The Effects of Electrical Stimulation on Planaria Tissue Regeneration

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Cellular regeneration is a primary process necessary for the reconstruction of impaired tissue following an injury. In contrast to acute wounds, chronic wounds are characterized by prolonged regeneration leading to an increased susceptibility to infection and potential nerve damage. The role of electrical signals is crucial in initiating regenerative processes integral to wound healing. The objective of this study was to assess the efficacy of external electrical stimulation in enhancing wound healing by facilitating the targeted delivery of electrotherapy to the injury site and promoting the directional migration of regenerative molecules. Wound healing was modeled by the regeneration of bisected freshwater brown planaria. It was hypothesized that planaria exposed to electrical stimulation would have a significantly lower regeneration time compared to unexposed planaria. Electrical current of varying voltage groups (1-Volt, 3-Volts, and 5-Volts) was delivered through a DC power supply in an electrolyte solution. Complete regeneration was measured by the development of prominent photoreceptors in the eye as observed under a microscope. All exposure groups exhibited shorter average regeneration times compared to the control group. A Single-Factor ANOVA statistical analysis followed by a series of Two-Sample t-tests with adjusted Bonferroni correction values confirmed a statistically significant difference between the control group and the 3-Volt group. The accelerated regeneration observed in the 3-Volt exposure group supports that electrical stimulation can enhance wound healing processes after an injury. Future applications of electrotherapy supported by the results of this study may be used to promote tissue regeneration in individuals with chronic wounds.

Awards Won:
Air Force Research Laboratory on behalf of the United States Air Force: Glass trophy and USAF medal for each recipient
Air Force Research Laboratory on behalf of the United States Air Force: First Award of $750 in each Regeneron ISEF Category,