2017 Belmont Undergraduate Research Symposium

Biochemistry & Molecular Biology and Environmental Science

Moderator: Robert Grammer, Ph.D.

April 20, 2017, 3:45-5:15 p.m.
Inman 241

3:45 p.m. – 4:00 p.m.

The Pharmacological Use of Catechins to Improve Human Health

Sarah Maxwell
Faculty Advisor: Robert Grammer, Ph.D.

Catechins, a flavanol, are a class of molecules that exhibit antioxidant activity. It has been known for some time that increased antioxidant intake can have some positive effects on human health. Catechins have been identified in a number of foods including chocolate, red wine, and blackberries. Increased catechin intake has been observed to elicit effects ranging from reduced instance of ischemic heart disease to reduced body fat percentage. Further, this class of molecules have been shown to inhibit the pathway for the production of melanin. Studies that consisted of in vivo, in animals and humans, and in vitro experiments were examined. The present project compiled a variety of primary research articles to construct a review of the effects catechins have been shown to exhibit on human health and determine whether there have been any negative side effects associated with increase intake of catechins and green tea. Possible delivery mechanisms were also addressed.

4:00 p.m. – 4:15 p.m.

Inhibition of Tyrosinase with Extracted Catechins from Granny Smith Apples

Sarah Maxwell
Faculty Advisor: Rachel Rigsby, Ph.D.

Catechins, a flavanol and antioxidant, have been thought to be beneficial to overall human health for a small time now. Specifically, they have been shown to exhibit some inhibition of tyrosinase. The enzyme tyrosinase catalyzes the first major step in the synthesis of melanin, converting L-tyrosine into dopaquinone. Since it catalyzes the first step, inhibition would theoretically prevent the formation of any melanin. The current project isolated catechins from Granny Smith apples, concentrating the extract via amalgamation, filtering, and distillation. The presence of catechins in the apples was confirmed via UV-Vis spectroscopy, IR spectroscopy, and TLC. Utilizing a catechin standard, a curve was constructed so that the concentration of catechin per gram of apple could be calculated. The effect of these isolated catechins on the reaction of L-tyrosine catalyzed by tyrosinase was monitored in an assay containing a standard volume of tyrosinase and L-tyrosine via UV-Vis Spectroscopy, varying the concentration of the extracted catechins.

4:15 p.m. – 4:30 p.m.

The Effect of Size on the Antipredator Behavior of the Snail, *Elimia laqueta* in Response to Predator Cues

Joanna Sorrell
Faculty Advisor: John Niedzwiecki, Ph.D.

Chemical cues are a key factor in the optimal foraging behavior of snails and their interactions with predators. The reaction of prey to predators, should depend on their individual risks and benefits. An individual's size may affect this balance, leading to different reactions to a predation threat. In this experiment we tested if snails of different sizes would therefore have different reactions and behavioral responses to chemical cues of their natural predators, the crayfish. Small and large snails were introduced to control water and water containing crayfish cues and their defensive behavior was observed. Large snails had no change in behavior between water treatments, however small snails showed a significant increase in antipredator behaviors. This could indicate a higher risk, or potentially lower rewards, for small snails foraging under risk of predation.

4:30 p.m. – 4:45 p.m.

Insight into the Chemotaxis of *Caenorhabditis elegans* toward *Bacillus thuringiensis* Strain 4A4 Using Chemosensory Deficient Nematodes

Stacey Crockett
Faculty Advisor: Robert Grammer, Ph.D.

Caenorhabditis elegans (*C. elegans*) is a model organism that is widely used in biological research. One of these areas of study involves the understanding of how *C. elegans* react to different types of nematocidal bacteria, such as *Bacillus thuringiensis* Strain 4A4 (Bt). Bt—a type of environmentally compatible pesticide—in its sporulated form has been shown to not only be extremely lethal to *C. elegans* but also appears to attract *C. elegans* toward it. However, it is unclear as to what exactly is attracting *C. elegans* to the bacteria in the first place. One theory is that the bacterium is emitting specific chemicals that *C. elegans* can perceive through specialized cilia and sensory neurons—those that can detect either volatile chemicals or water-soluble chemicals. A series of chemosensory deficient *C. elegans*—those with mutations in the sensory neurons AWA, AWC, and ASE—were used in a chemotaxis assay to help determine the chemical nature of Bt. Upon statistical analysis, it would appear that the most significant difference in the attraction of *C. elegans* towards Bt involve the double knockout mutation of both AWA and AWC, which ultimately affects the ability of the worms to sense an array of volatile chemicals in its environment. However, the results also indicate that it is possible that more than one type of chemical is being emitted from the bacteria. Further biochemical analysis of the bacterium itself could lead to a better understanding of the exact chemical nature its attraction.

4:45 – 5:00 p.m.

The Impact of a Reduced Tree Canopy Cover on the Composition of Stream Macroinvertebrate Communities

Sandra Bojic
Faculty Advisor: John Niedzwiecki, Ph.D.

Urbanization is one of the leading causes of local extinctions and loss of biodiversity, and canopy cover reduction as a product of urbanization creates physical and chemical changes in streams that impact biotic community assemblages. Aquatic macroinvertebrates experience varying sensitivities to environmental changes; therefore, they may act as bioindicators for poor stream health. This study compared macroinvertebrate diversity and composition in riffles of open canopy and closed canopy segments in two streams, and diversity was quantified using biotic indices. Indices representing macroinvertebrates by tolerance level indicate no significant difference between the open canopy and closed canopy sights of each stream. However, a difference in water quality between streams was observed, though this may be expected as the streams were in contrasting areas of urbanization. This suggests that the effects urbanization has on stream macroinvertebrate communities in the Nashville area may be less attributed to canopy cover reduction and more so to another environmental player.

5:00 p.m. – 5:15 p.m.

Catechin Isolation of *Rosa Damascena* Implies Novel Melanoma Prevention

Nicholas Orji
Faculty Advisor: Rachel Rigsby, Ph.D.

Melanoma is a virulent form of skin cancer that stems from the pathological growth of melanocytes. The melanin produced by these melanocytes can either be pheomelanin or eumelanin, the latter of which has inherent properties that provide provides greater protection from the damage caused by UV rays; this makes eumelanin-dominant individuals far less prone to developing melanoma. Tyrosinase is a critical enzyme in the melanogenesis pathway. Inhibition of this enzyme was examined via the introduction of the biomolecule catechin. This molecule has been shown to have inhibitory effects on tyrosinase. This study tested the effects of catechins found in *Rosa damascene* on the activity of tyrosinase. The catechins found in this species of roses showed no inhibition on the activity of tyrosinase. This shows that catechins from certain sources may be better suited for the inhibition of tyrosinase.