



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Emma S. Richter	Project Number S1420
Project Title Caffeine: An "Astro-pharmaceutical" Defense for DNA?	
Abstract Objectives/Goals To determine whether caffeine's chemical structure could be used to protect DNA against UV-induced damage, thereby reducing cancer risks to astronauts on Mars missions and individuals on Earth. Methods/Materials The experiment involved testing four groups of samples of amplified fish DNA (approx. 650 base pairs). One set of caffeinated and uncaffeinated samples were exposed to UV; another such set was not. These sets were run through electrophoresis and then analyzed. Results 1. Electrophoresis results were inconclusive. In one test, the sample with caffeine exposed to UV "lost" the DNA; in the other test, the analogous sample had DNA, but there was no visible break in the DNA. 2. I learned that my idea was interesting to other scientists and that I could use DNA damage reporter cells containing LacZ under the control of a p53 promoter to test a variety of substances for UV absorption (DNA protection). Conclusions/Discussion Although my hypothesis may not have been demonstrated (because my assay and equipment did not allow me to detect DNA breaks of less than 20 base pairs), I now have a better understanding of how I could design and run measurable tests in cells. Thus, my idea of testing chemical compounds for use as "astro-pharmaceuticals" could be a long-term goal, and the start of a career and maybe an industry, in support of manned space exploration and reducing the threat of skin cancer on Earth.	
Summary Statement To test whether caffeine, because of its chemical structure, can shield DNA from UV-induced damage.	
Help Received Marina Ramon, UCSC Ecology and Evolutionary Biology Lab, was my Designated Supervisor and oversaw lab work; Guidance was provided by Dr. Fred Hausheer, of BioNumerik Pharmaceuticals, Dr. Douglas Brash, of the Yale Genetics Department, Dr. Ned Sharpless, of UNC School of Medicine.	