Thesis Project Portfolio

Strain Scout: A novel device for the discovery and validation of novel mechano-pharmacological targets of disease

(Technical Report)

Examining the Politicization of Science Through Uncertainty in Knowledge, Confirmation Bias, and Misinformation

(STS Research Paper)

An Undergraduate Thesis

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Table of Contents

Sociotechnical Synthesis

Physical signals are happening constantly that impact cell behaviors. Muscles in the human body are constantly being stretched or compressed with an example being in breathing and heartbeat. When cells are going through mechanical stretching there are physical changes that produce “a set of biochemical and biomechanical responses that reprogram cell changing cellular processes, such as motility and lineage differentiation, thus critically impacting human (patho)physiology” (Constantinou & Bastounis, 2023). The issue is there are currently no drugs that target physical cues for cells. Understanding cellular mechanotransduction (how cells sense and adapt to stress) can unlock and improve numerous therapeutic treatments potentially improving the lives of countless people. There is a critical need for devices to test the impact mechanical factors have on cells as diseases such as cardiomyopathies, cancer, and muscular dystrophies have all been shown to be impacted by defects in mechanotransduction (Jaalouk & Lammerding, 2009).

Previous devices used to study the effects of strain on cells were only able to culture cells under stretch or image cells under stretch and were not able to do both simultaneously. The primary goal of this technical project is to develop a novel device, Strain Scout, that can apply mechanical stimuli to cells in a high-throughput, automation-oriented way. The device was modeled using Fusion 360 and 3D-printed in acrylonitrile butadiene styrene (ABS) and polylactic acid (PLA) to test various prototypes and designs. A membrane mold was also designed in Fusion 360 and printed in ABS and resin and was used to create a pliable polydimethylsiloxane (PDMS) membrane with a well-plate design for imaging tool compatibility. A successful, innovative device scaffold was made and PDMS was eliminated as a feasible material due to limited pliability. StrainScout will also provide a high-throughput and

automated platform for drug screening and mechano-pharmacology that can potentially reduce the cost and time of drug development and discovery.

The creation of devices like the Strain Scout could revolutionize research in cellular mechanotransduction. However, as with any technological advancement, there's potential for misuse and exploitation. As such, the STS research paper examines how often science is not concerned with morality, it is a tool used to answer questions about the natural world. It is neither good nor bad, with an example being the discovery of fission in 1938. Fission can be controlled using a nuclear reactor to generate electricity. Coincidentally, the chain reaction created by fission was used to create the first atomic bomb (December 1938, n.d.). The knowledge gained from a scientific discovery must be given meaning by society. Unfortunately, after a discovery has been made, it can be exploited to fit certain political agendas. These agendas are often hidden under pretenses. Additionally, scientific findings can be manipulated to support specific ideologies. This STS research paper will analyze the impact social factors have on science, and how science can be exploited to promote certain political agendas for financial gain, power, and control. This will be achieved through the analysis of eugenics, the link between cancer and tobacco, and the COVID-19 pandemic.

Works Cited

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