Gonadotropin hormones may increase frequency of spawning in the sea anemone *Nematostella vectensis*

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Introduction

Corals are animals that build underwater reef ecosystems, which are vital to human and marine life. Corals reproduce through highly synchronized mass spawning events, where eggs and sperm are released into the water in unison at precise times of the year and night. Studies suggest that seasonal temperatures and moonlight are important external stimuli that trigger signalling cascades, but there is much more to be discovered about the external and internal mechanisms involved in this process (Kaniewska et al. 2015).

Figure 1: Female coral spawning eggs

Purpose

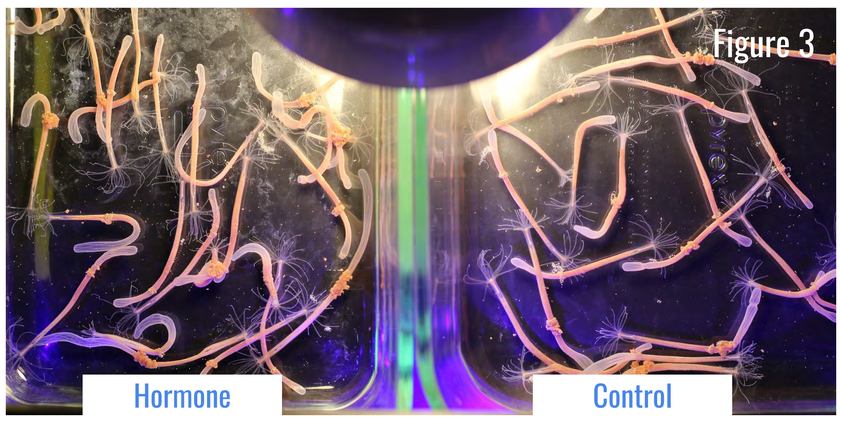
We are interested in how the timing of egg release is controlled. Environmental cues trigger spawning, but the biological pathways that control the timing of remain unclear. We developed the sea anemone *Nematostella vectensis* as a coral model to study the timing of spawning. In previous research, *Nematostella* were found to express receptors for hormones such as human chorionic gonadotropin hormone (HCG) that control aspects of reproduction in animals including humans. We determined **baseline timing of spawning** and explored whether exposure to **HCG affects the timing of spawning**.

Methods

Baseline Timing of Spawning

Eight trials were conducted to establish baseline timing of spawning behaviors. Anemones were maintained in artificial seawater and kept in total darkness. For each trial, the water temperature was raised from 18 to 25 degrees, and a light cue was added from a blue LED light and a white light desk lamp. These triggers mimic natural conditions that induce spawning.

All spawning activity was captured by photography; photos were taken every 5 minutes over the course of 10-15 hours. Photos were evaluated to identify the timing of egg release, including how many times each anemone released eggs.

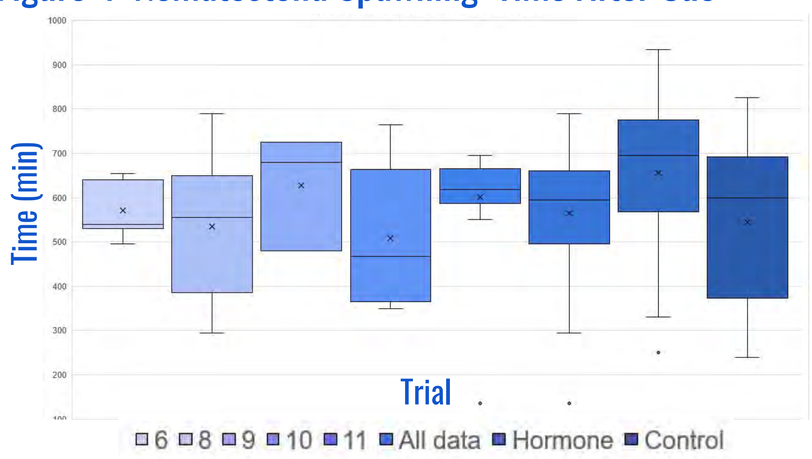


Impact of HCG Hormone Exposure

To examine the effect of human chorionic gonadotropin hormone, we conducted a pilot experiment with 28 anemones in a control dish containing seawater and 28 anemones treated with HCG hormone (100 ng HCG/mL seawater). We repeated the same protocol as for the baseline study (environmental cues to trigger spawning and photographic data to identify the timing of spawning).

