This summer I had the amazing opportunity to work with Dr. Alyssa Summers in her research lab in Sewanee. I had the chance to collaborate with Dr. Summers to create my own project for my eight weeks in the lab this summer. My main interest was investigating the role of both histone deacetylases (HDACs) and transforming growth factor-β (TGFβ) in tumorigenesis of mammary cells. In other words, further understanding genetic influences in breast cancer.

During my first week in lab I became acquainted with the laboratory mice and began my work genotyping. Genotyping is a process that determines differences in the genetic make-up (genotype) of an individual by examining the individual’s DNA sequence and comparing it to reference samples. It is important to understand each mouse’s genetic make-up to know whether or not they are susceptible to mammary tumors and can be considered part of our tumor study. The process begins by clipping the ears of the mice to be genotyped and isolating the DNA from those ear clips. After working to isolate the DNA I ran PCR analysis to amplify the DNA by adding primers and DNA polymerase to the isolated DNA samples. The samples are then run through the PCR machine to complete this step. Once this is complete I ran the samples on an agarose gel and imaged the gel to locate bands of DNA. The gel analysis shows a band in a specific location that indicates that a specific gene’s DNA is present. For example, if the gel showed a band when using the primer for Hdac3, that mouse has Hdac3 present in their genetic makeup. The mice I wanted to use for my tumor study had a band present for PMT (protein methyltransferases), which indicates a susceptibility to breast cancer.

Once a mouse was found to be PMT positive they were labeled as tumor study mice and I began examining them for tumor masses. A few weeks into the summer I discovered tumors in 5 of our mice. When a mammary tumor is initiated in a mouse it feels like a grain of sand, but it
grows rapidly over time. By the end of the summer each of the tumor mice had multiple large tumors. Once the tumors reach a large enough size I will be able to remove them and initiate my own tumor line. This will help provide an even larger set of data and allow additional experiments and tests to be conducted. Throughout the summer I checked the mice daily while also conducting a variety of other experiments.

Specifically, I also worked in tissue culture establishing and growing other cancer cell lines. There are three prominent types of breast cancer I was interested in: Luminal A/B, Her2 amplified, and triple-negative. These terms simply refer to the common genetic make-up of each type of cell line, each expressing a specific set of genes. In order to establish significant results I wanted to have a cancer cell line from each type and compare them together. Throughout the next couple weeks I focused on maintaining these cell lines and then running experiments. One interesting experiment that I ran was a western blot. A western blot is used to determine the presence of a protein in a sample. Particularly, I was working to understand the proteins Hdac3 and TGFβ. Because of time constraints I focused just on Hdac3 protein expression in my cell lines.

Setting up this experiment begins by plating the different cell lines on a tray and treating the experimental samples with an inhibitor to Hdac3 to ultimately determine the drugs effectiveness at killing the tumor cells. After incubating for 24 hours the next step is determining the protein expression through the western blot experiment. When analyzing the results, if a band is present where a specific sample is loaded, the protein of interest is present in that sample. In other words, if a band is present in the treated cancer cells the protein (Hdac3) is still signaling in those cells. This experiment was very interesting, but also very particular. Each step requires precision and I was appreciative for the opportunity to improve my skills and knowledge of this
Throughout the summer I also worked to further my understanding of breast cancer as well as Hdacs and TGFβ. When I was not focusing on running an experiment or caring for the mice, I studied the various cellular pathways involved in cancer signaling, the research that has been done on breast cancer, and the implications that we are hoping to address with this type of research. I enjoyed being able to bring my ideas to the experiments I was running and work to further my knowledge of cancer and its molecular and global implications. However, one frustration that I encountered was being constrained by time. Scientific research cannot be rushed and I quickly understood how fast eight weeks could pass by. I am grateful to be able to be at Sewanee for another year and have a chance to continue my research with Dr. Summers. I am hoping to collect significant results in which I will work on publishing in the medical community.

Overall I was so grateful to be able to work on multiple projects this summer and I appreciated the fact that I was able to contribute in so many capacities. I really enjoyed all my experiences and gained invaluable skills I will use throughout my scientific career. Ultimately I learned an extraordinary amount this summer, not only about research and its greater implications, but also about myself. Collectively, I gained skills in laboratory research, confidence in pursuing my own ideas and ultimately I expanded my certainty as a student pursuing a career in medicine. I enjoyed getting the chance to work in the lab this summer and appreciate the origins of medicine. This summer I affirmed that research is something I value and that it truly offers invaluable opportunities.