately need it. However, its patent is set to run out soon, opening up the market to biosimilars, proteins with slightly different structures but nearly identical biological function. Additionally, this opening also allows for the process for production to be changed. Seeking to drive the cost of the drug down when the patent expires in 2023, we have designed a facility to continuously produce an Adalimumab biosimilar. In order to

accomplish this, the design details the scheduling and use of perfusion bioreactors, feed-and-bleed crossflow filtration, and periodic counter-current chromatography columns. These technologies, which are relatively new to the production of biological drugs, also serve to drive down costs by minimizing down time allowing the manufacturer to produce the drug for approximately 30 days without stopping. These savings can then be passed on to the patient, opening the door for more financially disadvantaged people to have access to this drug.

Alternative medicine is a growing industry that is often used to supplement or replace scientifically based conventional medicine. Homeopathy is one type of alternative medicine that a large number of people currently use. To gain a greater understanding of the motivations for homeopathy use, this research addresses the question “What factors contribute to disinformation surrounding homeopathic medicine use in the United States?”. Using the Actor-Network Theory framework, connections are made to how social media and current medical practices influence the usage of homeopathy. Results from this study are that the history and limitations of Western medicine help add to the fears surrounding medicine, helping fuel disinformation. Additionally, the use and popularization has provided a platform for further expansion of this disinformation, effectively widening its audience. All in all, an important result of this research will be the role of trust in adoption of technologies, especially in the field of medicine.

Together, these projects shed light on two unique ways disease can be reduced in the United States. While the technical project shows how this might be accomplished through technological means, the research paper seeks to understand the reasons of those who seek to use a slightly more unconventional treatment. This dual approach to this problem gives a broader understanding of the attitude towards health in the United States to the reader by combining a technological perspective with a social one. This reflects the reality of the situation, that health is

not a simple one-dimensional problem that can be solved with a better technology or an outreach program. Instead, multiple solutions must be considered simultaneously to reduce disease prevalence.