CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
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Project Number
S0411

Project Title
UV Exposure Accelerates Telomere Shortening: An Implication of Premature Aging

Abstract

Objectives/Goals
This experiment provides a health statistic that demonstrates one of the dangers of UVA in biological systems, particularly in yeast. Telomeres are protein caps that protect chromosomes from natural DNA shortening during mitosis (binds to repeated DNA with lengths varying between organisms), and are responsible for aging on a cellular level. UV-A is a type of ultraviolet light that causes cells to produce DNA-damaging reactive oxygen molecules. The goal of my experiment was to find out whether telomeres themselves shorten faster in the presence of ultraviolet light due to these molecules. The results show the life-shortening effects of UV light on irradiated organisms.

Methods/Materials
Yeast cells were divided into groups and allowed to proliferate under specific conditions for three days. Changing DNA patterns through HindIII restriction enzyme digests were recorded. Controlled variables were integrated into the experiment, including colony separation, stable environment, and un-irradiated control groups. The independent variable was the duration of UVA irradiation. Hind III restriction enzymes fragmented non-telomeric DNA but left telomere DNA unaffected. Electrophoresis allowed the separation of the DNA fragments so that the CBI (comparative band intensity) of 200-400bp DNA could be measured using ImageJ software.

Results
All test groups experienced semi-linear downward trends in CBI. For example, the B1 group (15 minute exposure) begins with a 171.92% the intensity of the control group average, but dropped down to 139.52% and then 99.66% of CBI. Similar trends reoccur in the other test groups to varying degrees, where surprisingly, the B group experiences a larger total CBI decrease.

Conclusions/Discussion
The definite implications of this experiment demonstrate the link between UV light and premature cellular aging caused by telomere shortening. From these results shown in yeast cells, I conclude that sources of excessive ultraviolet radiation also cause telomeres in humans to shorten in the same manner due to identical telomere function in all eukaryotic organisms.

Summary Statement
Exposing yeast cells to UV accelerates telomere shortening, implying premature UV aging risk for humans.

Help Received
Teacher helped stain toxic gels, borrowed equipment from SCCBEP, Schmahl Sciences, and Lawrence Livermore National Lab.