CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

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Project Number

S1416

Project Title

A Bacterial Test System for the Carcinogenicity and the Global Effects of Ultraviolet Radiation

Abstract

Objectives/Goals

The bacterial system, Escherichia Coli-recA, a strain that has a defect in genes that encode for a DNA repair enzyme, was used to model the effects of increasing concentrations of UVA and UVB radiation. By comparing growth of the bacteria under varied conditions, the effects of global warming and holes in the ozone layer will be inferred. The efficiency of current solutions for cancer prevention under increasing levels of radiation was also analyzed.

Methods/Materials

A diluted solution of the bacteria was spread onto nutrient agar plates and irradiated underneath a lamp. The plates' duration of irradiation and distance from the lamp were varied separately in different trials to examine the effects of increasing radiation. The efficacy of protective clothing to shield the epidermis was studied by covering plates with different materials. Transparent sunscreens of different SPFs were also tested by spreading the surface of plates.

Results

It was found that increasing UV intensity by decreasing the distance or increasing radiation duration decreased the number of colonies present. Protective clothing and sunscreen were effective in shielding some radiation, as growth patterns on those plates were similar to those on plates that underwent no radiation. Plates with UV protective cloth or a higher SPF had more bacterial growth than plates with average cotton cloth or a lower SPF, respectively. However, differences between these plates were not significant, and further research using even more concentrated levels of UV may reveal more information about when certain solutions become ineffective.

Conclusions/Discussion

Data was used in comparative studies to learn more about UV carcinogenesis in humans. Because humans possess DNA repair enzymes with similar functions, the decrease in the growth of E. Coli show that the same deleterious effect of increased UV radiation from global warming can be expected in skin cells. DNA subjected to radiation may be rendered useless through the formation of thymine dimers, and enzymes can only repair so much damage. Moreover, damaged DNA may become even more harmful by hindering the production of other regulatory proteins and needed enzymes, leading to an increased risk of skin cancer. Though the research showed that protective clothing and sunscreen were useful in combating radiation, they may become less effective at even higher UV concentrations.

Summary Statement

Escherichia Coli-recA was used to model the effects of an increase in UV and to study the efficiency of current protective solutions under elevated levels of UV, in order to infer how humans would be affected by global warming.

Help Received

Mr. Daniel Matthews helped me with the initial research process and technical writing. He supervised me during irradiation. Dr. Gary Blickenstaff provided me with advice when I was developing methods of experimentation and data collection. He supervised me when I was handling bacteria.