

UGA Libraries Research Award

Christian Cullen | 3/19/17

Conducting research within the Department of Infectious Diseases has equipped me with a new understanding of the synergistic relationship between medicine and the research that fuels its advancements. My journey in research has given me a glimpse of what it is like to go beyond healing those that are sick and attempting to target the illness from the start. I grew up with a best friend who spent 17 years battling cystic fibrosis (CF), therefore the opportunity to take part in research surrounding this disease has not only been knowledgeable, but personal.

For the past two years, my research under the direction of Dr. Balazs Rada has focused on the role of immune response in CF lungs. Cystic fibrosis is a genetic disease resulting in severe mucus build-up in the lungs often leading to chronic bacterial infection. Due to its strong adaptive ability, *Pseudomonas aeruginosa* has remained the main respiratory pathogen present in CF lungs. Given its unique resistance to airway mucus, *P. aeruginosa* remains capable of vast replication- often leading to large-scale immune response with neutrophils. This immune response can result in unregulated inflammation and lead to lung tissue damage which makes this a pressing issue for CF patients. Researching key bacterial components that lead to such inflammation is of high clinical relevance as they pose as potential therapeutic targets for future treatment.

The UGA libraries are a central component for my research process. In addition to study spaces, the libraries house a multitude of resources that have fueled the momentum in my research. When I first joined the lab near the end of my freshman year, I relied heavily on the libraries' databases to provide me with articles

that would shape my understanding of the material we would be researching. As a freshman, entering a lab teeming with new concepts seemed like a daunting task. After learning about the UGA databases in my FYOS, I was able to access PubMed for free and refine my search to find every publication my principal investigator had published. This forged a smooth transition as I was able to read material specific to my researcher's field.

In addition to the library databases, my research has given me the opportunity to learn even more about technology available in our libraries as I used MakerSpace to 3D print objects, which allowed the production of lab materials at a fraction of the cost. As mentioned before, much of my research is centralized around the interactions between *P. aeruginosa* and neutrophils leading to inflammation response pathways in CF lungs. This bacterium colonizes CF lungs in the form of bacterial aggregates that line the lung epithelia. In research, it is important to make sure that your observations are produced in a setting comparable to the environment in question. In order to strengthen the efficacy of our results, I wanted to simulate these aggregate formations to make our experiments as similar to the CF lung as possible.

After searching through recent publications in the UGA Academic Search Complete, I limited the search results to recently published scholarly articles between 2009 and 2017. After a matter of seconds, I found an article that suggested the use of agarose gel as a scaffold to grow small spherical tumor cells. Through use of robotic technology, the researcher was able to stamp divots of definable sizes into agarose gel, which would act as a vessel in which tumor cells would sediment. After

a few days, the sedimented cells were washed out of the scaffold and existed as spheres of uniform size- closely resembling the aggregates I sought to recreate. Seeing this as a promising method to simulate bacterial biofilms in CF airways, I began to brainstorm ways of creating these scaffolds without the use of a robot- despite my childhood expertise in lego building. After a few days, I realized that I could use MakerSpace at the science library to 3D-print a template that can be used to imprint a desired layout into agarose gel. After designing a model with the help of the MakerSpace staff, I printed a template with material that could withstand the temperatures of autoclaving, which is a critical procedure ensuring sterile lab equipment. This proved to be a successful procedure, and I am currently in the process of optimizing its protocol for more reliable aggregate formation.

The services the libraries provided were especially appreciated as I used the databases and tools like RefWorks while writing my CURO thesis. After using the UGA libraries vast database system, I was able to explain my thought processes clearly as I validated known information with respectable sources. By limiting the search results to peer-reviewed articles, I was rest assured that the sources were accurate. The interdependence between different disciplines of research encouraged me to critically think how different topics of research coincided with others. As I fortified my results with sources, I was advised by a librarian to use RefWorks as a tool to keep track of my sources along the way. This proved to be of immense help as it organized my sources and ensured their correct formatting.

My experience in research has given me a new desire to learn beyond the classroom. Given the opportunity to learn concepts in class and directly apply them

in a lab setting has made what would normally be routine memorization come alive. This hands-on experience has fueled my curiosity and desire to search for answers. After two years in the Department of Infectious Diseases, I recently had the privilege of becoming an author on a featured article in *PLoS Pathogens*, a clinical research journal, regarding the role of *P. aeruginosa* and immune response in CF airways. This would not have been possible without the university's strong foothold in research and resources made available in the UGA libraries. I seek to carry this knowledge to Bethesda, Maryland this June where I will spend my summer interning at the National Institutes of Health in the Infectious Diseases department.

Works Cited

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