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Kuhn

Worms on Drugs: Can Allergy Meds Mess with Regeneration?

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Honors Research Pinnacle Project



Abstract

- Investigating inhibitions to regeneration in planaria using Loratadine, a mucus thinner.
- Our hypothesis is that the healthy mucus barrier is essential for planarian regenerative abilities. In our experiment, we exposed planaria to 5 concentrations of loratadine and tested their growth and the time it takes to fully regenerate.
- We discovered that loratadine slowed down regeneration time, potentially demonstrating the effects of pharmaceutical runoff, even in medications low in toxicity. As the concentration of loratadine increased, planaria experienced slower growth times and higher mortality.

Background

- Planaria are freshwater flatworms capable of full-body regeneration using pluripotent stem cells called neoblasts.
- Planaria are used as model organisms due to their simple bilateral body structure, primitive nervous systems, and ease of experimentation.
- They are ideal for drug studies as their responses often mirror human reactions, making them useful in developmental and pharmacological research.
- Planaria secrete a mucus layer that helps with mobility and immune defense, preventing pathogen invasion and playing a key role in protecting regenerating tissues.
- Loratadine, an antihistamine used in humans to reduce mucus, is tested for planaria mucus and regeneration rates.
- Disruption to mucus in planaria may impair immune functions and slow neoblast-driven tissue growth.
- Loratadine affects H1 histamine receptors, and prior studies show planaria also have these receptors.
- This study addresses a research gap: whether mucus is essential in tissue repair and regeneration in planaria.

Results

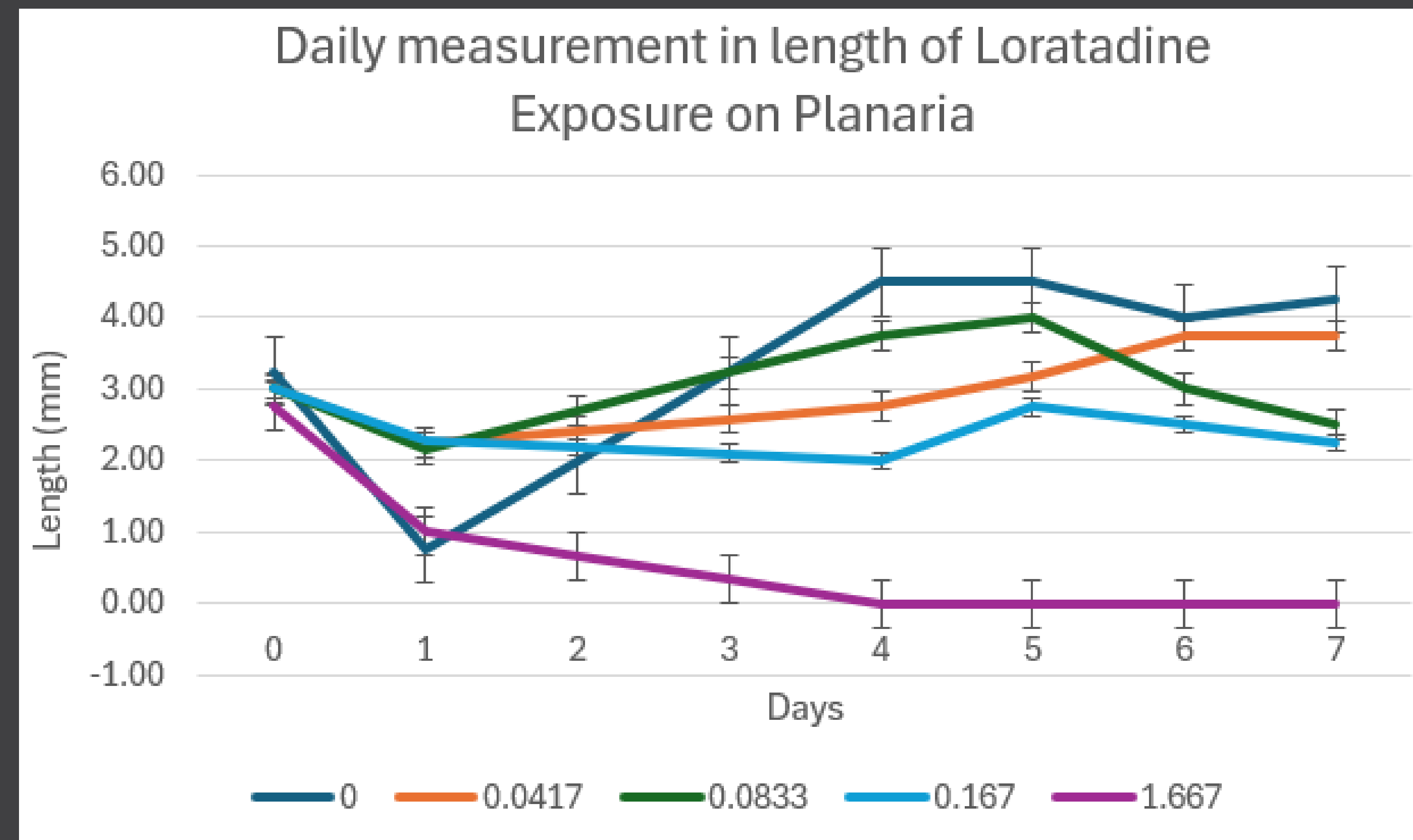


Figure 1. There is a significant effect of loratadine on preventing planaria growth. The days that the planaria grew was graphed against the lengths of the planaria. Each loratadine concentration was assigned a different color on the line graph. Dark blue was assigned to 0%, orange was assigned to 0.0417%, green was assigned to 0.0833%, light blue was assigned to 0.167%, and purple was assigned to 1.667%. The bars are 1xSEM.

