

Planaria Regeneration and Patterning Lab Write-up*

Introduction to Stem Cells and Planaria Lab

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Abstract

The planaria is a remarkable invertabrate that has the ability to regenerate within a few days of being halved. Planaria are of key interest to biologists because their signaling pathways involved in development is highly similar to humans. The process by which the planaria are able to split and recreate vital appendages is hypothesized to be linked to calcium homeostasis. This lab exposes planaria to PZQ (Praziquantel) to further understand the planaria's re-formation process. The authors of this lab report were interested in exploring the impact of PZQ on the regeneration process of planaria, in addition to the period of time it took to reform. Within the experiment, it was discovered that there was a significant difference within treatment mediums; particularly, that exposure to PZQ itself would greatly impact the average time needed for planaria tails to reform eyespots and for planaria heads to reform their pharynx. Thus, it is learned that PZQ itself most likely has disruptive mechanisms that either block or even outright destroy the signaling pathways of planaria. In understanding the interaction that PZQ has with planaria regeneration, it is possible that biologists can build a stronger understanding of the chemical nuances involved with regeneration signaling.

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1 PZQ Impact on Regrowth

The null hypothesis for this section is the proportion of PZQ treated segments will regrow the same proportion as those in the control treatment.

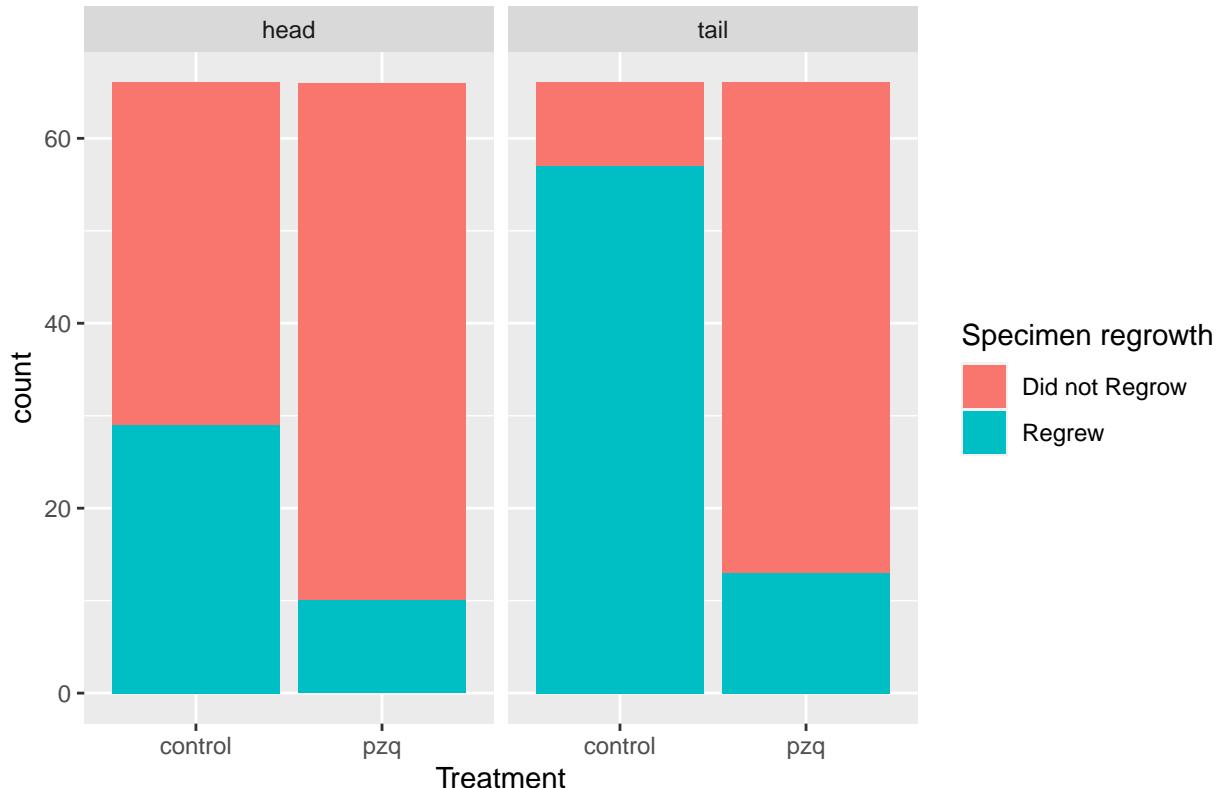
```
##  
##          N   Y  
##  control 37 29  
##  pzq      56 10
```

