Thesis Project Portfolio

Simultaneous Production of FAME Biodiesel and Lutein Nutraceutical from *C. vulgaris*

(Technical Report)

Media Framing of Cultivated Meat

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

The overarching motivation for my STS and capstone projects stemmed from an interest in the technological aspect of addressing global environmental challenges. This resulted in investigating technologies that serve as sustainable alternatives to traditional methods and processes. My capstone project involves the design of a manufacturing plant to produce biodiesel and the nutraceutical lutein from microalgae. Biodiesel serves as a renewable substitute for petrol diesel used by vehicles and lutein is an important nutrient used to promote eye health. While these products have significant potential to assist in meeting the growing energy and nutritional demands of society, these concepts remain confined to the laboratory setting and have yet to be implemented on an industrial scale. The integration of emerging environmentally friendly innovations from development into the market and everyday life is dependent on public acceptance. This drove me to examine how media framing can impact how consumers perceive cultivated meat in my STS thesis. Biofuels and cultivated meat are both aimed at preserving and enhancing existing consumption practices. Studying how the public responds to cultivated meat through media portrayal can provide insights applicable to future sustainable technologies such as algae biodiesel.

My capstone project consisted of developing a theoretical algae farm and biofuel refinery plant to synthesize biodiesel and lutein from the microalgae *Chlorella vulgaris.* It was hoped that the economic feasibility of the plant would be increased by generating a high value byproduct in lutein. The recommended design is built upon Aspen Plus modeling, research literature, and chemical engineering principles. The process begins with algae cultivation and harvesting. The algae is grown in open raceway ponds containing a nutrient media formed from swine waste. During harvesting, algae is concentrated via dissolved air floatation. Bead milling was used as a

cell disruption method to release lipids from within the algae, and the mixture was dried to facilitate efficient downstream processing. Lipids were extracted via solvent washing using chloroform and methanol and were reacted in a two-step acid esterification and base transesterification to form the fatty acid methyl esters (FAME) that constitute biodiesel. During the esterification reactions, lutein is co-produced as the secondary product of the plant. Separation of FAME and lutein occurs through two liquid-liquid extractions with various solvents. A final distillation was used to refine the FAME to its objective purity while anti-solvent precipitation generated pure lutein crystals. Although this project may provide benefits such as sustainable energy production, health benefits, job creation, and swine waste management, we do not recommend the plant is built due to challenges in economic viability and land use.

My STS thesis considers the way cultivated meat is represented in the media. The media is a powerful influencer of public opinion through the intentional depiction of issues in order to sway societal understanding and reaction, which can subsequently inform policy decisions and industry practices. To study this subject, I examined the websites of Upside Foods and GOOD Meat, two prominent companies in the cultivated meat industry. This included an analysis of the media frames being utilized to promote the adoption of cultivated meat through the lens of sociotechnical imaginaries. I found that the media often emphasizes normalization and societal appeals, seeking to make the product more palatable and familiar to consumers, advocating for a future in which cultivated meat is just as desirable as traditional meat. This pushes the individual consumer to drive the transformation of agricultural practices to benefit society and the environment instead of encouraging change on a broader, systemic level. However, there is still resistance to the uptake of cultivated meat in the form of statewide production and distribution

bans, as well as national advertising campaigns persuading consumers to abstain from purchasing it. This skepticism is often a result of poor education on the product, and possibly competing economic incentives. This research demonstrates the importance of media literacy and awareness among consumers, prompting them to recognize potential biases and underlying motivations when making decisions. Educating the public on cultivated meat may prove to be a more effective approach to increase popularity and adoption. This provides consumers with essential knowledge so they are better equipped to understand what they are ingesting and appreciate the potential benefits of cultivated meat.

Working on my capstone and thesis projects has helped me to realize that technology alone is not sufficient to tackle global environmental, health, and social problems and support wide scale change. The necessary technology often exists, but it is just one piece of the puzzle. Innovations such as cultivated meat and biofuels need more research and development to become commercially viable and affordable, and require public acceptance to be integrated within society. It is imperative that this is accompanied by systemic change, which involves collaboration across diverse stakeholder and social groups and fundamental shifts in individual and community lifestyles. Biofuels and cultivated meat are essential tools but their ultimate impact depends on aligning them with broader transformations in values, priorities, and lifestyles. These projects have additionally given me an understanding of just how difficult achieving change can be. Vested interests, cultural biases, and public skepticism can create barriers that oppose progress but overcoming these obstacles may be paramount in building a more sustainable and equitable future.