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4-2023

Memory Acquisition by Brainless Juvenile Terrestrial Planarians (*Bipalium kewense*)

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Memory Acquisition by
Brainless Juvenile Terrestrial
Planarians (*Bipalium kewense*)

By: Christine Gildea and Christina Chueiri

Background

Who are our subjects?

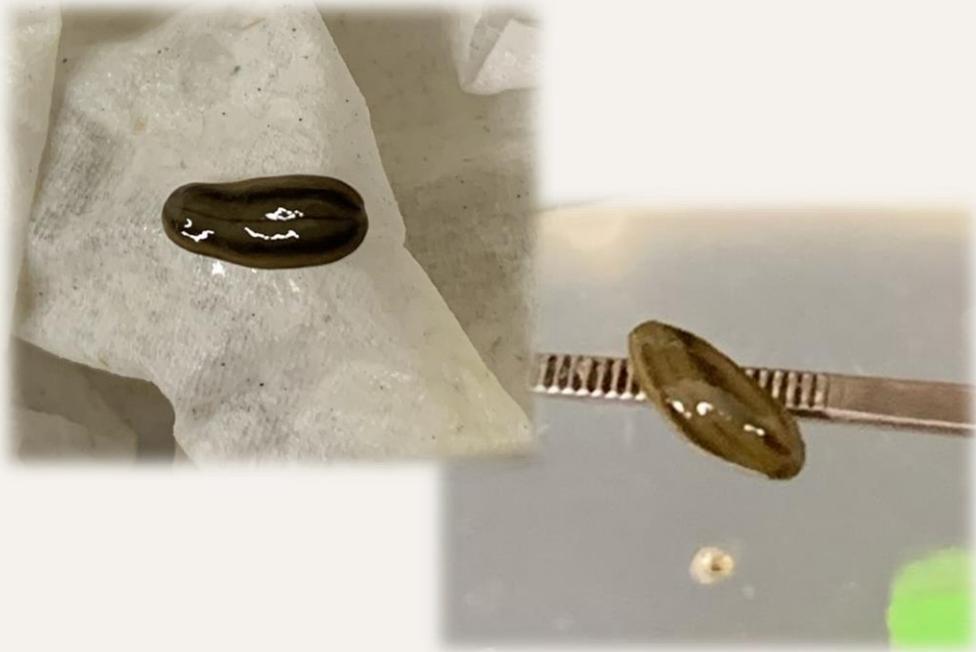


Bipalium kewense:

- ✓ Invasive flatworm species of Platyhelminthes
- ✓ Fragmented reproduction by pinching off a small piece of their posterior end
- ✓ Size range varies; can grow upwards a foot

Background

Who are our subjects?

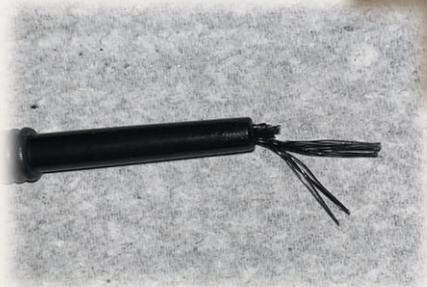


Bipalium kewense:

- ✓ Very minimal central nervous system; two nerve cords and two ganglia serve as their brain in adult
- ✓ Juvenile has no ganglia until full maturation (over 2 weeks)
- ✓ Behaviors

Previous Experiments

Both of us independently have tried a multitude of avoidance experiments with the juvenile and adult stage groups:



- ✓ Chemical substrates
- ✓ Light
(negative reinforcement)
- ✓ Paintbrush on early-juvenile stages
(mimic predators)

Our Research

Can *Bipalium kewense* store and retain a memory?

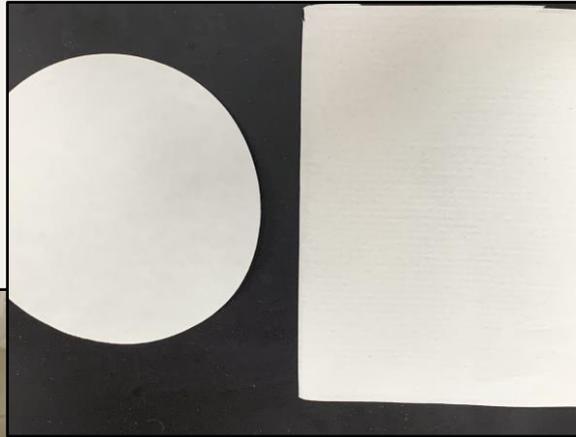


Hypothesis:

If early-stage juvenile *Bipalium kewense* are raised on condition A and exposed to a negative stimulus on condition B as a late-stage juvenile, then the late-stage juvenile would prefer condition A.

Methodology

1. Fragmented *Bipalium* was categorized into either the **Control (C)** or **Experimental (E)** group. **C** was raised in rough texture and **E** was raised in smooth texture.

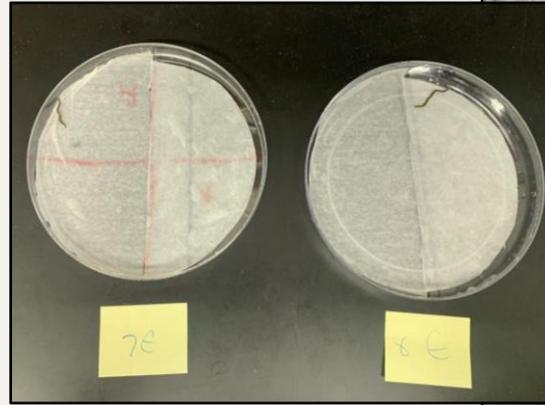


2. When the head began forming after 16 days, **E** was removed from the smooth and was placed into the rough.



Methodology

3. **E** was negatively poked 2x daily for 4 consecutive days to mimic predation.



4. After 4 days, **C** and **E** were placed into testing chambers for 24 hours to observe their choice in texture.

Objectives

Our goal with this experiment was to determine if memory acquisition in early-stage juvenile *Bipalium kewense* was possible, since they fragment without a developed "brain."

If possible, this would indicate that memory is not stored in their brains, but rather elsewhere in their body.



Preliminary Results

| | Control | Experimental |
|--------|---------|--------------|
| Rough | 6 | 4 |
| Smooth | 1 | 6 |
| Middle | 0 | 2 |

- ✓ 85% of the control preferred the rough texture, where they were raised.
- ✓ 50% of the experimental preferred the smooth texture, where they were raised.
- ✓ Sample size - too small (12 E and 7 C), so cannot show effect of negative stimulus

Discussion

- ✓ Could not determine significance for learning to avoid the negative stimulus due to sample size
- ✓ Preference for home texture clearly seen
- ✓ Previous studies have been done with aquatic planaria to:
 - Determine where memory is stored
 - Attempted to teach directional behavior
- ✓ Is preference for where they were raised considered “learning”?



Conclusion



- ✓ More trials and adjustments of the training protocol are needed.
- ✓ Well, *why do we care?*
Our study is the first on headless frags and their ability to learn!
- ✓ What human implications could this have?

Future Ideas

- ✓ We would like to test the offspring from both groups to see which texture they would prefer to reside on.
- ✓ This would signify transgenerational memory inheritance.



References

Abbott, S. M., & Wong, G. K. (2008). The conditioning and memory retention of planaria (*Dugesia tigrina*) for directional preferences. *BIOS*, *79*(4), 160–170. <https://doi.org/10.1893/0005-3155-79.4.160>

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