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Characterizing the Role of Hyaluronic Acid in Tissue Regeneration Rate of Planaria Schmidtea Mediterranea Receiving Ultraviolet Radiation

Aditi Bondugula, Abbie Nicholson

Department of Biology, Rock Ridge High School, Virginia

ABSTRACT

Hyaluronic acid plays a crucial role in the skin by increasing hydration and stimulating collagen growth (Papakonstantinou, Roth, & Karakiulakis, 2012). It has a key position in wound healing and tissue repair processes such as healing and the stimulation of growth factors, and cellular components (Gonzalez, Costa, Andrade, & Medrado, 2016). Planaria Schmidtea Mediterranea are flatworms able to regenerate parts of their body if injured within a span of five days. These flatworms contain adult totipotent stem cells called neoblasts allowing them to do so (Wagner, Wang, & Reddien, 2011). Ultraviolet radiation (UV radiation), however, damages the planarian's abilities to regenerate tissue (Franjevic, Kalafatić, & Kovačević, 2006). In the present work, the effect of hyaluronic acid on two groups of ten planarians was investigated. Experimental populations of the Planarian Schmidtea Mediterranea were placed and physiological changes were monitored daily with a microscope in laboratory conditions at room temperature. Both groups of the planaria received ten seconds of UV radiation at the beginning of the experiment. Hyaluronic acid was only given to only one out of the two groups of planaria for 10 days. Data indicates that the ten deciliters of added hyaluronic acid predominantly slowed down the rate of tissue regeneration in planarians and reduced tissue regeneration rate compared to the other group of planarians. These results illustrate how hyaluronic acid had the opposite influence on planarian tissue regeneration and how it significantly diminished tissue growth.

I. INTRODUCTION

To better characterize the role of hyaluronic acid and planarian flatworms with ultraviolet radiation, an investigation was done in order to understand whether hyaluronic acid would regenerate tissue quicker that was destroyed by UV radiation. An experiment was performed to better understand how these factors influence planarian tissue rate of regeneration. In the study, a total of three trials were done. Stem cells are important in regenerating tissue and treating diseases (Baguna, Salo, & Auladell, 1989). UV radiation in planarians slows down the tissue regeneration rate, causes damage in regenerative properties, DNA, and may even result in cell death (Brown, 1967). If ten deciliters of hyaluronic acid are added into a petri dish with planarians who have received ten seconds of UV radiation, then the rate of tissue regeneration will accelerate since hyaluronic acid has tissue regenerative properties. There is no statistically significant correlation between the type of hyaluronic acid added to the planarian. Due to these issues, data from experimentation in the study pointed towards a slower rate of tissue regeneration in group 1 as compared to the rate of tissue regeneration in group 2 showing that hyaluronic acid plays an important role in greatly diminishing tissue rate of regeneration in planarians as well as their survival rate.

II. METHODS

Experimental Setup:

A UV lamp was placed against the wall and was ready to face the planaria in a dark environment. This setup helped duplicate the effect of UV radiation.

Preparation:

Two petri dishes were obtained and labelled group 1 and group 2, respectively. A pipette was used to add 15 drops of pond water into the two separate petri dishes.. Ten planarian were removed from their container and five were placed into group 1 while the other five planarian were placed into group 2.

Application:

Planarians in group 1 and 2 were cut in half using a scalpel. UV radiation was then supplied to both groups of planaria for ten seconds. After UV radiation, ten deciliters of hyaluronic acid was given to group 1 while group 2 did not receive any hyaluronic acid. Planarians were observed under a microscope and observations and measurements were written down. Both petri dishes were then placed in a dark environment to allow the planaria to grow and develop without any unknown variables. The next day, petri dishes were removed from the environment and a microscope was used to analyze the planarian. Findings were written down and pictures of the experiment were taken. After, planarians were removed from the petri dish to clean the pond water. This was done for ten days consecutively.

III. RESULTS

After testing the role of hyaluronic acid on the rate of tissue regeneration in planaria who received radiation, hyaluronic acid proved to slow down tissue regeneration rate significantly. Hyaluronic acid was administered to both groups of planaria but tissue regeneration rate in group 2 had approximately a 35% increase compared to group 1. These results led us to discover that the hyaluronic acid hurt the neoblasts that caused cell proliferation and caused more damage than tissue growth.

Table 1: Amount of Hyaluronic Acid Added to Group 1 vs. Group 2 In a Span of Ten Days

Da y	Amount of Hyaluronic Acid Added to Group 1	Amount of Hyaluronic Acid Added to Group 2
1	10 deciliters	0 deciliters
2	10 deciliters	0 deciliters
3	10 deciliters	0 deciliters
4	10 deciliters	0 deciliters
5	10 deciliters	0 deciliters
6	10 deciliters	0 deciliters
7	10 deciliters	0 deciliters
8	10 deciliters	0 deciliters
9	10 deciliters	0 deciliters
10	10 deciliters	0 deciliters

Table 2: Tissue Regeneration Growth in Group 1 vs. Group 2 In a Span of Ten Days After the Administration of Hyaluronic Acid

Day	Tissue Regeneration Growth in Group 1 (cm)	Tissue Regeneration Growth in Group 2 (cm)	Difference in Tissue Regeneration Growth Between Group 1 and Group 2.
1	0	0	0
2	0	0	0
3	.15	.5	.35
4	.22	1.5	1.28
5	.36	1.8	1.44
6	.39	2	1.61
7	.41	2.3	1.89
8	.44	2.7	2.26
9	.47	2.8	2.33
10	.48	3	2.52

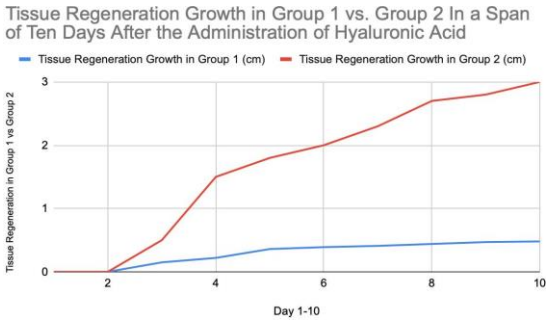

Figure 1: Tissue Regeneration Growth in Group 1 vs. Group 2 In a Span of Ten Days After the Administration of Hyaluronic Acid

V . CONCLUSION

The findings in this experiment procured understanding on the ineffectualness of hyaluronic acid on tissue regeneration rate in planaria receiving UV radiation thus disproving our initial hypothesis that hyaluronic acid will promote tissue growth in planarian. After evaluating the computable results in our experiment, we also recognized the properties of hyaluronic acid. We concluded that hyaluronic acid is harmful when excess amounts are added causing it to remove the moisture within the planarian. This led us to understand that decreasing the amount of hyaluronic acid predominantly may stimulate tissue growth and reduce the harmful effects.

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