



**CALIFORNIA STATE SCIENCE FAIR  
2007 PROJECT SUMMARY**

<b>Name(s)</b> <b>Shamik Mascharak</b>	<b>Project Number</b> <b>J0514</b>
<b>Project Title</b> <b>Antioxidants in Tea: A Green Defense?</b>	
<b>Abstract</b> <b>Objectives/Goals</b> To determine (a)if tea (green and black) contains the polyphenol type of antioxidants, namely, epicatechin, epigallocatechin, epicatechin gallate, and epigallocatechin gallate, (b)which method of brewing (cold brew and hot brew) will yield the most antioxidants, and (c)if green tea extracts and capsules are good sources of these polyphenols. <b>Methods/Materials</b> Two techniques of analytical chemistry namely, High Pressure Liquid Chromatography (HPLC) and Mass Spectrometry have been utilized to identify the four polyphenols in tea. A batch of 2 g of tea was brewed in 100 mL of water either at room temperature (cold brew,4 h) or at boiling temperature (hot brew,5 min). The tea was then filtered and 20 microL of it was injected into a C18 Alltima Rocket column (Spectra Physics HPLC instrument, isocratic elution with 87:13 acetonitrile:water; 285 nm detection). The peaks of the chromatogram were identified by matching their retention times with those of authentic samples. The identity of the compound associated with each peak was also checked by running its mass spectrum and identifying its molecular weight (Waters Micromass instrument). The relative amounts of the four polyphenols in hot tea brewed for different periods of time were also measured. Diluted samples of the green tea extracts and capsules as well as Sobe green tea were also analyzed. <b>Results</b> My results showed that (a)both green and black tea contain significant amounts of all the four polyphenols, (b)hot brewing yields more polyphenols (and caffeine)with time but causes considerably more decomposition of the polyphenols, (c)cold brewing, although a slow process, provides more intact polyphenols, (d)green tea extracts and capsules are both excellent sources of these polyphenols, and (e)Sobe tea contains very little amounts of the polyphenols. <b>Conclusions/Discussion</b> The conclusions of my project are (a)tea is a good source of the polyphenol class of antioxidants, (b)a quick hot brew (or steeping) of tea leaves is the best way to leach significant amounts of the polyphenols in tea without much caffeine, and (c)tea extracts are excellent sources of polyphenols. Reactive Oxygen Species (ROS) such as superoxide, peroxide and hydroxyl radicals cause serious damage to cellular components (DNA,membrane lipids and proteins)in aerobes. Since antioxidants destroy ROS, it is evident that tea is indeed a Green Defense.	
<b>Summary Statement</b> Using HPLC and mass spectrometry, I determined the presence of four polyphenol type of antioxidants in green and black tea.	
<b>Help Received</b> I performed the experiments at the laboratory of Prof. Glenn Millhauser (of UCSC) under the supervision of Mira Patel, a graduate student. Mr. Rod Atchley, my science teacher corrected my research report. My father, Pradip Mascharak, helped me in procuring the materials.	