CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

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Project Number

34793

Project Title

The Effects of Glucose on Totipotent Cell Formation and Differentiation

Abstract

Objectives/Goals

The purpose of this experiment was to determine how various levels of dextrose monohydrate (D-glucose) affect the regenerative capacity of dugesia dorotecephala (brown planaria). The null hypothesis, H0, was that dextrose monohydrate has no effect on regenerative capacity. The alternative hypothesis, Ha, was that the dugesia dorotecephala exposed to higher levels of dextrose monohydrate have higher regenerative capacity because glucose increases Wnt signaling and mitotic division in cells.

Methods/Materials

To perform this study, pieces of liver were soaked in 0.00%, 5.00%, 10.0%, 15.0%, 20.0%, and 25.0% glucose concentrations to saturate the feed, which was then given to the planaria, 10 per concentration. The planaria were bisected about 3 hours after feeding, their lengths were measured after two days, and the percentage growths were calculated.

Results

The results showed that glucose significantly increased the regenerative capacity of planaria, as measured by the percent growth of each segment over a period of two days. The control group, exposed to 0.00% glucose exhibited on average, a 2.16% and 8.27% growth in the anterior and posterior segments respectively. Conversely, on average, the planaria exposed to 5.00% glucose exhibited a 15.7% and 26.6% growth; the planaria exposed to 10.0% glucose exhibited a 9.73% and 19.2% growth; the planaria exposed to 15.0% glucose exhibited a 13.0% and 16.1% growth; the planaria exposed to 20.0% glucose exhibited a 11.1% and 20.6% growth; and the planaria exposed to 25.0% glucose exhibited a 11.0% and 22.1% growth respectively. It was also noticed that the posterior portions of the planaria regenerated at a higher rate than the anterior segments.

Conclusions/Discussion

Thus, it is evident that glucose does increase the regeneration rate of planaria, most likely due to glucose#s ability to enhance mitotic division and Wnt signaling for cell differentiation. After statistical analysis using the Student#s T-Test, the calculated T-value, 3.36, was found to be greater than the critical value, 3.20. Therefore, the null hypothesis can be rejected and the alternate hypothesis considered. Further, this knowledge can be extended to understand the effects of blood glucose levels on embryonic development in humans.

Summary Statement

Our project tests the effects of glucose on planaria regeneration.

Help Received

Father helped to autoclave equipment for use during experiment and supervised the bisecting of planaria using a razor.

Preliminary