

Can *Hydra*, an organism with no brain but a nerve network, be conditioned?

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Introduction

The freshwater cnidarian polyp, Hydra, serves as an ideal model to study various scientific phenomenon in the lab. Hydra are inexpensive animals, which do not undergo senescence i.e., Hydra are biologically immortal. Unlike animals that are higher in the evolutionary tree, Hydra have a very simple nervous system, consisting of a nerve net that regulates behaviours such as feeding, contractions and elongations.

- Hydra possess thread cells, nematocysts--tiny stinging cells--which release a paralyzing poison into the prey, allowing for their capture.
- Hydra do not have eyes and sense food when glutathione, a chemical is released from prey.
- Studies show that exposure to glutathione increases the feeding response of Hydra (2). We designed an experiment to explore whether Hydra, which do not carry out complex behaviours, can be conditioned to increase the amount of food intake. It was also easy to measure the feeding response of Hydra, given the stereo-microscopes provided by BioBus. Inc.

Hypothesis: Hydra exposed to glutathione can be conditioned to significantly increase their average intake of brine shrimp.

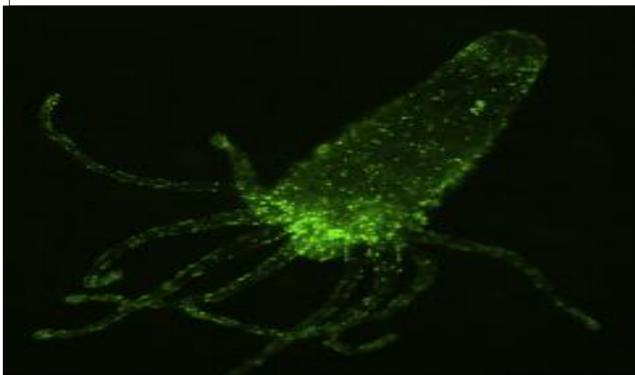


Figure 1. The nervous system of Hydra. Neurons throughout the Hydra nervous system, visualized by labeling with GFP. (Image courtesy of Christophe Dupre.)

Methods

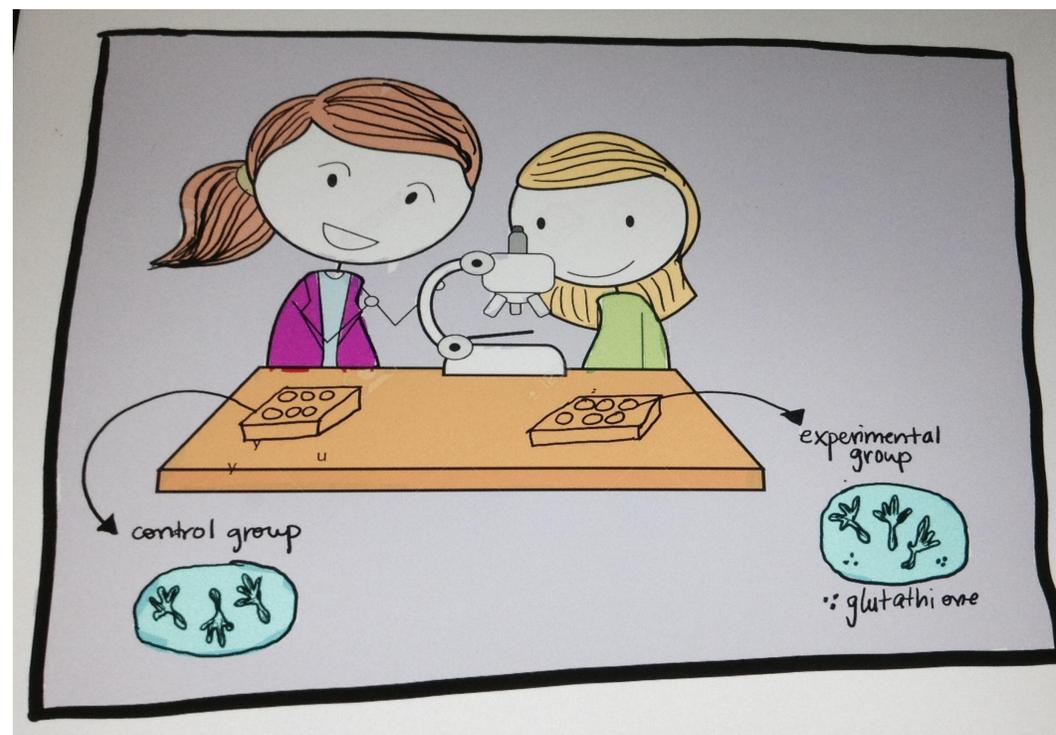
We had two treatment levels

- 1) experimental group which received the treatment, i.e., deposition of 3 uM glutathione five minutes before introducing brine shrimp to the culture
- 2) control group which didn't receive the treatment.