Head segments exposed to PZQ ($\frac{10}{66}$) are statistically significantly less likely to regrow than the control treatment ($\frac{29}{66}$) ($\chi^2 = 11.7915633$, $df = 1$ $p = 5.949975 \times 10^{-4}$)

```
##  
##          N   Y  
##  control  9 57  
##  pzq      55 11
```

Tail segments exposed to PZQ ($\frac{11}{66}$) are statistically significantly less likely to regrow than the control treatment ($\frac{57}{66}$) ($\chi^2 = 61.4200368$, $df = 1$, $p = 4.6109419 \times 10^{-15}$)

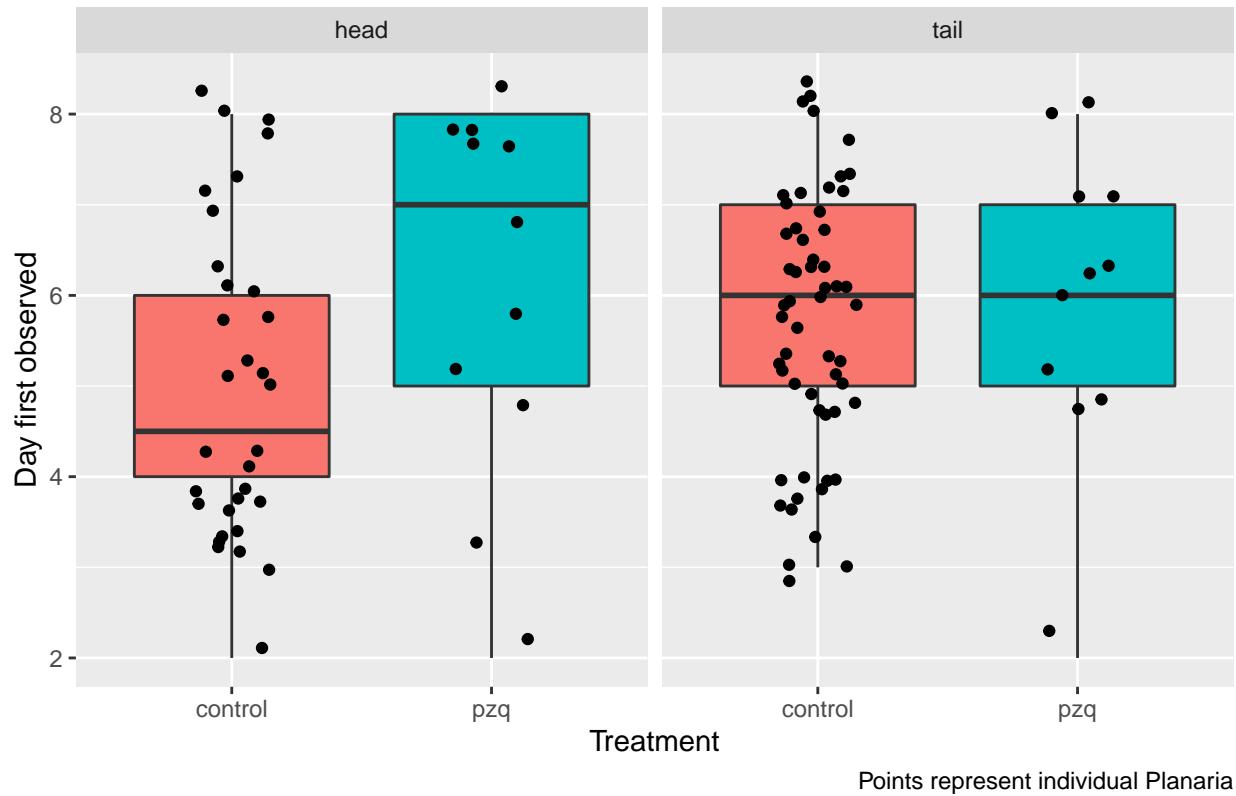
Regrowth by treatment and segment



2 ANOVA Test

The null hypothesis is that across groups planaria take the same number of days to regenerate.

