CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Yamila D. Hernandez

Project Number
S1414

Project Title
Differentially Altering the Ability of Haemophilus to Form Biofilms using Subtherapeutic Doses of Multiple Antibiotics

Abstract

Objectives/Goals
When studies began showing the concept of antibiotic resistance, researchers felt that the remedy was to give patients lower dosages of antibiotics, as subtherapeutic dosages lead to the inhibition of initial microbial adherence. However, the flaw in many researchers# thinking was that all antibiotics behaved the same way at subtherapeutic doses. Most researchers also believed the difference between planktonic cells (individual bacterium) and biofilms (many bacteria) was virtually none. Bacteria are actually in biofilms for the duration of their existence. It is only when making the transition from biofilm to biofilm that the bacteria are in a planktonic state. The difference between planktonic cells and biofilms is that the latter are much more resistant to antibiotics than are planktonic cells. Researchers believed that they could treat antibiotic resistance by only examining planktonic cells, when in reality it can only be treated by looking at biofilm formation.

Methods/Materials
96-well microtiter plates were used throughout the experiment, as they go beyond Petri-dishes which are only able to test for planktonic cell growth and inhibition. Microtiter plates have the ability to test for biofilm growth and inhibition, as they can be introduced to a Victor 3-V Perkin Elmer, 595 nm, plate reader. As biofilms are the predominant state of bacteria, it was fitting to use a plate reader which tested for biofilm growth of Haemophilus influenzae after crystal violet had been added, followed by water, and finally the addition of ethanol.

Results
The plate reader showed a significant biofilm spike for Benzylpenicillin. In other words, Benzylpenicillin was shown not only to fail at subtherapeutic doses, but also to cause patient health to drastically worsen as biofilm formation increased at such a low dose. This spike is what contributes to antibiotic resistance in patients.

Conclusions/Discussion
Often times patients do not fully finish taking their antibiotics or are started on a sub-therapeutic dose. In the case of some antibiotics, such as Benzylpenicillin, this method leads to a rendering of a much more harmful bacterium than would have been present had no antibiotic been administered or had an MIC (Minimal Inhibitory Concentration) dose been put into place immediately.

Summary Statement
My project examined the effect of using subtherapeutic doses, of four antibiotics, on the planktonic cells and biofilm growths of Haemophilus influenzae.

Help Received
My parents drove me to UCLA; I used the lab equipment at UCLA under the supervision of Dr. Bradley and Dr. Damoiseaux; SCAS (Southern CA Academy of the Sciences) provided me with a grant to conduct my research.