CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
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Project Number
S1404

Project Title
Effectiveness of Coliphage T4 on E. coli B at Variable Antibiotic Dilutions

Abstract

Objectives/Goals
This project explores the effects of antibiotics on the efficaciousness of bacteriophages on bacteria. I hypothesize that at certain dilutions, the phage will not have any effect on the bacteria due to the absence or alteration of some part of the bacterium which acts as a marker for the likely parasite.

Methods/Materials
The project consisted of two tasks which led me to my findings. The first task was to find dilutions where it would be easy to see that the bacteria had been affected by the antibiotic but were not completely destroyed. ANOVA and T-tests were used to prove significances in differences. The second phase consisted of two further sub-experiments: first were the actual tests with the bacteriophage and antibiotics accounting for all combinations and positive and negative controls. The second sub-experiment was to further understand what changes had occurred to the cell structure using a modified gram-staining procedure I developed.

Results
All acquired data and research was compiled into two categories defined by the mode of action of each antibiotic.

Exteriorly Resistant Strain:

Penicillin destroys bacteria by targeting the peptidoglycan layer of the bacterium's cell wall. Because the ompC receptors are located on the lipopolysaccharide layer, these too begin to denature reducing the chances of a phage latch-on. This would present a temporary inconvenience which could possibly confuse those administering the treatment. From this we can deduce that using penicillin in combination with phage therapy would not be a good decision in vivo.

Long-term Genetic Resistance:

Tetracycline works by halting the action of the 30S ribosome (one in charge of creating proteins used throughout the cell wall). Because this is a genetic alteration dealing with the blockage of the aminoacyl-tRNA, if the bacterium survives the treatment, a phage resistant strain will be produced. Being a genetic trait also means that the resistance can have a prolonged negative effect on the efficaciousness of phage therapy.

Conclusions/Discussion
In conclusion, caution is the word when combining antibiotic and bacteriophage therapies; "ultra bugs" may be produced when both treatments are used in unison. Therefore, we must make sure to have a well thought out transition in order for such a natural, self-bettering treatment to last for many future

Summary Statement
An exploration of bacteriophage to bacterium interactions at various antibiotic dilutions for future medical applications.

Help Received
I acknowledge my family for their moral support and encouragement. I would especially like to thank Mrs. Alonzo, my advisor and head of the Lynbrook science department, for the many hours she gave up to supervise and advise.