

Thesis Portfolio

A Nano-Enhanced Vaccine for Metastatic Melanoma Immunotherapy

(Technical Report)

The Artificial Divide: How Food Additives Perpetuate Cultural and Socioeconomic Stereotypes in the United States

(STS Research Paper)

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Sociotechnical Synthesis

This portfolio contains two projects that seek to address the contrasting views held by the general American public regarding the remedy to disease. Cancers and diet-related health problems, two leading categories of health issues in the United States, are in particular discord. Cancers and other diseases that arise from genetic mutations and produce life-threatening symptoms are deemed to be under the jurisdiction of medical professionals and scientists to fix. On the opposite end of the spectrum, the general public believes individuals with food-related diseases cause their illness through their behaviors and are responsible for their recovery. These illnesses are treated in part, or entirely, through adjusting patient lifestyle, such as type 2 diabetes and nonalcoholic fatty liver disease, which leads people to blame the sick person for the lifestyle that contributed to their health condition. Differing from the traditional view of medicine, this form of patient care requires high patient involvement and responsibility, which adds to blame-placing, and ultimately, stigmatizing individuals and their lifestyles as “causes.” Critically, commonly held societal beliefs impact the quality of care and stigma patients experience.

Both the type of disorder and the perceived cause, real or constructed, create major problems for United States public health, but each pose unique barriers to its affected population. Consequently, the technical capstone project and science, technology, and society (STS) research paper intentionally cover separate topics in order to understand and compare two different problems affecting public health. The capstone project addresses the technological barrier to access for metastatic melanoma treatment, and the STS project investigates the social construction of food technology as causes of diet-related health worsening.

A Nano-Enhanced Vaccine for Metastatic Melanoma Immunotherapy

Many metastatic melanoma patients do not respond to the immunotherapies currently available (Lim et al., 2019). This technical project aims to address the gap in available treatment offering efficacy and an improved quality of life through developing and testing a cancer vaccine, a promising method of immunotherapy, enhanced with nanotechnology for treating metastatic melanoma. Immunogenic, nano-sized liposomes formulated previously by the author are employed in encapsulation of tumor-associated antigens, peptides uniquely expressed on cancer cell surfaces, identified by Slingluff *et al.* for metastatic melanoma (2008). Several central aims are performed and met in this research: 1) nanoliposome stability property characterization, 2) *in vitro* T cell activation nanoliposome testing, and 3) *in vivo* mouse testing for nanoliposome biodistribution and immunogenicity. The immunogenic nanoliposomes are tested *in vitro* in white blood cell cultures derived from patients immunized with the peptides alone in a 2008 clinical trial (Slingluff et al., 2008). The T cell response results from *in vitro* testing and antibody concentration results from mouse serum of the *in vivo* tests offer exciting data that suggest the improvement of cancer vaccine immune responses when this research's custom nanotechnology approach is used compared to the standard methods. The demonstration of extended nanovaccine stability and preliminary *in vivo* mouse model data of nanovaccine biodistribution and immunogenicity make this combinational immunotherapy technique a promising opportunity to address the therapy gap for metastatic melanoma patients.

The Artificial Divide: How Food Additives Perpetuate Cultural and Socioeconomic Stereotypes in the United States

Problems for public health go beyond the absence of a technical solution for patients. In fact, many public health issues are not caused by missing technology but, instead, caused by

present technology whose construction by society causes social harm. A gap exists in analysis of socially constructed food additive technologies from development to their evolving social implications on public epistemology. Studying the generally accepted perceptions of society in regard to chemical ingredients in food is important for understanding how group stereotypes and implicit biases enter, influence, and persist in American sociomaterial networks and culture. This STS research employs a mixed methods approach combining framework elements of social construction of technology (SCOT) and actor-network theory (ANT) to the study of food additive construction. Three case studies and methodologies cover a historical case analysis of the additive MSG, a modern case exploration of the sweetener brown rice syrup, and a case exploring the role of the media and marketing in the fluctuating construction of high fructose corn syrup. Each case pays special attention to social processes and circumstances that introduce or reinforce stereotypes, particularly of racial-ethnic and socioeconomic minority groups, in America. The perpetuation of stereotypes creates social norms and beliefs that increase risk of implicit and explicit bias, blame placing, and neglect of social determinants of health. An issue of equal and quality care arises in public health when patients are members of a stereotyped group or are assumed to be members. Beyond public health, this research illuminates unethical, irresponsible practices by influential actors, like media and food corporations, of stratifying foods as unhealthy and healthy and then limiting certain groups access to “superior” healthy foods.

Although these projects were intentionally separated by their differing motivations, working on both simultaneously proved valuable for holistic insight into each project. Studying the social context of chemical food additive technology caused me to consider the relevant stakeholders and actors involved in my technical capstone project. I realized that developing and

testing a cancer treatment was just one part among an actor-network of many factors, social and technological, influencing patient access to treatment. Engaging in technical research concurrently with sociological research uniquely caused an interdisciplinary approach to both projects. I learned how engineering and scientific problems exist within a complex social context and that analyzing social factors around a problem is critical for creating solutions that are valued and accepted by users. Further, I discovered how collective or individual human actors socially construct and are influenced by technologies. Overall, the complementary nature of studies in science and technology with studies of society offers insight that would not be apparent if the projects were performed independent of one another.

References

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