



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

<b>Name(s)</b> Sarah M. Hansen	<b>Project Number</b> <b>J0316</b>
<b>Project Title</b> <b>Eyedropper Properties that Affect Drop Size</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> Commercial eyedrops are made twice as large as they need to be. This leads to a lot of medical waste. I wanted to understand the factors that determine drop size in order to find a way to construct an eyedropper that could produce a smaller drop in which medicine is not wasted. I decided to only change the eyedropper because changing the liquid would be changing the medicine which could have unforeseen consequences.</p> <p><b>Methods/Materials</b> I used a syringe pump which was attached to a pipette that dropped onto an analytical balance. 10 drops were dropped, then the mass was converted to volume to find the drop size. 3 different orifice sizes were tested, 1.02mm, 1.81mm, and 5.4mm. Hydrophilic and hydrophobic surface properties were tested by treating glass with acid or Rain.x. Angle of use was measured by tilting the pipette. The conditions that made the smallest drops were combined and tested with both water and real eye drops.</p> <p><b>Results</b> When the orifice size almost doubles, so does the drop size. Hydrophobic pipettes only make slightly smaller drops than hydrophilic pipettes. There was not a great difference with different drop formation rates. The smallest drops out of a hydrophilic pipette were at a 90 degrees while the smallest hydrophobic were at 25 degrees. The combined conditions that make the smallest drops decreased the size of a water drop and a real eyedrop from approximately 31ul out of a packaged eyedropper to approximately 12.5ul.</p> <p><b>Conclusions/Discussion</b> When the orifice diameter approximately doubles, so does the volume of the drops produced. Held at 90 degrees, the effect of surface properties and drop formation rate were small. When using a hydrophilic pipette at an angle, the drop can wrap around and adhere to the side of the pipette increasing the adhesive surface area. However it is different for hydrophobic pipette where the water does not adhere to the glass. With the conditions that produced the drops for pure water and Visine eye drops.</p>	
<b>Summary Statement</b> I altered eyedropper size, angle of use, drop formation rate, and surface chemistry to decrease drop size.	
<b>Help Received</b> I took all of my own data, accompanied by my dad. I borrowed equipment from Revolution Medicines.	