



**CALIFORNIA STATE SCIENCE FAIR  
2008 PROJECT SUMMARY**

<b>Name(s)</b> <b>Siegen A. McKellar</b>	<b>Project Number</b> <b>J1122</b>
<b>Project Title</b> <b>To Breathe or Not to Breathe: Is Swim Sprint Time Faster with Normal or Reduced Breathing?</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> This study investigated whether the time saved by reducing the number of breaths in a 100 yard freestyle sprint is offset by the physiological effects of the reduced oxygen available for energy production and the clearing of anaerobically produced lactic acid in the aerobic energy producing system.</p> <p><b>Methods/Materials</b> Eight A-B level competitive swimmers between ten and twelve years of age were randomly selected. Each swam four 100 yard freestyle sets at race pace with a uniform reduction in the number of breaths taken. Swimmers rested three minutes after each set so fatigue would not be a factor. The results were then compared to their personal best times from 100 yard freestyle races breathing normally.</p> <p><b>Results</b> The results showed that none of the swimmers beat their personal best time, adding an average of 4.77 seconds. This indicates that normal breathing provides faster times, and that the number of breaths in a 100 yd. freestyle race is offset by the physiological effects of the reduced oxygen available for energy production and lactate clearance in the aerobic energy producing system.</p> <p><b>Conclusions/Discussion</b> A closer look, however, shows that four of the swimmers got consistently faster across all four trials with reduced breathing. This suggests that, with training, further physiological adaptation and times faster than their best normal breathing times might be possible.</p> <p>To test this, I would use a larger number of swimmers, categorize the swimmers by size, speed, age, gender, and VO<sub>2</sub> max, and make the training period longer. This would show whether certain groups better adapt to reduced breathing, and would explain the variability in my current experiment. If reduced breathing is faster, it could be a deciding factor for whether elite swimmers, when fractions of a second make a difference, win first place.</p>	
<b>Summary Statement</b> Whether the time saved by reducing the number of breaths in a freestyle sprint is offset by the effects of the reduced oxygen available for energy production and clearing of anaerobically produced lactic acid in the aerobic energy system.	
<b>Help Received</b> Assistants helped me time swimmers and monitor breathing patterns. My swim coach confirmed that the reduced breathing patterns were doable and that the rest time was adequate. Dr. George Brooks at Berkeley clarified a question on the processing of lactic acid. My parents drove me to the research library.	