

Thesis Portfolio

Therapeutic Mitochondria Delivery to Astrocytes for Ischemic Stroke
(Technical Report)

The Effect of Causative Beliefs of Major Depression and Schizophrenia on the Stigma, Treatment, and
Well-being of Patients
(STS Research Paper)

An Undergraduate Thesis

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Thesis Prospectus

Sociotechnical Synthesis

The general topic for the portfolio is an overview of disorders of the brain from the factors that lead to their development to the treatments used to address them. The technical topic focuses on the treatment of neurological disorders by creating a new treatment to decrease post-stroke complications and disability. The STS topic focuses on the development of mental illness and how public beliefs about their development affect the treatment of the disorders. The motivation for both these topics is to improve the lives of those living with different disorders of the brain by identifying ways to improve current treatment methods. In the case of stroke, treatment can be improved by the addition of mitochondria as a novel therapeutic to treat the damage of the disease. In the case of mental illness, specifically major depression and schizophrenia, treatment can be improved by adjusting the mentality and beliefs of the general public and the medical community to decrease stigma towards the disorders.

The technical topic of the portfolio is mitochondrial transplantation to astrocytes for the treatment of ischemic stroke. Ischemic stroke is caused by a blood clot lodged in an artery supplying blood to the brain, and they affect approximately 660,000 people per year in the US alone (Roger et al., 2011; Yang, Mukda, & Chen, 2018). Although there are treatments to remove the clot and replenish blood flow to the brain, current treatments do not address the damage to mitochondria that occurs as a result of an ischemic stroke which continues the ischemic cascade and leads to further post-stroke complications and disabilities. Previous studies have demonstrated that the transplantation of mitochondria from healthy tissue to the damaged cells can increase cell survival and communication. Therefore, the goal of the technical project is to determine which tissue source (cardiac muscle, skeletal muscle, or adipose tissue) provides the most effective mitochondria for maximum uptake and ATP potential in astrocytes of the brain.

We expect to find which mitochondria is the best therapeutic for treatment of stroke and what properties lead to the mitochondria being the most effective. As a result, we will be able to suggest the best mitochondrial transplantation treatment to be used in addition to treatment to replenish blood flow in order to decrease post-stroke complications.

Over the past 70 years, there have been several differing opinions on what factors can play a role in the development of major depression and schizophrenia. These differing opinions have as a result affected the lives of those living these mental disorders. Therefore, the research question for the STS research paper is “How do public beliefs on environmental factors as a causative factor in the development of mental illness affect the stigma, treatment, and well-being of major depression and schizophrenic patients?” In order to conduct the research for this topic, documentary research methods are utilized because they provide a large and unbiased source of information. The analysis for the topic is conducted through the framework of paradigm shift. The paradigm shift primarily focuses on the shift in thinking of considering mental illness only in terms of a chemical imbalance of neurotransmitters to also taking into account the environmental factors that work to instigate their development. Additionally, paradigm shift is used to analyze how the views of medical education and the medical community fall behind that of the general public. The research outlines what the most influential environmental factors are to the development of major depression and schizophrenia and how public belief of environmental factors affects stigma towards patients with the diseases. Additionally, the content of the paper can help to educate both the general public and the medical community about the role environmental factors play in the development of the mental disorders so that they can be better considered in the treatment and prevention of both major depression and schizophrenia.

The synthesis of working on both projects simultaneously provided a more holistic look into neural engineering. The technical project focused solely on the engineering, science, and medical aspects of brain disorder while the STS project focused more on the psychology that affects those with mental illness. Working on both projects together created an opportunity to think of all disorders of the brain in respect the science and engineering that affects the pathologies of the diseases and also the psychology and sociology that affects the lives of those patients. As a result, the portfolio presented represents a synthesized view of the brain that incorporates aspects of neuroscience, neural engineering, psychology, and sociology.

References

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