

BIOLOGY II

Section Moderator: Dr. Lori McGrew

Room: Beaman Hitch Science Building 208

Time: 7:00 – 8:00 PM

7:00 – 7:15

“The Effects of Nicotine on Learning and Acetylcholine Expression in *Danio rerio*”

Taylor C. Walter

Faculty Advisor: Dr. Lori McGrew

It has long been known that nicotine can enhance short-term cognitive processes (Levin et al. 2006). It is thought that Nicotine enhances memory via the pre synaptic α -7 receptor and the post synaptic α 4 β 2 receptor pathway (Kelley A., 2002). Past undergraduate research indicates that *Danio rerio* learn best when treated with 5 μ M of nicotine as opposed to 0 μ M or 10 μ M. This study examined the exact concentration of nicotine that produces the highest learning level in zebrafish as well as the correlation between learning and acetylcholine receptor α -7 expression. It was hypothesized that nicotine enhances cognition best at a concentration of 5 μ M and as a result there will be higher expression of acetylcholine α -7 in fish treated with 5 μ M of nicotine. To test learning ability, 40 fish were treated with 0 μ M, 4 μ M, 5 μ M, or 6 μ M of nicotine (10 treated with each concentration) and examined using a learning paradigm. A Western blot was then performed to examine levels of acetylcholine in 4 fish (1 per concentration). It was found that the untreated fish had the highest learning percentage and the highest expression of acetylcholine. This was significantly different from the fish treated with 4 μ M and 6 μ M of nicotine. This data suggests that nicotine does not play a role in enhancing short term cognition, but does give insight into the link between learning and expression of nicotinic receptor α -7.

7:15 - 7:30

“Biphasic Olfactory Response of *C. elegans* to Benzaldehyde via Capillary Assay”

Sachin H. Amin

Faculty Advisor: Robert Grammer

Previously, a standard chemotaxis assay has been utilized to measure the olfactory behavior of *C. elegans*. More recently, a capillary assay was developed to test for avoidance. Here we have extended the capillary assay for the measurement of attraction (specifically, less concentrated benzaldehyde and isoamyl alcohol odors) using naïve worms to avoid any effects of habituation or adaptation. It has been shown that the frequency of pirouettes (sharp turns) is lower in an odor gradient than in uniformly distributed odor. In effect, when a worm senses an attractive odor, then the frequency of reversals is reduced; thereby the overall motion of the worm is in the direction of odor strength. In our modified capillary assay where the capillary with attractive odor is presented at a right angle, the

worm exhibits a positive directional change toward the attractant. New turning behavior driven by an attractant is an expansion upon the previously proposed pirouette model. As part of this experiment, we have confirmed many of the previous chemotaxis experiments centering on benzaldehyde and isoamyl alcohol. Wild-type animals exhibited the characteristic biphasic dose response to benzaldehyde indicating that the aversive response is not due to habituation. The attractive response was reduced in *tax-4* animals, while *che-2* animals were completely defective in their response, showing neither attraction nor avoidance. However, *osm-9* animals show strong avoidance at all tested doses, which differs from previously published results.

7:30 – 7:45

“The Effect of Abnormal Conditions on Visual Discrimination Learning in Zebrafish”

Jackie Hunter

Faculty Advisor: Dr. Lori McGrew

Zebrafish, *Danio rerio* are a model organism commonly utilized for studies of vertebrate development, but recent studies have also shown the viability of zebrafish as a model organism for the study of behavioral plasticity and normal learning patterns. *Danio rerio* are small tropical fish, typically found in fresh water streams and rice paddies of East India, Bangladesh, and Burma. Previous studies have shown that zebrafish are able to perceive colors in the visible spectrum along with some ultraviolet wavelengths. Light has a limited ability to penetrate water, so that fish adapted to have good visual acuity in dim light have a selective advantage. Additional studies have demonstrated the visual acuity can be impaired by embryonic exposure to abnormal light conditions such as bright light. The purpose of this experiment was to determine whether adult zebrafish could learn to visually discriminate between two colors and whether or not exposing adult zebrafish to abnormal conditions, such as bright light, would affect the fish's ability to discriminate. This study showed that zebrafish trained under normal light conditions, learned to visually discriminate in normal conditions and were still capable of visually discriminating when tested under abnormal conditions. Zebrafish that were only exposed to the abnormal learning conditions did not learn to visually discriminate between the two colors.

7:45 – 8:00

"Presence of *mecA* Gene in Methicillin-Resistant Isolates of *Staphylococcus aureus*"

Anna L. Walsh

Faculty Advisor: Dr. Jennifer T. Thomas

Staphylococcus aureus is a bacterium that is found on the skin and in the noses of one-third of healthy individuals. However, some strains of *Staphylococcus aureus* have developed resistance to standard antibiotics, such as methicillin and are termed methicillin-resistant *Staphylococcus aureus* (MRSA). One mechanism of resistance is the presence of the *mecA* gene which produces the PBP2a protein. MRSA has been found in hospital settings for the past 20 years. Recently, however, cases of MRSA have been found in the community and are posing a new threat. MRSA isolates from various athletic locations on Belmont's campus were determined by disk-diffusion assays and examined for the presence of the *mecA* gene via PCR analysis. Three of 16 MRSA isolates were positive

for the *mecA* gene. As expected, all methicillin-sensitive isolates were negative for *mecA*. These data indicate mechanisms of resistance independent of *mecA* and puts into question the use of *mecA* PCR for identification of MRSA clinical isolates.