



**CALIFORNIA SCIENCE & ENGINEERING FAIR  
2018 PROJECT SUMMARY**

<b>Name(s)</b> <b>Waleed W. Randhawa</b>	<b>Project Number</b> <b>J1017</b>
<b>Project Title</b> <b>Artificial Pancreas: An Automatic Insulin Delivery System</b>	
<b>Abstract</b>	
<b>Objectives/Goals</b> The objective of this experiment is to create an Artificial Pancreas using electronic components that is able to autonomously neutralize a baking soda solution using vinegar which represents high blood sugar levels and insulin respectively.	
<b>Methods/Materials</b> Developed an Artificial Pancreas using a solderless breadboard, a Metal Oxide Semiconductor Field Effect Transistor (MOSFET) and three potentiometers which regulated the speed of the pump. A liquid peristaltic pump was used to automatically pump vinegar into the baking soda solution until the latter is neutralized. In the experiment, the system was tested with four different concentrations of baking soda. The time the system took to neutralize the solution was recorded using a stopwatch and pH was measured using litmus paper and bromothymol blue.	
<b>Results</b> The Artificial Pancreas was tested with four different concentrations of baking soda per 200 ml of water. After completing more than 25 tests with each concentration, it was noticed that the solution took the longest amount of time when neutralizing a solution with 7.5 grams of baking soda and took the shortest time when neutralizing a 2.5 grams of baking soda solution. The Artificial Pancreas was most consistent when tested with a 7.5 grams of baking soda solution.	
<b>Conclusions/Discussion</b> The Artificial Pancreas effectively neutralized a baking soda solution without human intervention. It was proven the time the system took to neutralize the solution was directly proportional to the concentration of the baking soda solution. The Artificial Pancreas effectively neutralized four different concentrations of baking soda more than 85 percent of the time. In the future, this module has the potential to outperform current methods to normalize blood sugar levels in the human bloodstream and could be available for clinical use.	
<b>Summary Statement</b> An Artificial Pancreas was engineered using electronic components that aims to autonomously neutralize a baking soda solution using vinegar which represents high blood sugar levels and insulin respectively.	
<b>Help Received</b> I developed the Artificial Pancreas myself. My father explained the basics of electronic circuits to me. My science teacher, Mrs. Gillum, reviewed my results.	