There is no overlap in error bars, showing that different concentrations of loratadine cause the planaria to grow at a corresponding slower rate eventually.

Figure 2:

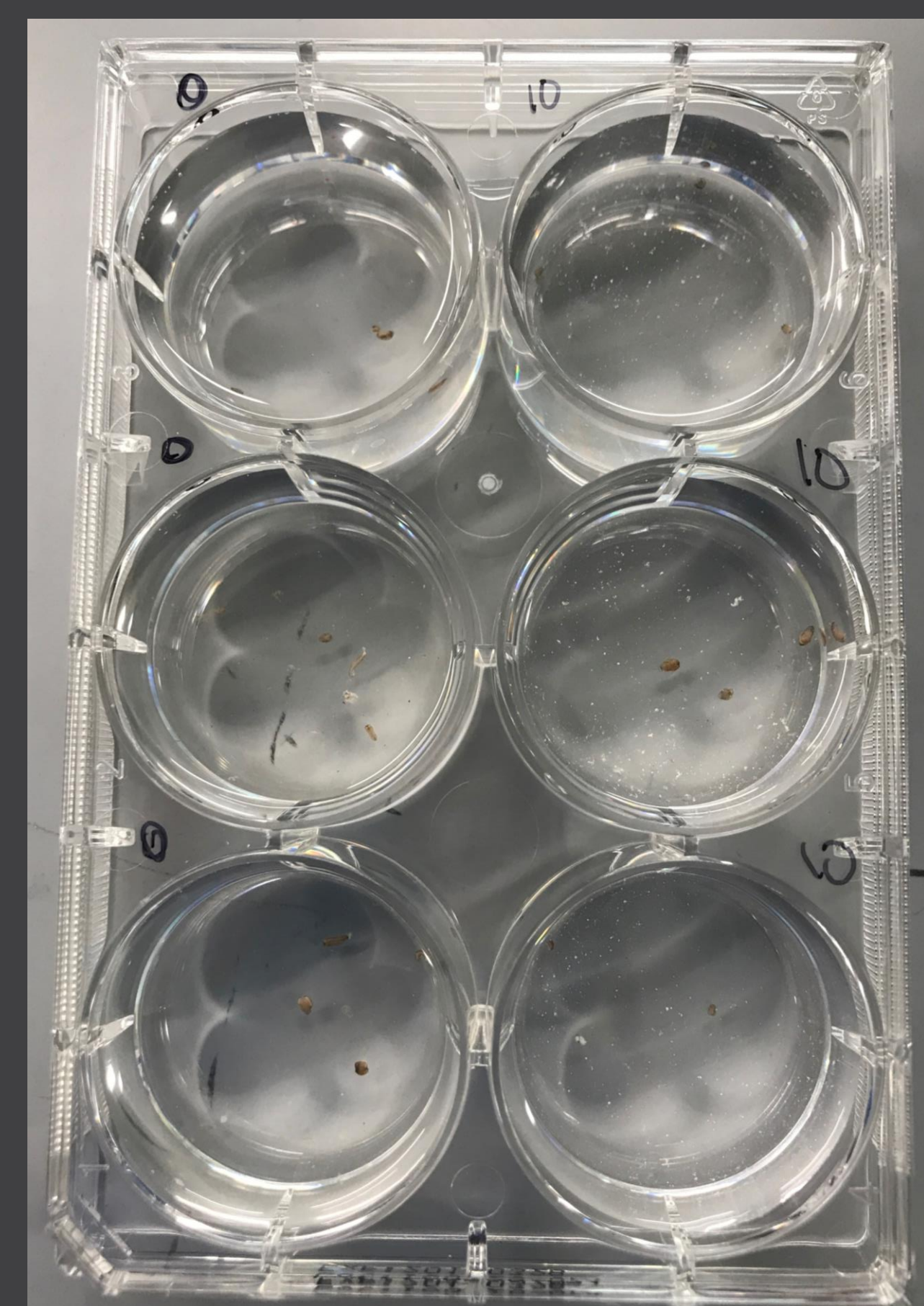


Figure 2. On the left are the well plates we used for each concentration. Three wells were for each concentration listed above and we cut each planaria in half at the start.

Figure 3. The well plates close-up look like this. It allows us to easily measure the planaria individually, especially since each experimental solution is split into three different wells. These planaria specifically appeared white after 4 days of experimentation.



Methodology

Part one:

- Culture planaria using aerators and a closed environment to prevent light penetration.
- Once the culture is mature, isolate 5 planaria per concentration of loratadine. We used 5 diluted concentrations and tested for mortality rate within 1 week. Observations on levels of activity and death rate.
- Test planaria in each concentration of loratadine for levels of mucus.

Part two:

- Note down the concentrations with the most activity and least death rate and make concentrations of loratadine to match those again.
- Using well plates, insert 2 planaria in each well. The same loratadine concentration should be inserted into 3 wells, overall testing 6 whole planaria.
- We made a dilution sample of 0%, 0.0417%, 0.0833%, 0.167%, and 1.667%
- Cut Planaria in 2 equal bits.
- Observe growth patterns within 1 hour, 24 hours, and everyday past that for 2 weeks.

Conclusion

- Loratadine slows the regeneration rate and survival of planaria. Across the various concentrations we tested, there was a noticeable trend that higher concentrations of Loratadine meant there was an increased mortality and delayed or incomplete regeneration.
- These results reflect the larger issue of pharmaceutical runoff, as improperly disposed medication is often seen to end up in waterways and are not fully removed by treatment plants. Over time, these contaminants can accumulate, potentially impacting human health.
- In addition, future scientific developments may include allowing the regeneration of human limbs, which is currently impossible due to humans' lack of pluripotent stem cells. However, if regeneration in humans becomes developed, it must be considered whether mucus is necessary.