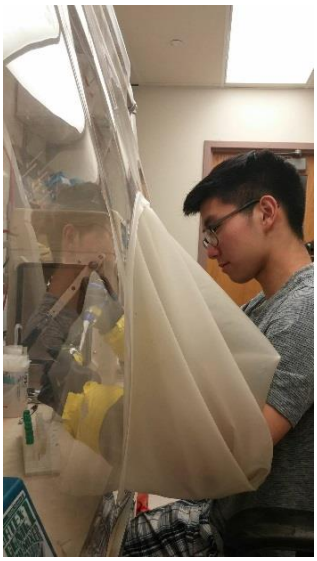

Evaluating the Effects of Enterobacteria on Klebsiella pneumonia Mucosity and Colistin Resistance

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Thanks to the Penn Undergraduate Research Mentorship program, I was able to experience first-hand what scientific research is like under the mentorship of Dr. Jay Zhu and post-doc Dr. Logan Nickels in the Perelman School of Medicine's Department of Microbiology. The main subject of my research was *Klebsiella pneumoniae*, a "superbug" under the Enterobacteriaceae family found in our gut that is the causative agent of many hospital-acquired (nosocomial) bacterial diseases and infections such as urinary tract infections and pneumonia. The genus, *Klebsiella*, has been placed among the eight most infectious agents in hospitals, and its increasing resistance to antibiotics gives us all the more reason to conduct research on *Klebsiella pneumoniae* virulence. I worked with two strains of *Klebsiella pneumonia*, A2312 and A1763, both of which had two phenotypes: mucoid and non-mucoid. The mucoid phenotype tends to be larger with hypermucosity being linked to virulence, while the non-mucoid phenotype tends to be smaller and is associated with a higher colonization rate.

The goal of my project was to determine whether the presence of other Enterobacteria had an effect on the conversion rate of *Klebsiella pneumoniae* from mucoid to non-mucoid and vice versa, as well as its resistance to Colistin, a last resort antibiotic typically used for bacteria that are resistant to almost all other antibiotics. This project involved the use of over thirty different Enterobacteria, many of which were found in a hospitalized patient's gut flora and were thus strict anaerobes, which required the use of an anaerobic chamber to mimic the conditions that would occur naturally inside the human body.

Given the limited amount of time I had to work on this project, I did not find any conclusive evidence that any of the Enterobacteria I worked with affected *Klebsiella pneumonia* mucosity or Colistin resistance. However, I did determine that under anaerobic conditions, there is essentially a 0% conversion rate in mucosity, whereas in aerobic conditions, there is a steady conversion from

mucoid to non-mucoid and vice versa. As for its Colisitn resistance, there appeared to be a significantly higher resistance to Colistin in aerobic conditions compared to anaerobic conditions.

Through this research experience, I not only learned practical laboratory skills such as using proper aseptic techniques (which are essential in a microbiology lab), organizing data to be easily understandable, and working in an anaerobic chamber, but also invaluable skills that can only be learned through experience in a lab. For example, this experience helped shape me into a more analytical thinker and taught me the importance of meticulousness and patience, as being careless and impatient would not only lead to unusable results but also time wasted. It also contributed to my experience as a student, with almost everything I learned about microbiology in class being used in a hands-on situation in the laboratory. I could not have asked for a better first research experience, and I would like to thank Dr. Zhu, Dr. Nickels, and the rest of the Zhu lab for providing me with an enlightening experience.