



**CALIFORNIA STATE SCIENCE FAIR  
2010 PROJECT SUMMARY**

<b>Name(s)</b> <b>Jen H. Kelly</b>	<b>Project Number</b> <b>J0110</b>
<b>Project Title</b> <b>Tubular Turbulence: A Study of Water Flow</b>	
<b>Abstract</b> <b>Objectives/Goals</b> My objective was to determine how the flow rate (discharge) through different sized siphon tubes is affected by the diameter of the tubes. I predicted that the discharge would not double with doubled diameter, but would increase by 4 times if the diameter were doubled. <b>Methods/Materials</b> I built siphons using four different sized tubes made of the same material, with each tube being twice the diameter of the next smaller tube. I used tubes that were 1 inch, 1/2 inch, 1/4 inch, and 1/8 inch in inside diameter. I made my siphons all the same length and height, and used the same amount of water each time. Then I used multiple trials to time how long it took for four liters of water to flow from the top bucket to the bottom bucket through each tube. I used the discharge of the smallest tube as the reference point, and then compared the discharges of the bigger tubes to this reference point. <b>Results</b> I found that the discharge did not increase four times with double the diameter, but found that the discharge increased 5 to 6 times with each progressively larger tube. <b>Conclusions/Discussion</b> The diameter of a tube is not the only thing that influences how the water flows through it. Other factors such as tube length, tube material, friction, and turbulence are extremely important, especially in smaller tubes. I also learned that people such as farm irrigators, engineers, and even fish biologists must use complex discharge calculations, such as Bernoulli's equation, to design water flow structures.	
<b>Summary Statement</b> I examined flow rates of water through siphon tubes to determine the influence of tube diameter.	
<b>Help Received</b> Father helped build siphon assembly and helped with math, typing, and background research. Mother helped format the graphs on the computer. Both parents helped run the trials.	