



**CALIFORNIA STATE SCIENCE FAIR  
2009 PROJECT SUMMARY**

<b>Name(s)</b> <b>Meaghan H. Truman</b>	<b>Project Number</b> <b>J2426</b>
<b>Project Title</b> <b>Caged vs. Free-Range: Chicken Eggshell Strength</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The purpose of this project is to determine whether caged or free-range chicken eggs have stronger shells. This project will prove whether caged or free-range chicken eggshells are stronger.</p> <p><b>Methods/Materials</b> To do this project, you need to purchase three dowels and two wood triangles. Then, you make a machine with two equilateral triangles with holes in each corner to fit the dowels. You glue the dowels in the corners of the bottom triangle, while you allow the top triangle to slide up and down on the dowels. You place a block of styrofoam with an egg shaped indentation on the bottom triangle to hold the egg vertically, and balance the top triangle on the egg. Then, you place a plastic bucket on top of the triangle and slowly fill the bucket with water until the weight of the water crushes the egg. Measure and record how much water you put in the bucket. Do this with all of the eggs.</p> <p><b>Results</b> In my experiment, I noticed the eggs could tolerate a lot of force. I repeated the steps with all the eggs and recorded the measurements in my logbook. Then, I calculated the force that crushed each egg, using the combined mass of the water, the bucket, and the top triangle and Newtons second law of <math>F=ma</math>. The results showed the average force required to crush a caged chicken egg was 34.8 Newtons and the average force required to crush a free-range chicken egg was 46.5 Newtons.</p> <p><b>Conclusions/Discussion</b> This project proved that free-range chicken eggshells are stronger than caged chicken eggshells.</p>	
<b>Summary Statement</b> I devised a method to prove that eggs from free-range chickens are stronger than eggs from caged chickens.	
<b>Help Received</b> My dad helped me cut the triangles of wood with a power saw.	