

Title: Mutation Rates of *Staphylococcus aureus* from Cystic Fibrosis Patients

Cystic fibrosis (CF) is a genetic disease that results in increased mucus formation in several organs of the body, but its major effects are on the lungs and pancreas. CF patients are susceptible to *Staphylococcus aureus* infections with *S. aureus* being the most prevalent infection in childhood and the second most common infection in adults with CF (Cystic Fibrosis Foundation, 2006). *S. aureus* is an opportunistic pathogen that has adapted to the respiratory tract due to its metabolic versatility, but is normally associated with the skin and mucus membranes (Parker and Prince 2012). CF is caused by a mutation in the cystic fibrosis transmembrane regulator (CFTR) gene (Yagci et al. 2011). The CFTR glycoprotein is expressed in epithelial cells and acts as a chloride channel, an ion regulator, and regulates airway hydration. The thick mucus inhibits the mucociliary escalator, a structure that is suggested to protect the host from bacteria (Chmiel and Davis 2003). This creates an ideal environment for pathogens to colonize and infect the CF lung.

Antibiotic resistance is a huge concern, not only in CF patients, but in all infections. Due to the high frequency of bacterial infections in individuals with CF, antibiotics are frequently administered, and the increased antibiotic exposure can lead to increased antibiotic resistance (Cystic Fibrosis Trust 2009; Centers for Disease Control and Prevention). Antibiotics inhibit bacterial growth, but three types of genes can cause antibiotic resistance such as genes related to synthesis and positioning of targeted structures, genes that effect antibiotic access, and genes that attack antibiotic resistance (Martinez and Baquero 2000).

The aim of this study is to determine the mutation rates of *S. aureus* isolated from CF patients. Understanding mutation rates, especially to antibiotic resistance is essential for developing proper treatment plans for patients. In this project, the antibiotic, Rifampicin, will be used to determine mutation rates in *S. aureus* isolated from CF patients in three age groups: children (under 13), adolescents (13-18), and adults (over 18). This study will test **the hypothesis that adult patients, who have been infected with *S. aureus* for a longer time, will have increased antibiotic resistance and mutation rates compared to *S. aureus* from younger patients.** Patient samples have already been obtained through collaboration between my mentor's lab and the Cystic Fibrosis Clinic located at the Children's hospital in Oklahoma City.

Resistance to rifampicin develops rapidly, and that makes it suitable for testing mutation rates (Goldstein 2014). Rifampicin will be used to distinguish resistant mutant cells and susceptible non-mutant cells. This will be done by using *S. aureus* from at least 6 patients in each age group. Each *S. aureus* will be grown in the bacterial growth media overnight and transferred onto growth medium either containing or lacking Rifampicin. The number of *S. aureus* colonies will be counted in both conditions. The rate of mutation will be determined by dividing mutated colonies (that grow on Rifampicin containing plates) by the average number of *S. aureus* colonies that grow on Rifampicin free plates.

These experiments will be completed in one semester. The knowledge gained will be of great importance understanding the relationship between antibiotic resistance and age could be helpful in drafting new treatment methods for individuals with CF.

References

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