Nine brine shrimp were added to each well. With the exception of independent variable, exposure to glutathione, we employed **standardized conditions** in both groups.

- temperature of sixty degrees Fahrenheit
- volume of Hydra Medium (HM)
- species of Hydra and Brine Shrimp
- type of container i.e., well plates were used. Well plates allowed for multiple repetitions of the experiment, which helped us verify our results and ensure that particular behaviour isn't by chance alone; well plates also made it simpler to count how many brine shrimp were eaten by Hydra.

- 3) Feeding response was measured by counting how many live brine shrimp were left in the HM.



Works Cited

- Bossert, Patricia, and Brigitte Galliot. "How to use Hydra as a model system to teach biology in the classroom." *International Journal of Developmental Biology* 56.6-7-8 (2012): 637-652.
- Kulkarni, Ram, and Sanjeev Galande. "Measuring Glutathione-Induced Feeding Response in Hydra." *Journal of Visualized Experiments: JoVE* 93 (2014): 52178. PMC. Web. 18 June 2017
- Ni, and Steven W. Flavell. "Hydra: Imaging Nerve Nets in Action." *Current Biology* 27.8 (2017): R294-R295.

Results

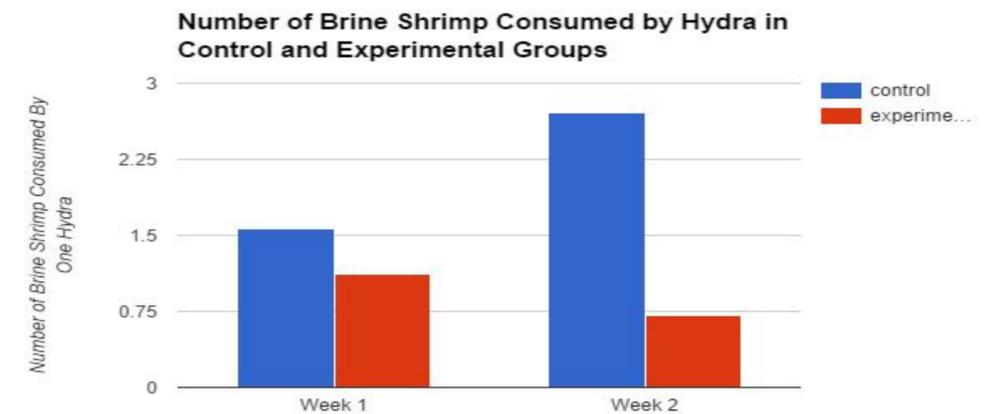


Figure 2

In the graph above blue bars represent the amount of brine shrimp eaten by Hydra in control group and red bars represent the amount of brine shrimp eaten by Hydra experimental group.

- Hydra in the control group consumed more brine shrimp than Hydra in the experimental group
- We observed Hydra preconditioned with glutathione subdued brine shrimp much more quickly; though we aren't sure what caused this behaviour.
- There's variability in baseline feeding response from week to week (see graph above)
- Based on the data generated, we can't conclude whether glutathione increased the feeding response of Hydra

Future Directions

There were many challenges in the execution of this study. Initially we wanted to carry out the experiment for more than four weeks; however, by week two all the experimental Hydra had dried up. Hence we couldn't continue the experiment since there were no conditioned Hydra left.

- It is, therefore, recommended that further investigations institute robust amount of HM in each well and cover up the set-up with parafilm to prevent evaporation of HM.
- To avoid accidents such as losing organisms, it is important to monitor the Hydra culture more than once a week.

With these considerations, it is possible to carry out the experiment for a longer time and derive data that will lead us to conclusive results. Conducting the experiment for a longer time can also lead us to answer whether Hydra, with such a simple nervous system can be conditioned.