CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
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Project Number
34595

Project Title
Do Ions Regulate Positional Information and Regeneration?

Abstract

Objectives/Goals
Planaria are flatworms with an amazing ability to regenerate lost body parts. I was intrigued by this trait and wondered about the factors that contribute to regeneration. The goal of this study is to understand and identify ways to regulate this power using positional information, which is a set of instructions that "governs" the process of regeneration.
Ion channels are essential for cellular communication. This study illustrates that the transference of positional information may be dependent on certain ion channels. Therefore, changing the concentration of the available ions in the planarian habitat may affect regeneration. In this study, regeneration was measured by blastema formation (mass of proliferative cells at the wound site) and eventual differentiation into a head or tail.

Methods/Materials
I investigated by cutting planaria into two segments (head and tail) and subjected them to living conditions with different concentrations of selected monovalent and divalent ions. The Montjuic salt solution, a standard media in labs for culturing planaria, was used. The Montjuic solution contains sodium, calcium, potassium, and magnesium in distilled water. Removing specific ions created variants of the solution. Decapitated brown planaria were placed in the solutions along with a whole worm (the control.) The changes in their development were observed and the findings were recorded.
Nine different solutions were used, with four petri dishes of each solution. Three cut planaria (head and tail) and one whole planaria was in each petri dish. The total sample size was 144 planaria.

Results
The results supported my hypothesis that ion channels are linked to planarian regeneration. Each group of ions (monovalent and divalent) had a distinct and specific effect on the planarian life cycle. The divalent ions appear to be necessary for survival, while the monovalent ions may be required for regeneration.

Conclusions/Discussion
I found it interesting that the two ions most closely linked to regeneration, potassium and sodium, are also essential for the transmission of stimuli from the neurons through the sodium/potassium pump.
I plan to continue this project with an even larger sample size, more complex ions and better equipment. As we better understand the process and power of regeneration, we hope this knowledge will be used to improve the quality of life of mankind and other living beings.

Summary Statement
The goal of my project was to investigate if certain ions had an effect on the transference of positional information, and to discern which of these ions had the greatest effect.

Help Received
My science teacher, Mrs. Roxanne Hunker, helped guide me in this project. MBI, Inc. provided me with chemicals I needed to make my solutions, and I purchased the planaria from Ward Scientific. My father supervised me for safety and when needed.