

Thesis Portfolio

The Physiological Effects of Various Vasoactive Agents on Mouse Ear Microvasculature

(Technical Report)

The Historical Significance of Viral Therapy and How it has Shaped the Current Field in Cancer Treatment

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

Introduction

The medical industry is ever changing, and while many are looking to the future for the next scientific innovation, I believe some of the secrets to innovation are hidden in the past. Plastic surgeons around the world use vasoactive agents multiple times a week for their procedures. Vasoactive agents are inotropes and or vasopressors. Vasodilation widens the blood vessels due to the relaxation of the smooth muscle cells of the vessels (*Vasodilators—Mayo Clinic*, n.d.). Vasoconstriction is the narrowing of blood vessels; thus, slowing the blood flow (*Vasoconstriction: MedlinePlus Medical Encyclopedia*, n.d.). Not much is known about these vasoactive agents outside of whether it is a vasodilator or vasoconstrictor; thus, a surgeon using an agent may not truly know how long the drug stays in the system, whether or not there are other physiological effects outside of altering vasculature diameter, and the dosage depending on the procedure type. Much is still left unknown about these agents that surgeons and doctors everywhere have been utilizing for decades. How can we expect to move forward if we do not understand the past and present of the medical world? The same can be said for the field of Virotherapy. Today, this field of cancer therapy is a promising option for treatment; especially in tandem with other therapies. However, while Virotherapy is promising today, it was also a promising field over 50 years ago, and yet the field fell into a period of abandonment. To better comprehend the current state of the field, and any potential obstacles advancement of Virotherapy may face, the causes of the previous field-wide abandonment must be determined.

The Physiological Effects of Various Vasoactive Agents on Mouse Ear Microvasculature

The physiological effects of nitroglycerin, diltiazem, and lidocaine will be observed to determine base dosage, peak effects of the agents, and when the agent leaves the system. A

model to replicate the physiological effect of each drug in the microvasculature of a mouse ear has been developed. Our advisor uses vasoactive agents when transplanting tissue flaps amongst other reconstructive surgeries to ensure the success of reconstruction. A successful reconstruction depends partly on ensuring the vascular vessels, or pedicles, supplying the tissue are active and attached well (*Microvascular Lifeboats*, n.d.). Vasoactive agents can be directly applied to these pedicles to avoid spasming, kinks, or clots which can lead to thrombosis and ultimately failure of the reconstruction. Vasoactive agents are also applied topically to aid in healing after surgery followed by wrapping of the site (Zhang & Chen, 2016). Deeper understanding of each of these vasoactive agents will aid doctors in making the right, informed decision that is best for their patient's specificities. The project is currently using eight female, albino mice. Doppler imaging technology will be utilized to image the ear. It does not simply take pictures of the mouse ear, but it examines the blood flow rate through the imaged vasculature. After the mice have acclimated to the UVA vivarium setting, experimentation occurs. This experimentation falls under two categories of injectable versus topical agents. The injectable agents are observed every 10 minutes for the first hour following injection, and then follow-up observations at the four, six, and 24-hour mark. The topical agents are further divided into two subcategories of applying tegaderm to the ointment or simply the ointment. The tegaderm is applied to help ensure that the mouse does not attempt to remove the topical agent. The topical agents are monitored three hours post application in hopes that the agent has fully absorbed into the skin, with a follow-up at 24 hours post application. Currently one of the injectable agents and one of the topical agents have gone through the whole experimentation process, and the next half of experimentation will commence mid-March.

The Historical Significance of Viral Therapy and How it has Shaped the Current Field in Cancer Treatment

Virotherapy was a new cancer treatment in the 1960s. Virotherapy reprograms viruses into oncolytic viruses that target and attack cancerous tumors. However, by the late 1970s and early 1980s, the field had been abandoned. To project the growth of the field in the coming years, it must be determined why the field fell into decades of lack of advancement, and prevent this field-wide abandonment again. Investigating the funding surrounding the Virotherapy field from the 1960s to the 1980s and again in recent years, as well as those that controlled said funding, the House Committee on Science, Space, and Technology, will aide in determining whether the field was deserted due to the limited technology of the time, or if it was due to the public opinion of viruses turning especially negative and cautious at this time that in turn caused the funding to dry up. Examining what the media outlets of said times will hopefully shed some light on this question. Two leading scientists in the Virotherapy field will be interviewed to gain a more personal perspective on the abandonment of their field. Actor Network Theory and Politics of Technology will be utilized to analyze the research and determine the leading cause of fieldwide abandonment in the 1970s. Knowing that in this day and age that media so strongly influences not just the greater public's opinion; but also has a say in what the scientific community is researching, is vital when it comes to formatting an experimental plan.

Conclusion

Conducting research into the history and past of two different medical fields simultaneously has further emphasized how most innovation in the scientific world is just building off of a previous idea. Virotherapy grew out of gene therapy and as the field of gene therapy has grown, as has the field of Virotherapy as the foundation of both fields are strikingly

similar. Vasoactive agents of the past have not been utilized correctly or to their greatest potential due to the lack of knowledge surrounding these agents. It is shocking that doctors and surgeons are okay utilizing these agents with this limited understanding. This behavior is very reminiscent of that surrounding doctors trying to cure cancer from the late 19th century to the mid 20th century; slightly unethical at best.

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