



**CALIFORNIA STATE SCIENCE FAIR  
2015 PROJECT SUMMARY**

<b>Name(s)</b> <b>Katherine S. Matsukawa</b>	<b>Project Number</b> <b>J1910</b>
<b>Project Title</b> <b>Photobioreactors vs. Raceway Ponds</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> This project was designed to discover which of the two most common commercial methods of growing algae helps it grow fastest. The two commercial methods, a photobioreactor and a raceway pond, were compared to a replication of a natural pond, which was the control. The hypothesis was that the algae would grow fastest in the photobioreactor, followed by the raceway pond then natural pond.</p> <p><b>Methods/Materials</b> The type of algae used was a combination of Spirogyra and Desmodesmus serratus, more generally known as types of common pond algae. I constructed the photobioreactor by using pinewood for the frame and 3 acrylic tubes, the raceway pond by using a 68L bin, a motor, and a paint mixer, and the control pond using a 30L container, 2L of pond mud, and pond organisms. For taking and measuring samples, silicone baking cups, 10ml syringes, and a grams scale were used. Each baking cup was pre-weighed, and then 3 10 ml samples were taken from each environment. I recorded the wet weight, dried the algae in a 150° oven for 2 hours, then recorded the dry weight. Lastly, the grams of algae per liter of water were calculated.</p> <p><b>Results</b> After 23 days of testing, the samples taken from the photobioreactor had an average of 5.8 g/L, the samples from the raceway pond had an average of 5.8 g/L, and the samples from the natural pond had an average of 1.14 g/L.</p> <p><b>Conclusions/Discussion</b> My hypothesis that algae would grow fastest in the photobioreactor, followed by the raceway pond then natural pond, was not supported by the results. The algae in the photobioreactor did not grow as fast as hypothesized because of a nitrogen and CO(2) deficiency, long light path, and lower than optimal pH level. Reasons for the lowest growth in the control pond were the combination of susceptibility to contamination from bacteria and other organisms, no mixing regime, and no thermal management.</p>	
<b>Summary Statement</b> My project was designed to discover which of the two most common commercial methods of growing algae, photobioreactors and raceway ponds, helps it grow fastest.	
<b>Help Received</b> David Romero helped construct the raceway pond and photobioreactor, Mauricio Gonzalez provided the algae and pond components as well as information on the growth of algae, and Katiana Junes-Gill helped with identification of the algae.	