



**CALIFORNIA STATE SCIENCE FAIR  
2010 PROJECT SUMMARY**

<b>Name(s)</b> <b>Heidi L. Lederhos</b>	<b>Project Number</b> <b>J0113</b>
<b>Project Title</b> <b>Swimming Can Be a Drag! Does Form and Surface Condition (the Suit) Affect the Speed of the Swimmer?</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> To determine the effect surface condition (the suit) and different forms or body strokes (good form, bad stroke and streamlining) can have in relation to the speed of a swimmer.</p> <p><b>Methods/Materials</b> Make wooden scale models of myself of 3 different swim forms or strokes. Use pennies to match density of a human body. Construct a swim tunnel using 8" pvc pipe. Attach a scale to measure drag force. Determine water speed. Conduct tests at different flow rates, measure the force on a scale, measure height of water in pipe, and calculate water speed. I conducted 108 trials.</p> <p><b>Results</b> The experiment went well. The drag on the swimmer as related to form showed that at higher speeds, good form is important. For my size, the results indicated that a drag force of 2-6 pounds can be expected at my swimming speeds. My research indicated that swimming is only 9% efficient. So you have to apply 11 times more force to overcome the drag. Streamlining is more efficient than surface swimming, but it is hard to propel yourself underwater. The data showed that the speed suit had the least amount of drag when compared to the other suit, no suit, and wood body. In the Ratio of Drag Compared to a Regular Suit, results showed that the speed suit was 20% faster than a regular suit. The drag suit, had the most drag. The results showed, that if a good swimmer has an average speed of 5.3 feet/second, then by wearing the speed suit, the good swimmer would get an average speed of 6.3 feet/second giving them about a 4 second faster time for a 50 yard freestyle.</p> <p><b>Conclusions/Discussion</b> I determined that drag was directly related to speed. The speed suit was generally faster. My hypothesis about the form (good to bad) was correct at higher speeds; the streamliner swimmer had less drag than the good swimmer. When you are swimming, the type of material you are wearing can be a factor in achieving a better time and having less drag. An observation I have made is at high speed, the water separated from the model, causing waves. Also, when you change the conditions of the experiment, like the rate, it took time to stabilize the conditions. This experiment used about 32,000 gallons of water.</p>	
<b>Summary Statement</b> My project is about determining the effect that different forms or body strokes (good form, bad stroke and streamlining) can have in relation to the speed of a swimmer.	
<b>Help Received</b> Father supervised construction of wooden body forms and use of family farm irrigation system. Mother helped type report.	