

2017 Belmont Undergraduate Research Symposium

Biology IV

Moderator: Steve Murphree, Ph.D.

April 20, 2017, 7:00-8:15 p.m.
JAAC 2091

7:00 p.m. – 7:15 p.m.

The Effects of Isoflurane on Learning and Spatial Memory in *Danio rerio*

Curtis Brown

Faculty Advisor: Lori McGrew, Ph.D.

Postoperative cognitive dysfunction (POCD) is a medical condition characterized by an impairment in cognition following anesthesia and surgery. Typically affecting elderly patients undergoing major surgeries, this complication may interfere with everyday functions and lead to further health complications. Zebrafish (*Danio rerio*) are commonly used as a model organism to study mechanisms of brain function and dysfunction, exhibiting similar neural physiology and pharmacological responses to that of humans. The objective of this study was to evaluate the effects of isoflurane, a halogenated ether used in general anesthesia, on short-term memory and identify any possible contributions to cognitive impairment in zebrafish. Through operant conditioning, the fish were trained to discriminate between colors in a T-maze, and treated with isoflurane for varying exposure times to observe changes in spatial learning and short-term memory. Choice latency times and the number of correct choices were recorded. As exposure times increased from two minutes to four minutes, a trend of less correct choices and longer latency times followed, however these results were found to be insignificant. Further research into clinically relevant anesthetic agents may lead to the development of less harmful, more efficient drugs for anesthesia.

7:15 p.m. – 7:30 p.m.

Disinhibition of *C. elegans* towards *Bacillus thuringiensis*

Samantha Bush

Faculty Advisor: Robert Grammer, Ph.D.

Alcohol has a wide variety of effects on physiology and behavior in many species. One of the most well recognized behavioral effects is disinhibition, where behaviors that are normally suppressed are displayed following intoxication. *Caenorhabditis elegans* are a model organism because of their ability to reproduce fast, they are easy to maintain, and have a similar genome to humans. In this experiment, *C. elegans* are washed with different dilutions of ethanol. The worms are then put on a chemotaxis plate to see if the ethanol will cause disinhibition of eating the bacteria *Bacillus thuringiensis*. The chemotaxis assay showed an increased attraction to the *Bacillus thuringiensis*.

7:30 p.m. - 7:45 p.m.

The Effects of a Trophic Cascade and Trait-Mediated Interactions Have on the Survival Rate of the Southern Oyster (*Crassostrea virginica*)

Kristen Estes

Faculty Advisor: John Niedzwiecki, Ph.D. and Chet Rakocinski (USM)

Trophic cascades occur among ecosystems, improving the health and populations of prey items on an oyster reef such as the Southern Oyster (*Crassostrea virginica*). Using tanks divided each into 2 chambers, the feeding rates on the Southern Oyster by two species of crabs found in the Gulf of Mexico were observed. A caged predator, also found in the Gulf, was placed in half of the chambers to see how its presence changed the amount of oysters preyed upon by the different crab species. The presence of the predator significantly affected the feeding behavior of both the crab species, causing them to consume less spat. Trophic cascades keep ecosystems healthy by keeping populations in control. The presence of predators, such as the Toadfish (*Opsanus beta*), could keep an oyster reef from collapsing as indirectly affecting predation by both Mud Crabs (*Panopeus* sp.) and Blue Crabs (*Callinectes sapidus*).

7:45 p.m. – 8:00 p.m.

pH Indication of Respiration and Effects of Different Carbohydrates and *E. coli* on Respiration Rates in *Caenorhabditis elegans*

Prisha Patel

Faculty Advisor: Robert Grammer, Ph.D.

Prior to this study, researchers outlined procedures that can be utilized to detect respiration in *C. elegans* using spectrophotometry. They also reported worm viability, acidification based on absorbance, and the effect of sodium azide, a mitochondrial inhibitor (Parrish and Grammer, 2012). In their experiment, only glucose was utilized to study its effect on acidification. The current study aimed to solidify the procedures involving spectrophotometry from the initial study. Furthermore, the effects of glucose, fructose, maltose, and the food source, *E. coli* on respiration rate were also studied. In this study, it was hypothesized that each sugar and *E. coli* would have detectable respiration of *C. elegans*, but *E. coli* and glucose would generate the strongest effect. Instead of using spectrophotometry, pH probes were utilized to detect the change in pH over 60 minutes.

Worm viability experiments revealed that few nematodes died over a sixty-minute period in the absence of sodium azide. In the presence of sodium azide, there were rarely any live worms at each time interval tested. Baseline experiments, i.e. no additives, revealed minimal differences in respiration of worms treated with sodium azide and worms not treated with sodium azide. Furthermore, the addition of 10 μ L of 1.6mM sugar produced minimal differences. However, the addition of 10 μ L of *E. coli* generated a greater change in pH levels for the worms not treated with sodium azide. These findings can be further explored to by testing the effects of other bacteria, lipids, or protein on respiration rates of *C. elegans*.

8:00 p.m. - 8:15 p.m.

Anti-Proliferative Effects of Epigallocatechin-Gallate and Enoxacin on Cervical Cancer-Derived Cells in Culture

Anna Margaret McDonnell

Research Advisor: Chris Barton, Ph.D.

Cervical cancer is one of the most commonly diagnosed cancers of the female reproductive system. Cervical adenocarcinoma, a common subtype of cervical lesions, originates in the endocervical lining and is known for its aggressive nature. Treatment for this malignancy involves chemotherapeutic regimens with harsh side effects due to lack of tumor specificity. As a result, novel treatments for cervical cancer are essential to target cancer cells and reduce non-specific toxicities. The present study used the cervical adenocarcinoma line, HeLa, as a model to assess novel chemotherapeutic agents for cervical cancer. Recent studies have shown the effectiveness of an antibacterial drug, enoxacin, as an antitumor agent against prostate cancer. Similarly, the green tea polyphenol epigallocatechin-gallate (EGCG) has shown to be an effective antitumor and synergistic agent with chemotherapeutics. However, whether these effects are observed in other types of cancers, such as cervical adenocarcinoma cells, is currently unknown. Here, we detail the effectiveness of both enoxacin and EGCG as antitumoral agents against HeLa cells grown in culture. Both drugs were effectively decreased cell viability in a dose response assay ($p < 0.05$). Additionally, a significant decrease in mitotic cells and increase in apoptotic cells with Hoescht staining following exposure to each compound was observed ($p < 0.01$). Furthermore, we examine the effect of combination therapy with both drugs in culture. In conclusion, our findings suggest that both enoxacin and EGCG are effective at inhibiting the growth of cervical cancer cells *in vitro*. Their potential for use in therapeutic regimens should be further explored.