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Mr. Speice

Independent Study and Mentorship- 3A

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Research Assessment 8

Subject: Tissue Engineering

MLA Citation:

Shinoka, Toshiharu. “Tissue- Engineered Blood Vessels in Pediatric Cardiac Surgery.” *Yale Journal of Biology and Medicine*, no. 81, 208ADAD, pp. 161–166.

“The Fontan Heart,” director. IHeartChange, 22 Feb. 2015, www.youtube.com/watch?v=1bmq2ewfyyw.

Assessment:

For this assessment I chose to research something more specific, innovations within pediatric cardiac surgery. I found one article on tissue engineered blood vessels, which I chose to deeply annotate to truly understand what this article was saying. This article was found in Yale’s Journal of Biology and Medicine, a highly credible source, spoke of solutions to a the modified Fontan procedure to fix single ventricle anomalies.

The article began by speaking of congenital heart disease, which I had previously researched before. It however spoke specifically of single ventricle anomalies, a cardiac anomaly I had a very limited knowledge on. I learned that all single ventricle anomalies has one ventricle of adequate functional size, and result in tricuspid atresia, pulmonary atresia, and hypoplastic left heart syndrome. This results in the mixing of deoxygenated blood from the pulmonary

circulation and oxygenated blood from the systemic circulation. This abnormal circulation causes chronic hypoxia, cyanosis, and possible blood volume overload. According to this article, 70% of infant mortality is associated with single ventricle anomalies. The article followed by speaking of the surgical treatments for single ventricle anomalies, and the limitations of this treatment with the use of vascular conduits. I learned of the goal of this surgery: “to separate the pulmonary circulation from the systemic circulation”. This prevents the mixing of oxygenated and deoxygenated blood and blood volume overload on the heart. This treatment can be obtained through the Fontan operation. This operation has gone through several modifications to improve the quality and extended the lives of patients. However, a major cause of morbidity and mortality is the conduit used to connect the inferior vena cava to the right pulmonary artery. After discussing several different types of conduits and why they do not work, the author that the best long term results have been obtained from autologous tissue. The article then expands on autologous tissue and its effectiveness. The author author also states that a reason that autologous tissue is not widely used is due to its limited supply, which results in the use of synthetic or biological conduits. A solution to the lack of autologous tissue is tissue engineering, which allows for the construction of autologous grafts. Tissue engineering works by seeding autologous cells onto a biodegradable tubular scaffold. This scaffold as mentioned by the author is a site for cell attachment and neotissue formation. The article expands on the process of building the perfect scaffold and the best autologous cells for use. They came to the conclusion of using autologous cells obtained from bone marrow. The author then explains their clinical trial process and finished with a conclusion on the importance and impact of tissue engineering.

This article sparked an interest in stem cell researched and tissue engineering in pediatric cardiac surgery, something I could possibly do with Independent Study and Mentorship through my mentor. I was also able to learn more about single ventricle anomalies, which I had not really researched before. It also gave me the opportunity to learn about the Fontan operation, something I hope to someday do. Before reading this article I had a more general idea of what possible things I would be achieving with this career, with the opportunity to learn about an innovation like tissue engineering I am able to grow and learn with this topic and spark a possible original work idea.