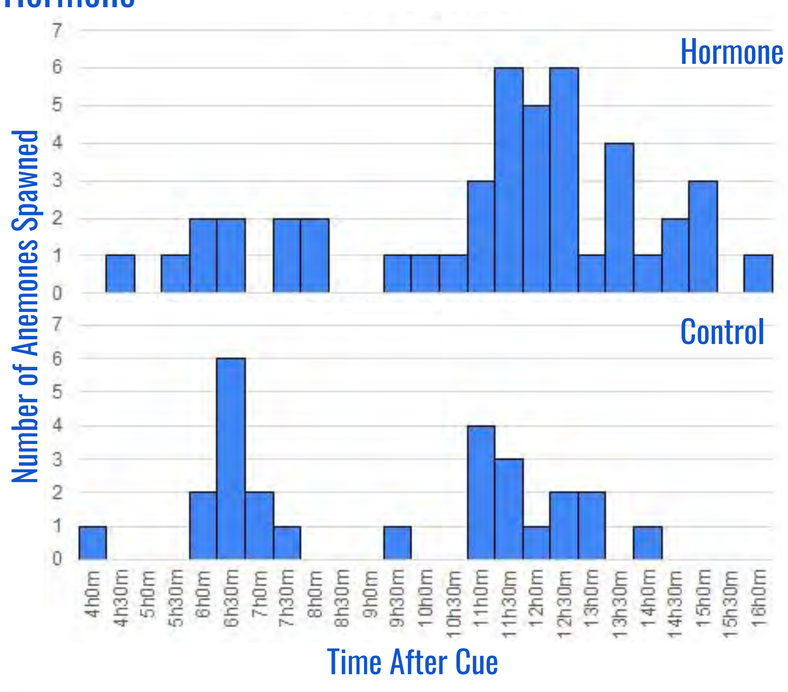
Data Analysis

Figure 4: Nematostella Spawning: Time After Cue



Each box in this chart represents one night of spawning.The anemones largely spawn at the same time each night - the average for control trials was 9h 25m. The hormone trial is skewed slightly later than the rest, but not by enough to be very meaningful without more data.

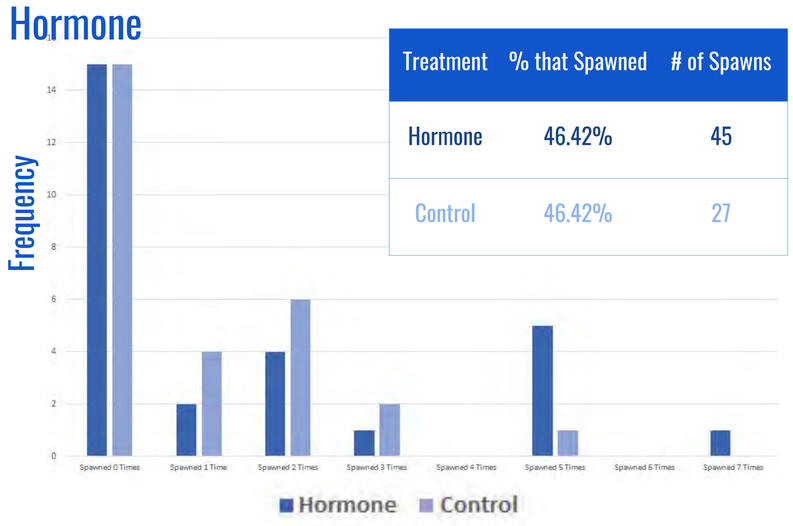
Figure 5: Nematostella Spawning In Response to HCG Hormone



This histogram shows the distribution of spawning over the period of one night, comparing the hormone trial to a control, showing that the peak of spawning happens later in the night for anemones treated with HCG hormone.

Figure 6: Spawning Frequency in Response to HCG Hormone

Treatment	% that Spawned	# of Spawns
Hormone	46.42%	45
Control	46.42%	27



From our preliminary analyses of the impacts of the hormone treatment on spawning behavior, we see that spawning anemones in the control group typically only spawned 1 or 2 times during the night, while spawning anemones in the hormone group most often spawned 5 times, with one anemone spawning 7 times. The hormone and control treatments had identical percentages of anemones that spawned at 46.4%, or 13 out of 28 anemones. Yet, the hormone treatment had 45 spawning events, while the control only had 27 spawning events, even though the same number of anemones spawned in each. These data suggest that hormone exposure increases the frequency of spawning events for individual anemones.

Conclusion and Next Steps

We established a method for quantifying anemone spawning behavior and established the baseline spawning behavior for *Nematostella.* We found that most spawning events occur between 8h 15m and 11h after the heat and light cues (average 9h 25m).

We found preliminary evidence that hormones may affect spawning behavior, but this needs to be investigated further. The average spawning time for anemones exposed to HCG occured about 1.5 hours later than control. Going forward, more trials need to be conducted to determine the role of hormones on anemone spawning behavior.

References

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