Days before regrowing missing segment



The mean number of days before regrowing based on the segment was not statistically significantly longer for heads (5.2790698) than the tail group (5.7014925). (Two-Way ANOVA, $df = 1$, $\sum^2 = 0.398005$, $f = 0.1553$, $p = 0.6943$)

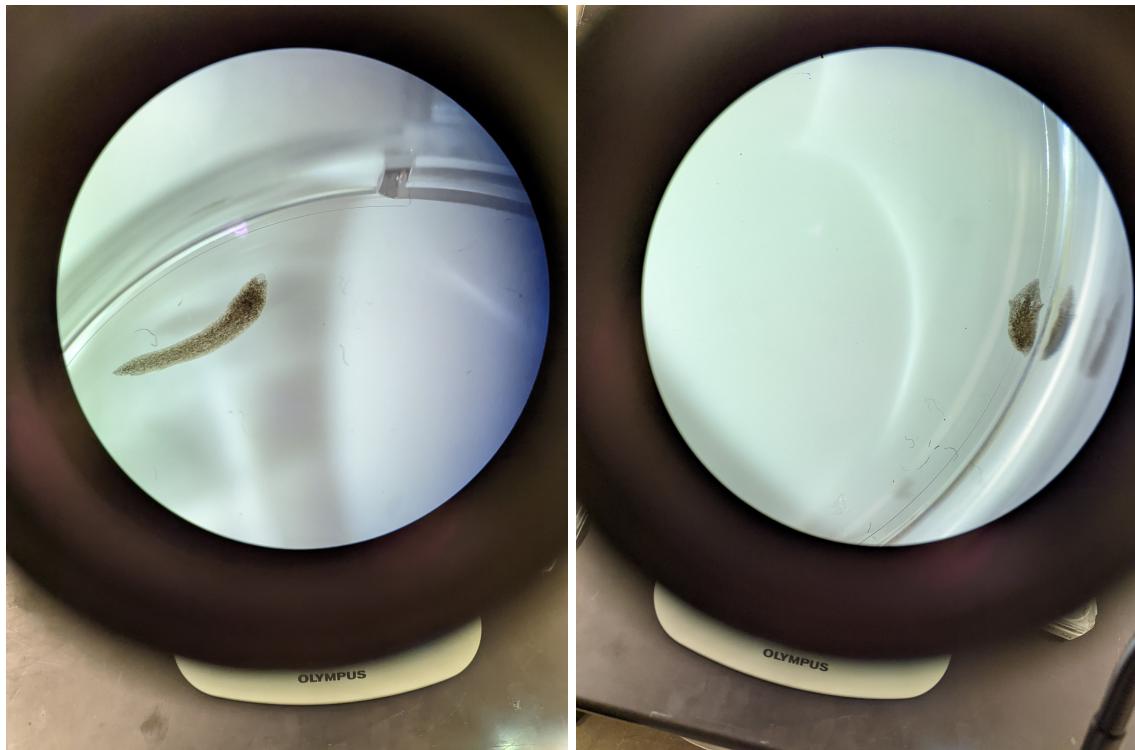
The mean number of days before regrowing based on the treatment is statistically significantly longer in the PZQ group (6.0454545) than the control group (5.4090909). (Two-Way ANOVA, $df = 1$, $\sum^2 = 10.776460$, $f = 4.2050$, $p = 0.0428$)

There is no statistically significant interaction between treatment and segment in the PZQ group (head, PZQ 6.3333333; head, control 5.030303; tail, PZQ 5.7; head, control 5.6363636). (Two-Way ANOVA, $df = 1$, $\sum^2 = 3.118567$, $f = 1.2169$, $p = 0.2725$).

3 Figures



Figure 1: A split planaria with a head (top) and tail (bottom) segment



The figures above are pictures of two regrowing segments taken on day 4.

On the left is a regenerating tail which is significantly longer than the head segment. Although it does not

have fully reformed eyes, there is a rough outline that suggests that it is beginning to reform the core of its head.

On the right is one of the sample head segments. The segment in this figure is currently in the early phases of its regeneration.

