



**CALIFORNIA STATE SCIENCE FAIR  
2007 PROJECT SUMMARY**

<b>Name(s)</b> Yuxin Zhu	<b>Project Number</b> <b>J1440</b>
<b>Project Title</b> <b>The Effects of pH and Temperature on the Growth of Escherichia coli DH5a</b>	
<b>Objectives/Goals</b> The purpose of this project was to study the growth of the bacteria Escherichia coli DH5a under a variety of different pH and temperature, in order to discover and approximate the optimal value at which the cell was able to increase in size and divide the quickest.	
<b>Abstract</b> <b>Methods/Materials</b> Material used for this experiment included Escherichia coli DH5a, flasks, cuvettes, test tubes, adjustable pipettes, disposable tips, 12N HCl, 10N NaOH, graded transfer pipette, safety goggles, gloves, LB medium, lab coat, electric pipette filler, autoclaver, pH meter, Beckman DU640 spectrophotometer, shaking incubators (New Brunswick Scientific)  The experiment was conducted through a three-step process. Each level of pH (2, 5, 7.4, 9, and 11) and temperature (4°C, 22 °, 37°C, 50°C, and 70°C) had three designated test tubes. On the first day, environments were set and the medium was prepared. Escherichia coli DH5a was then added. After the bacteria were grown overnight, a spectrophotometer was used to measure how much bacteria was present.	
<b>Results</b> The experiments demonstrated that Escherichia coli DH5a's optimal growing conditions are around pH 7.4. Both acidity and alkalinity could inhibit the growth of Escherichia coli DH5a bacteria. Escherichia coli DH5a also grew best at 37°C. Either lower or higher temperature could stall cell growth.	
<b>Conclusions/Discussion</b> Acids and bases had apparently created a negative impact on cell growth through a variety of factors possibly prohibiting certain cell functions, intracellular stability, and lengthening lag times. In cold temperatures, cell metabolism starts to slow, and growth is limited. At higher temperatures, cell parts started to fall apart and growth completely stopped.  However, this project in essence describes more than just the growth of Escherichia coli DH5a but of many other types of bacteria. Escherichia coli DH5a, because of its organization and physical properties, has long represented cells on a whole. For this very same reason, Escherichia coli DH5a is the basis of microbiology. In addition, this experiment shows that if proper care of food containing Escherichia coli or other bacteria was taken, then lives could be saved. From this experiment, we now know that most cells on a whole cease to function in higher temperatures, in acidic environments, and alkaline mediums. Indeed, this project has extended to tell of life itself, and its limitations.	
<b>Summary Statement</b> This project exhibited the growth of Escherichia coli DH5a, showing that certain temperature and pH variables inhibit its activities.	
<b>Help Received</b> Used lab equipment under the supervision of Dr. Genghui Zhu	