

Last summer, I began my research internship in Dr. Hagberg's Cardiovascular Health and Disease Research Laboratory in the Kinesiology Department in the School of Public Health at the University of Maryland. During the first week, I met with my primary advisor and mentor, Daniel Shill, a Ph.D. candidate. We discussed his ongoing research and possible projects I could do to contribute to the lab. I explored the discipline of cardiovascular disease and exercise physiology by reading a couple articles that he provided. The work being done on perivascular adipose tissue (PVAT) struck me as a unique topic to investigate since it was a relatively unknown biological field with direct impacts on both cardiovascular disease (CVD) as well as obesity – both are epidemics that plague our society today. My specific research query formed after learning more about CVD and obesity cures involving adipose tissue reduction. After discussing this line of inquiry with both Mr. Shill and Dr. Hagberg, the primary research question became: ***How do beta-adrenergic agonists impact perivascular adipose tissue growth?***

The research process began with understanding all of the terminology and literature related to both PVAT and beta-adrenergic agonists. Mr. Shill provided me with tens of articles to build a solid foundation upon which I could advance my questioning and research. Mr. Shill also helped me navigate the UMD library website which was incredibly helpful and full of fantastic journals and articles which were integral to the formation of my new knowledge base. Though Mr. Shill and Dr. Hagberg provided guidance and advice throughout the entire process, 75% of the research was done independently. Dr. Kuzmiak-Glancy provided guidance on the experimental design process since she works primarily on animal studies.

The majority of my resources were found on PubMed which is a very useful database created by the National Library of Medicine. After searching key words, I would find articles

relevant or tangentially related to my interest and look at the citations to find the literature that the most current research was based on. Throughout my search I also relied on authors who had many publications in the field of interest. I found that authors who had published about PVAT expansion and beta-adrenergic agonists were likely to write about other relevant research that could be useful for my project. Though PubMed is considered a free database, I would not have been able to access 90% of articles in their entirety without the support of UMD libraries.

Without utilizing the resources offered by UMD libraries, the research process would have been a large financial burden, beyond the research budget I was given.

After compiling a long list of useful articles, I proceeded to evaluate their credibility and usefulness. I looked for three primary components: quality of the journal, citations, and recency. In academia, most scholarly publications are peer reviewed by a panel of experts in the field, to guarantee the information is correct and accurate. Reproducing experiments and scrutinizing the methods and results of the paper are primary components of the process. However, some journals are regarded as more impactful to the scientific literature than others. The journals with more impact are usually advancing the scientific field, while publications from journals with a lower impact tend to fill in the cracks left behind by the groundbreaking studies. I also checked for the number of times the article has been cited by other research articles. I have found this is a fairly good indicator of the article's usefulness to the field. Lastly, I take recency into account since the most recent information is the most accurate. Often in science, previously accepted facts are found to be incorrect and therefore amended. I was taught that it is good practice to rely on the newest research and findings instead of older discoveries which may have been debunked.

Once I evaluated and determined which articles were relevant to my research interest, I realized research my question was not directly answered; PVAT was an uncharted path of

scientific discovery. Based on the relevant articles, I formed working hypothesis and designed experiments to directly answer my research question. After a couple of months of data collection and analysis, I realized a confounding variable was influencing the results. I went back to the drawing board and after a couple of weeks of research, I learned PVAT has varying sensitivity to growth factors which directly control the amount of expansion. This changed my perspective on the experiments and provided an excellent future direction to continue this work.

After this experience, I learned two primary lessons about the research process. First, research is never complete. It is an ongoing process which can lead to new and surprising discoveries that were not originally expected. Research is not a linear process but instead has multiple components all occurring at the same time. The second lesson that I will take into my future academic and professional career is to always consider the tangentially related aspects of a given topic. Everything, especially in biology, is related and may have an impact on the results. For example, the effect of growth factor on PVAT is not directly related to my research question yet had a dramatic effect on the results. It is important to have a wide view of the topic as well as an understanding of the specific research question.

I believe that my research process was very smooth and occurred without many problems. An improvement the library could make would be to create a centralized database of the research interests of all the professors at the university. This would provide an excellent opportunity to discuss research questions with multiple experts in the field who work on our campus. Their perspectives could prove to be very valuable and influential on the research that is done. Overall, I am very grateful for the resources provided by the University of Maryland Libraries and I am certain that without them I would not have been able to complete this project.