CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
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Project Number
22777

Project Title
Running with DNA

Abstract

Objectives/Goals
The objective of my project was to see if the pH of a porous gel had an effect on the the structure of DNA molecules that are running through it.

Methods/Materials
Gels were prepared with electrophoresis running buffers of different pH?s (5, 8.3, 9, and 13). Three types of DNA molecules were used in each of the gels. One type of DNA was a 100 base pair ladder, a set of linear double helixes that differ in size by 100 base pairs; another is lambda Hind III, DNA from a bacterial virus cut into linear double stranded pieces of different sizes by an enzyme;
the third is a set circular DNAs, also double helices.

Results
DNA in the pH 8.3 environment ran perfectly. The electrophoretic mobility of DNA in the gel of pH 5 was retarded and the quality was not as great as the pH 8.3 gel. The reason for this observation is that in such acidic environments, the H+ ions neutralize the negatively charged phosphates that help link the nucleotides together in each chain. The DNA is less negatively charged and slows in its migration towards the positively charged electrode that represents the far end of the gel. The gel with the pH of 9 revealed that DNA ran even worse at high pH levels. The only type of DNA that ran at pH 9 was the circular DNA and that ran too fast to obtain proper results. The linear DNA in that gel did not even run at all. At such alkaline extremes, the hydrogen bonds holding the DNA double helix break and the two strands separate, thus nullifying the use of running the gel. However, the strands of circular DNA stays together because the
strands are braided together even though the bonds break. The fourth gel with the extreme pH of 13 did not properly solidify. Therefore, I was unable to run the DNA through it to observe how it to observe how DNA would react at such an extreme pH.

Conclusions/Discussion
The results of my experiment support my hypothesis in that the pH of a gel has a major effect on DNA structures and thus the way the DNA runs through it. In order to obtain proper results in the most efficient manner, the pH of an electrophoresis gel should be 8.3. This pH allows for DNA to travel through the gel in a way that shows the data clearly and in the most timely manner.

Summary Statement
My project is about how pH affects the structure of DNA.

Help Received
I used lab equipment at the University of California Riverside under the supervision of Dr. Hyman