



**CALIFORNIA STATE SCIENCE FAIR  
2012 PROJECT SUMMARY**

<b>Name(s)</b> Sean W. Kelley	<b>Project Number</b> <b>S0906</b>
<b>Project Title</b> <b>Measurement of Glucose in Aqueous Solution Using a Proton Magnetometer</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> My hypothesis is that if the glucose concentration is varied in an aqueous solution then by using a proton magnetometer, with a two coil relay system, the glucose concentration can be determined by measuring the frequency, amplitude, decay constant, and Q (inverse bandwidth) of the resonance</p> <p><b>Methods/Materials</b> Two coils were created out of 18 gauge wires around a 5.8cm diameter and 7.8cm long around a PVC pipe. Each coil contains 600 turns of wire with a resistance of 4ohms and 21.34mH of inductance. A relay system was created to connect the coils to power and switch to a National Instruments measurement unit. The experiment began by activating a switch which connected the coils to power for approximately 2.4 seconds. Then the coil was then disconnected from power and reconnected to the measurement unit.</p> <p><b>Results</b> A total of 9 trials were conducted; 7 were with glucose dissolved in 125ml of water from 0.79% to 7.5%, 1 was with only 125ml of water and 1 was with no solution. The one trial of water showed a singular resonance peak at 2006Hz, while the one trial without solution showed no resonance peak at all. The 7 trials with glucose showed that the concentration affected the amplitude, Q factor and decay constant of the peak resonance frequency.</p> <p><b>Conclusions/Discussion</b> The experiment confirmed part of my hypothesis in that I measured a difference in the peak resonance amplitude but I measured no difference in the resonance frequency and thus disproved that part of my hypothesis. In addition, I also found that the concentration of glucose altered the Q factor and the decay constant. This study shows that it is physically possible to noninvasively measure glucose which has not been done before.</p>	
<b>Summary Statement</b> My project is about using a proton magnetometer to measure the concentration of glucose dissolved in water.	
<b>Help Received</b> Father helped build proton magnetometer, Mr. Joseph Geller provided designs for proton magnetometer	