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作品名稱	Investigating the Effect of Coloured Light on the Behaviour and Learning of Lymnae stagnalis
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Abstract

Lymnae stagnalis (pond snail) is emerging as a preferable invertebrate model in understanding neurological mechanisms because of its simple nervous system. A three-cell network mediates behaviours such as aerial respiration and research has shown that small, subtle changes occurring across the network might result in a disruption of natural behaviour (Lukowiak et al. 1995). It is also known that *Lymnae* features a more developed eye than other molluscs and studies have shown that various wavelengths of light can activate photoreceptors producing distinct electrophysiological responses (Sakakibara et al. 2004). However, no studies have looked beyond the electrophysiological response. The purpose of this project was to determine if coloured light would firstly, elicit a ***behavioural*** response as observed in its movement and secondly, affect ***learning and memory*** through the operant conditioning of its aerial respiration.

Procedures

Freshwater snails and water were collected from a lake in northern British Columbia.

Movement: Test-site included a round barrier (40cm diameter) placed on moistened glass which covered a grid mat. A tripod supported a camcorder 1m above the test-site and a 200lumen LED flashlight (with various colours of cellophane wrapped around it) 60cm above the test-site. A timer was placed in camera-view. Snails were numbered and grouped in sevens. Each group was placed on the glass and recorded through no light, white, blue, red, yellow and green light in 20-minute intervals. Video was analyzed to measure the distance travelled by each snail in each test.

Operant Conditioning of Aerial Respiration: 500mL of lake water was deoxygenated by vigorously bubbling N_2 for 20mins. Bubbling continued at a reduced rate to maintain hypoxic conditions. Numbered snails were placed into the water to acclimate for 10mins, then were trained for 30mins. Each time a snail attempted to open its pneumostome at the water's surface, the pneumostome was

gently poked using a sharpened stick and this was recorded. Snails were returned to natural lake water for 1hr. After 30mins, deoxygenation began and procedure was repeated. 24hrs later, the procedure was repeated to test for retention of memory and learning. Process was repeated under red, yellow, blue, and green light with new snails each time.

Results

Analysis through Anova showed significant difference ($p=0.007$) in movement under the various colours including controls of no-light and white-light. T-tests and video evidence supported that snails were significantly more active in blue light and least active in yellow light where an interesting turning-in behaviour was observed.

Operant conditioning of snails under white-light (control) was successful with a significant reduction of aerial-breathing through the pneumostome 24 hours after training sessions. Statistical analysis of aerial respiration in subsequent coloured-light training revealed no significant learning or memory occurred under any colour.

Conclusion

This research suggests with strong evidence that coloured-light affects learning and behaviour as observed in movement of *Lymnae stagnalis*. Through building knowledge of the simple nervous system of this model creature, there is tremendous potential to begin to unlock the mysteries of more complex neurological systems and mechanisms.

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Very intriguing study. Ability of color-detection in animals is usually related to resource- seeking or sexual selection, it will be even more interesting if you may combine your animal learning experiments with color-detection abilities.