



**CALIFORNIA STATE SCIENCE FAIR  
2008 PROJECT SUMMARY**

<b>Name(s)</b> <b>Timothy V. Santos</b>	<b>Project Number</b> <b>S1719</b>
<b>Project Title</b> <b>The Safer Way to Eat Lettuce</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The goal of this experiment was to determine whether the bioaccumulation of perchlorate and nitrate is more substantial in the outer leaves of a romaine lettuce when compared with the inner leaves. Studies have shown that perchlorate and nitrate have harmful effects on humans, which would make this portion of the lettuce more hazardous for human consumption.</p> <p><b>Methods/Materials</b> I took a relative quantitative approach in the determination of perchlorate and nitrate. I needed one kilogram of lettuce per inner and outer leaf. Each lettuce head was divided into outer and inner leaves by equal mass, blended, and filtered through cheesecloth. The lettuce juice was analyzed by means of ion chromatography-tandem mass spectrometry (IC-MS/MS).</p> <p><b>Results</b> The data showed no significant evidence of the presence of perchlorate due to the interfering chemical compounds in the mass spectrometer. In three of the five samples, levels of nitrate were significantly higher in the outer leaves than the inner leaves. In the other two samples, there was a slightly higher amount of nitrate in the inner leaves compared to the outer leaves. The amount of nitrate was more substantial within the outer leaves since the data was consistent with the hypothesis. The nitrate levels had no significant relationships with the store or price at which they were bought.</p> <p><b>Conclusions/Discussion</b> The two samples with nitrate levels higher in the outer leaves may have been caused by errors in the preparation. Avoiding the outer/wrapper leaves of romaine lettuce would be a healthful decision for those concerned about nitrate consumption. Precautions should be taken until more studies are conducted to determine the level of nitrate consumption that is considered harmful and subsequent long term effects.</p>	
<b>Summary Statement</b> The focus of this experiment was to determine whether the bioaccumulation of perchlorate and nitrate is more substantial in the outer leaves of a romaine lettuce when compared with the inner leaves.	
<b>Help Received</b> Used mass spectrometer at the Chevron Laboratory (Richmond) under the supervision of Michael Cheng (chemist).	