My research took place in Dr. Erika Moore's laboratory for my BIOE399 class for Spring 2026, where I continued my work on an independent project from the previous semester. I first met with my primary mentor and advisor, Alison Veintimilla, a Ph.D. candidate in the Moore Lab, to discuss project ideas and goals. We decided to build upon a previous paper in which we explored sex-differences in macrophage behavior between two murine cell lines: J774A.1 (female-derived) and RAW264.7 (male-derived), exploring their potential to exhibit inflammatory behaviors in response to Vitamin D in the context of autoimmunity.

Autoimmune disease patients are almost 80% women in the United States; much of our lab's research focuses on elucidating the biological mechanisms behind this health disparity, especially in the context of macrophage function and behavior. When I first joined the Moore Lab, I was shocked to learn about this extremely lopsided and stark disparity. In spending time with Alison, Dr. Moore, and the other members of the lab, I witnessed their deep interest and drive in helping solve this challenge, and I grew to find my own passion for the subject as I learned more. When I was presented the exciting opportunity to pursue my first independent research project after spending some time in the lab in Summer 2025, I wanted to help contribute to scientific literature that may one day find a cure for these populations, while also getting the chance to explore one of the most complex puzzles in modern medicine: *why are women so much more susceptible to autoimmune disease than men?*

My initial research started with the Moore Lab's introductory papers detailing the immunomodulatory role of sex hormones in cell culture, which affected cell responses and behaviors, and how hormone-stripping was necessary to control for this factor. They also

introduced me to papers exploring the historic disinclusion of female biology from biomedical research: that even though the two macrophage cell lines we used (J774A.1 & RAW264.7) have been extensively studied since the 1980s, the vast majority of results were obtained using RAW264.7 cells, which are male-derived. From these papers, I utilized a “citation chaining” strategy on Google Scholar to move forward in time, exploring the newest literature surrounding these topics. In doing so, UMD’s University Libraries search portal was instrumental in easy access to each article through a simple login using my UMD credentials, and allowed me to access regularly-used databases like PubMed and Web of Science to continue my research. I also used key phrases such as “sex differences,” “sex biases,” and “macrophages” to find relevant literature, a strategy that was especially helpful in a field that has traditionally been underexplored compared to other topics in autoimmunity. Combining these two topics - historic disinclusion of sex hormones and sex differences in biomedical research - revealed a historical gap in research that has likely contributed to diseases with such a high prevalence in women, specifically, as research has not considered how treatments may affect their biology differently. UMD's institutional subscriptions allowed me to bypass expensive journal paywalls and track how the scientific community had historically documented (or ignored) these cellular behaviors.

Mentorship played a critical role in evaluating this literature. Before my experiences in the lab, I more readily trusted the “Materials and Methods” sections in scientific papers, assuming that they followed infallible scientific practices. Guidance from Alison and Dr. Moore helped me consider "standard practices" more critically, and provided enough help that I didn’t need to intentionally seek out the help of a librarian for my research. When I evaluated my sources, I started closely reading the methodology sections to see if authors explicitly disclosed the sex of

the cells they used or if they considered hormonal effects in cell culture. This evaluation helped shape my experimental design, directly comparing for differences between the two cell lines.

This research experience profoundly impacted how I envision myself as an aspiring physician. I primarily thought of sexism as existing through social contexts, art, literature, and politics, but in my research I found its presence permeating scientific literature by failing to consider female cell lines or biology, which has likely directly led to worsening outcomes and less effective treatments for women. Many autoimmune diseases also have worsening outcomes and higher prevalence in Black populations, another topic of our lab that I unfortunately wasn't able to explore in my project due to time limitations. Nevertheless, I will carry the knowledge that sex and ethnicity directly affect medical treatments throughout my future healthcare career, taking special considerations in treating populations for whom science has historically neglected. As an aspiring doctor who wants to be able to treat any person who walks through the hospital doors, this value is especially important to me.

Reflecting on my research journey, the University of Maryland Libraries provided incredible resources, but dealing with systemic gaps in literature is still incredibly difficult. If I could reimagine a library service, I would propose a "Bias Filter" integrated into the library's search engine. This tool would scan the methodology sections of scientific papers and automatically flag demographic or biological omissions, such as not considering sex or ancestry. For example, if a highly-cited paper only utilized male cell lines or exclusively studied a single demographic, the filter would mark the paper with a small tag on the search results page. This would help students and researchers identify historical disinclusions, empowering them to ask better questions and design more equitable studies from the moment they begin their literature review. It would also help them in citing reliable sources that considered all aspects of study design. In

modern times of federal spending cuts to research and attacks on DEI, it is now more important than ever to continue pursuing these questions and projects to treat at-risk populations.