

3D Bioprinting Pancreatic Cancer Cells
(Technical Report)

Using Practical Ethics to Examine the Case of ‘Cats on Speed’
(STS Research Paper)

An Undergraduate Thesis Portfolio

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Socio-technical Synthesis: The Benefits and the Limitations of Current Medical Models

Before therapies reach the clinical setting, they are extensively using models that function outside of humans. Over the past decade, these models have rapidly progressed so that they are becoming more physiologically relevant. Both my technical and my STS research are connected primarily through these models; however, the two works differ in the way they perceive the current models available. My technical work states that the models scientists have available is not enough to accurately study diseases and thus a new model must be developed, whereas my STS research explores the idea that scientists must continue to use models that are currently available to advance modern medicine, even if it is in an ethically grey-area. Therefore, while the research I've conducted this semester differs in its opinion on current medical models, the overall theme consists of using and creating these models to advance the medical field forwards, thus bettering the lives of many humans.

New research has shown that the use of three-dimensional (3D) cancer models over the traditional two-dimensional (2D) models can lead to significantly different gene and protein expressions, cell morphologies, cell-cell and cell-matrix interactions, and differentiation. Various technologies have been developed to model specific aspects of the complex tumor microenvironment *in vitro* ranging from simplistic spheroids models to more advanced, engineered organoids. These technologies aim to increase the spatiotemporal control in a more physiologically relevant context; however, there are still major challenges associated with current 3D *in vitro* models. As a result, most current models concentrate on reproducing specific, basic functions of the respective tissue instead of macroscopic interactions across interfaces. For my technical project, I proposed a 3D bioprinting approach to overcome many of the aforementioned limitations due to its ability to create complex architectures in an efficient and reproducible manner.

My STS research paper examined a case in which a scientist, Dr. Podell, used cats to conduct research on HIV. Animal rights activists exploded in protests and actually caused Podell to resign from the academic field due to the serious death threats his family received. I argued that Podell was morally correct despite his use of animals and my paper explores the idea of whether or not it is okay to sacrifice the few for the many. I go on to discuss why scientists need to use animals in medical research and what some of the repercussions would be if we were to suddenly stop their use. The goal of my research is to enlighten researcher and those outside of the medical field alike to why animals are needed in research and when their use is acceptable in studies.

While the concluding statement of my STS research declares that Podell's research involving animals was not morally incorrect, my technical project points out the critical need for alternative methods of research, especially for cancer. Working on both projects simultaneously forced me to evaluate the strengths and the weaknesses of utilizing current models available in medical research, thus adding significant merit to my work. My technical work highlighted how current models fail to fully mimic physiologically relevant systems which, as a result, taught me about what components are critical to include when designing a cancer model. On the other hand, my STS research showed me the importance of using current models to advance medicine, despite the ethically grey area that surrounds animal testing. In conclusion, researching my technical project and my STS paper in tandem this past year has allowed me to explore the benefits and the costs of using currently available models in research and better understand their effect on the medical field.