CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

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Project Number

S0518

Project Title

The Effect of Light Exposure on Chaperone Protein Alpha B Crystallin: Modeling Cataract Formation in the Lens

Abstract

Objectives

The objective of this experiment was to evaluate the extent to which visible light exposure affects the activeness of chaperone protein alpha B crystallin. AlphaB crystallin is a chaperone protein in the ocular lens which prevents other substrates in the lens from aggregation, known as cataract formation.

Methods

Samples of purified alphaB (aB) crystallin protein were exposed to LED white light for various amounts of time. After the designated exposure time, each sample of treated aB protein was evaluated for chaperone activity. To model the interaction between the aB and natural substrates in the lens, insulin substrate was mixed with the treated aB. Then, DTT, a denaturant, was mixed into the sample; the DTT was meant to denature the insulin substrate so that the aB, as a chaperone, could protect the substrate from the induced denaturation. Based on how well the aB was able to mitigate the effects of the DTT upon the insulin, its chaperone activity was measured. Once the DTT was added to the treated aB and untreated substrate mixture, immediately the sample was "zeroed" in the spectrophotometer, and the degradation in transmittance (caused by the induced aggregation of the insulin) was measured for each sample in intervals for an hour.

Results

The samples with the unexposed alphaB on average performed 1% higher in transmittance readings compared to the light-treated samples, suggesting that prolonged light exposure may have damaged chaperone activity of the protein. However, deviations within the results were calculated to be about 1% as well, thus making the experiment inconclusive.

Conclusions

Because both control and experimental groups fell between the margin of error, the results were deemed inconclusive. If this experiment was repeated, a higher concentration of proteins would be used, so that more dramatic changes would show in the spectrophotometer. Based on the data collected in this experiment, exposure to visible light has no significant impact on the activity of chaperone protein alpha B crystallin. Thus, light exposure should not be considered a contributing factor to cataract formation. A future direction of this research is to compare the effects of visible light with that of different types of UV radiations.

Summary Statement

Exposure to visible light did not significantly contribute to damaged activity in chaperone protein alphaB crystallin, the protein which mitigates cataract formation in the lens.

Help Received

All purified proteins utilized in this experiment were generously provided by Dr. Fan and Dr. Hilario at UCR. They also provided me guidance while designing procedures. The experiment was conducted at the Laub Lab; Dr. Laub taught me to use his uv-vis spec. in accordance with safety measures.