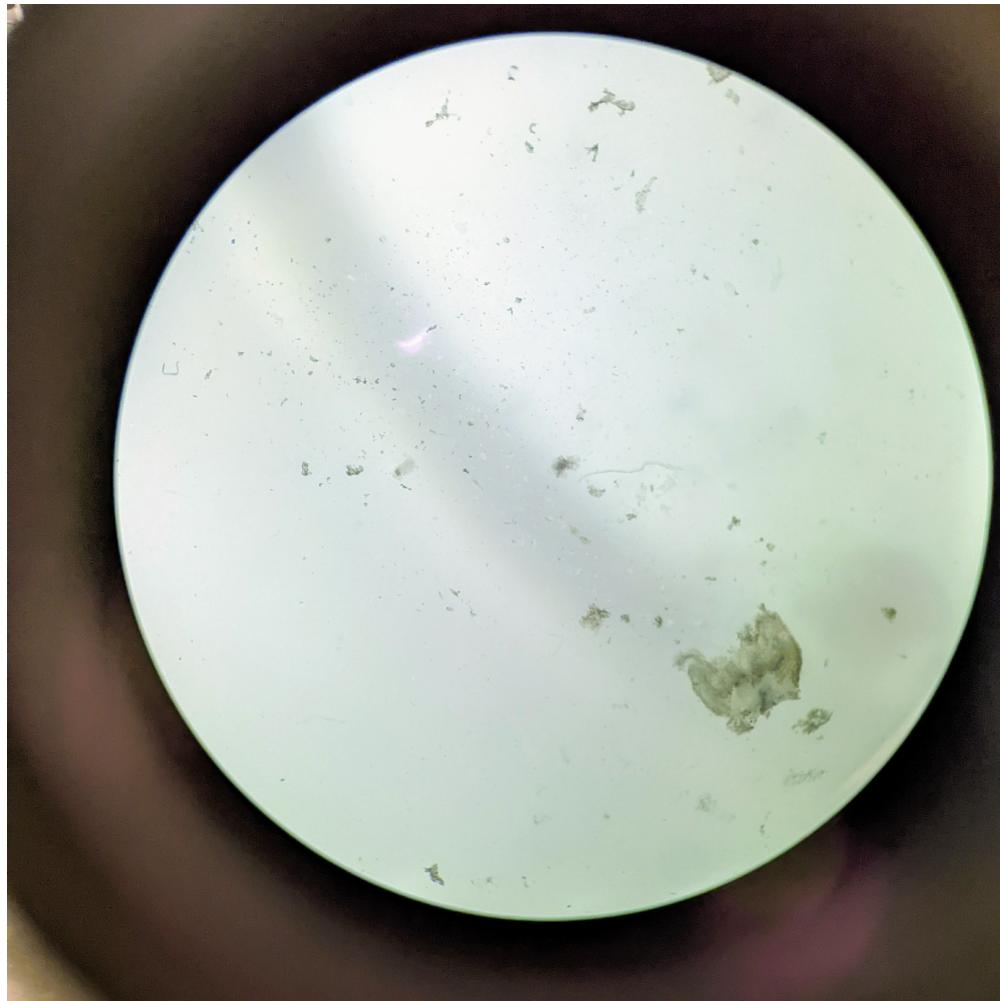


Figure 2: A disintegrated Planaria from the PZQ

Above is a planaria segment from the PZQ treatment that disintegrated. There are no distinguishable planaria features that can be discerned from the image above.

4 Author Contributions

Connie Mangan performed analysis in jmp, Morgan LeMay dissected the planaria for lab, and Taylor Blair created graphics and formatted the document. All authors contributed equally to the write-up.

The checking schedule was divided accordingly:

Table 1: Watch Schedule

Days since start	Date	Day of week	Time	Checker
0	2/3/2022	Thursday	14:52:00	All
1	2/4/2022	Friday	12:50:00	Taylor
2	2/5/2022	Saturday	14:30:00	Morgan
3	2/6/2022	Sunday	13:34:00	Connie
4	2/7/2022	Monday	12:30:00	Taylor
5	2/8/2022	Tuesday	12:30:00	Morgan
6	2/9/2022	Wednesday	17:30:00	Connie
7	2/10/2022	Thursday	13:44:00	All

5 Grading

This section left empty for grader feedback.

5.1 Table

Component	Excellent	Good	Satisfactory	Incomplete/Needs Work
Report organization				
Abstract: Background & Scientific Question				
Abstract: Methods & Results				
Abstract: Discussion				
Figure/Graphs				
Figure Legend				
Statistical Results				

5.2 Other Comments