



**CALIFORNIA STATE SCIENCE FAIR  
2015 PROJECT SUMMARY**

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| <b>Name(s)</b><br>Alap A. Sahoo   | <b>Project Number</b><br><br>35479 |
| <b>Project Title</b><br>Adaptations to Restriction Enzymes in Various Bacteriophage Genomes   |                                    |
| <p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b><br/>My project aimed to determine if various bacteriophages had adapted their genomes to avoid restriction enzymes commonly produced by their hosts. Restriction enzymes are used by bacteria as an immune system to combat viruses. They operate by splicing phage genomes based on the location of predetermined sequences of DNA, called restriction sites. My project studied the frequency of restriction sites on various phage genomes to determine if phages had evolved to avoid restriction.</p> <p><b>Methods/Materials</b><br/>I assembled a large set of restriction enzymes and bacteriophage genomes using data gathered from the NCBI database. I wrote a program in R to determine the number of restriction sites on each phage that would be generated by an enzyme derived from the phage's host. I also calculated the expected number of restriction sites given a random distribution of DNA bases, and compared the actual and expected values using standard statistical methods.</p> <p><b>Results</b><br/>I found that the vast majority of the phages genomes had significantly lower actual restriction site counts than expected restriction site counts for many of the restriction enzymes derived from their hosts, and that several hosts tended to have phages that exhibited this correlation for all most all of the native restriction enzymes.</p> <p><b>Conclusions/Discussion</b><br/>My results indicated that many bacteriophages had evolved to avoid splicing by host-produced restriction enzymes, and that in particular, phages that attacked specific genii had evolved these properties to a larger degree. Further research would focus on studying the exact relationship between these adapted phages and their hosts.</p> |                                    |
| <b>Summary Statement</b><br>My project aimed to determine if bacteriophages had evolved genomes resistant to restriction enzymes.   |                                    |
| <b>Help Received</b><br>My father helped me construct my board.   |                                    |