Why Should I Wear Sunscreen? Ultraviolet Radiation, DNA, And Mutations

Sheila Kratzer and Charlene M. Waggoner

Department of Biological Sciences
Bowling Green State University
Bowling Green, Ohio 43403

Ultraviolet radiation is part of the electromagnetic spectrum that comes to the earth from the sun. DNA absorbs ultraviolet radiation and forms thymine-thymine dimers. If these errors are not repaired, the DNA is altered and no longer codes for the original message. In humans, this damage can result in uncontrolled growth or skin cancer. In bacterial cells, which reproduce asexually, these mutations are passed onto the daughter cells. If the amount of radiation is sufficient, the cells will not reproduce.

This can be observed in the laboratory by exposing plated cultures of *Serratia marcescens* (available from American Type Culture Collection) to a source of ultraviolet radiation. Each group is given a liquid culture of the bacteria in nutrient media. They are instructed in aseptic techniques. Students use a sterilized swab to streak the nutrient agar plates. (Culture tubes and petri plates with the nutrient agar are available from Baxter/Scientific Products.) Plastic wrap is used as a support for various solar protectants. Each group covers half of the culture with a solar protectant and allows the other half to be exposed to the ultraviolet source. We use the ultraviolet light in a hood as our source. A hand-held source or the sun should work equally well. The exposure time will vary with the source. You should test times from 1 to 30 minutes. Exposed plates are allowed to incubate at room temperature for 24 hours. If students cannot examine plates at this time, they may be kept in the refrigerator for one week. The students determine relative amounts of bacterial growth based on the numbers of colonies. They relate the growth to the exposure to ultraviolet radiation.

This experiment is easy to do. It can be done using a very small amount of time in 2 or 3 consecutive lab sessions. It gives students a good chance to design an experiment and evaluate the results. If you have sufficient materials, it will take very little time to allow students to redesign and re-implement their experiment.