CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
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Project Number
S0408

Project Title
Gene Regulation: The Use of Antibiotics to Control the Kinetics of Lactose Operon Induction

Abstract

Objectives/Goals
To investigate the effect of ampicillin and kanamycin on the lactose operon induction of Escherichia coli through enzyme assays.

Methods/Materials
In the experiment, the production of beta-galactosidase (the enzyme produced during induction) was monitored for three different treatments (the control and the two antibiotic solutions) within a 60-minute time period. There were two important chemical processes used in this experiment: IPTG and ONPG. The compound IPTG has a similar structure to lactose; it starts lactose operon induction without being metabolized. The enzyme produced is measured in the chemical reaction between ONPG and the beta-galactosidase. The nitrophenyl group that is broken off the galactose by the enzyme has a yellow color. A UV/visible spectrophotometer was used to measure the intensity of the yellow color at a wavelength of 405 nm. The absorbances of the cultured tubes were graphed versus reaction time to show the enzyme activities.

Results
After tracking the enzyme production for sixty minutes, the amount of beta-galactosidase being produced slows down drastically in the kanamycin solution after only twenty minutes. However, the ampicillin did not affect the induction of the lactose operon. When compared with the control, enzyme production in this treatment is normal.

Conclusions/Discussion
The kanamycin did have a lactose operon induction effect as predicted. Within an hour, the amount of enzyme production leveled off. However, the ampicillin did not seem to have any effect. The antibiotic solution probably did not have enough time to induce cell wall destruction. If data was collected to make a growth chart versus time for the antibiotic solution spiked with bacteria, then the effect each of the antibiotics had on the bacteria as a whole could have been observed. It would also enhance the investigation because the amount of cells growing could be compared along with the amount of enzyme produced. Further investigation could include the effect of antibiotic dosage.

Summary Statement
The purpose of this investigation is to study the effect two types of antibiotics will have on the production of beta-galactosidase in Escherichia coli.

Help Received
Used laboratory equipment at La Sierra University under the supervision of Dr. James Wilson.