Thesis Project Portfolio

The Additive Cytotoxic Effect of BMS754807 and BMS599626 on the Head and Neck Cancer Proteome

(Technical Report)

The Impact of Telemedicine on Antimicrobial Resistance During the COVID-19 Pandemic

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

Drug resistance is a widespread issue that arises in many clinical circumstances, resulting in difficulty treating diseases/illnesses. Typically, a small population of the disease naturally contains gene mutations that diminish the efficacy of the treatment, and this immune population continues to grow. Alternatively, diseased cells can activate other pathways as a response to drugs in order to survive. While there are various types of drug resistance, resistance to antibiotics and cancer therapeutics were of interest for the purpose of this thesis.

The technical portion looked into the effect of a novel drug combination used to treat head and neck cancers, as single-target drugs are only successful for a short time before resistance occurs. This combination targeted two receptors in the cell membrane that were shown to play a role in tumor survival and growth in the hopes of more effectively killing the tumor. Prior research has demonstrated the combination's ability to inhibit cell growth, and this project looked more deeply into the proteins that were affected by the drugs. Targeted therapy for treatment of cancer is an evolving field, as current treatment options are invasive and not very successful. Thus, investigation of this combination is necessary to understand how head and neck cancer cells behave, leading to the development of safer and more robust therapeutics.

The STS portion focuses on antimicrobial resistance, specifically analyzing how COVID-19 and over-prescription via telemedicine has impacted its threat to society. The pandemic has increased the use of virtual doctor's appointments and evidence has shown that physicians are more likely to prescribe antibiotics when compared to in-person appointments. Thus, patients are more likely to develop resistance. Eventually, no effective medications will exist to treat basic bacterial infections, leaving our healthcare system and society as a whole in crisis.

This capstone uncovered the scientific and societal impact of drug resistance. I was able to reveal how the drug combination impacts protein expression and paved the way for wet lab

experiments. Future research will provide further understanding of how the drug combination works at a cellular level, focusing on the mechanism of interaction between the two receptors. Research like this will not only be useful in the field of oncology, but more broadly combating flaws in the treatment of many diseases.

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