Antibiotics have been used as powerful weapons to combat invasive pathogens for decades. Generally, the use of antibiotics has been a successful method to treat bacterial infections. However, an emerging issue is the fact that some bacterial strains such as Escherichia coli (E. coli) are increasingly gaining resistance to commonly prescribed antibiotics like Amoxicillin. The goal of our research is to determine a gene mutation that may be able to explain the cause of antibiotic resistance in bacteria. We will achieve this by comparing the genetic composition of several E. coli strains, both antibiotic resistant and susceptible through standard computational techniques to interpret gene sequence information extracted from our data. We will begin by comparing bacterial strains of antibiotic resistant E. coli strains to determine genes in common between these organisms. Furthermore, we will compare these common genes to the genes found in antibiotic susceptible strains to identify mutations found in both phenotypes. Then, we’ll find mutations among the genes unique to antibiotic-resistant bacterial strains to find a recurrent mutation. This process will be repeated for several commonly used antibiotics. The result of this effort is to develop a method that can be used to find the cause of antibiotic resistance in bacterial strains so that effective tools can be utilized on a more customized basis. These findings will enable medical professionals to effectively treat patients afflicted by bacterial infections with a more personalized treatment plan.

How Does Antibiotic Resistance Occur?

An antibiotic is administered. It kills only the bacteria susceptible to antibiotics. The prevalence of antibiotic-resistant bacteria increase. Bacteria transfer their antibiotic-resistant resistance through conjugation.

How Antibiotics Treat Bacterial Infections

- **Amoxicillin** prevents the bacteria from forming cell walls which leads to cell death.
- **Ciprofloxacin** prevents bacteria from being able to repair or replicate their DNA.
- **Fosfomycin** disrupts cell wall synthesis.
- **Sulfonamides** slows down the synthesis of folic acid to obstruct bacteria growth and proliferation.

Number of Commonly Shared Genes of E. coli Phenotypes

- Majority are susceptible to antibiotics and few are resistant.
- An antibiotic is administered. It kills only the bacteria susceptible to antibiotics.
- The prevalence of antibiotic-resistant bacteria increase.
- Bacteria transfer their antibiotic resistance through conjugation.

Results

Amino Acid Mutations Found in E. coli

- Amino Acid Flips
- Gap Reference
- Gap Matched

Reducing Gene Data Conferring Antibiotic Resistance

- **4,958 Genes in Organism**
- **2087 Genes in common in SULF Res E. Coli**
- **1558 Genes in common in SULF Sus E. Coli**
- **15 Genes Mutated in all Strains**

Discussion

- The goal of this project is to develop a method to determine a specific gene mutation responsible for antibiotic-resistance in bacteria.
- Identifying the specific mutations responsible for resistance will enable physicians to prescribe antibiotics with greater precision.
- In the future, this method can be used to discover gene mutations in clinical patients and allow physicians to use this information to successfully treat infections.

References