BIOCHEMISTRY & MOLECULAR BIOLOGY

ENVIRONMENTAL STUDIES

Section Moderator: Dr. Rachel Rigsby
Room: Beaman Hitch Science Building 209
Time: 7:00 – 8:00 PM

7:00 – 7:15
"Estimation of the Effects of Hormone Treatments on the Bioavailability of Lutein"

Alyssa R. Merkel
Faculty Advisor: Dr. Rachel E. Rigsby

Lutein is a naturally occurring carotenoid found in green leafy vegetables. With its high antioxidant activity, lutein helps prevent the formation of harmful free radicals in the body. Although it is concentrated in the macula of the eye, the body does not naturally produce this carotenoid and it must be ingested from vegetables such as spinach and kale. In order to get the full health benefits of lutein, it is recommended to ingest about 10 mg of lutein per day. However, because it is very susceptible to oxidation and chemically unstable in the presence of an acid, after digestion there is little lutein left for absorption into cells. Previous research has shown a possible positive correlation between hormone levels and serum carotenoid activity. The purpose of this research was to investigate what effects hormone treatments have on the bioavailability of lutein from spinach. An in vitro digestion model was used to simulate the gastral and intestinal phase of metabolism and to determine what amount of lutein was available from the spinach after digestion. Differing concentrations of synthetic hormones, Progesterone and Ethisterone, were added during the digestion and the amount of lutein was quantified using HPLC analysis. The results show an increase in the amount of lutein available after the addition of hormones, but no significant difference in the concentrations of each hormone. This data may help determine a way for older women, who are more susceptible to eye disease, to increase lutein in their diet with these hormone treatments.

Discipline: Biochemistry & Biology

7:15 – 7:30
"The Effects of Carotenoids on Lung Cancer"

Jocelyn A. Lostetter
Faculty Advisor: Dr. Rachel E. Rigsby

Carotenoids play a vital role in the diet of humans because they have antioxidant effects which make them key components to the human diet. The alternating single and double bonds of their polyene backbone allows them to absorb excess energy from other molecules protecting them from the effects of free radicals and singlet oxygen. Carotenoids antioxidant properties make them very important in the research of the treatment and prevention of cancer. In this research three different carotenoids, lycopene, lutein, and beta-carotene were extracted from plants and cultured with lung cancer cells. Lycopene was isolated from tomatoes and lutein and beta-carotene were isolated from kale and their concentrations where measured. High performance liquid chromatography and thin layer chromatography were used to identify the extracted carotenoids. The effects of the three carotenoids were investigated on a lung cancer cell line NCI-H69. NCI-H69 is a cell line that grows in aggregates and the number of aggregates and their approximate size were measure after being cultured with one of the carotenoids. Beta-carotene was found to enhance the growth as larger and more aggregates were found cultured with this carotenoid than with the control. There was a decrease in the size and number of aggregates with the cells cultured with lutein and lycopene. It was determined that beta-carotene may possibly enhance the growth and lutein and lycopene may hinder the growth of NCI-H69 cells.

Discipline: Biochemistry & Molecular Biology

7:30 – 7:45

"Isolation of Astaxanthin from *Procambarus clarkia*"

Emily A. Karr
Faculty Advisor: Dr. Rachel E. Rigsby

Carotenoids are components in the body that are essential for the removal of free radicals. Left unattended free radicals can cause cancer, autoimmune diseases, iron overload, and neuronal diseases. Astaxanthin is an orange or red carotenoid present in shrimp, crawfish, crabs, salmon, lobsters, and rainbow trout. It exhibits superior antioxidant properties to most carotenoids. There has developed a need for synthetic astaxanthin as a supplement for farm raised fish. It compensates for the lack of natural pigmentation and prevents the oxidation of fats of rainbow trout during frozen storage preventing rancidity. There is also a demand for all-natural astaxanthin to be incorporated into supplements. The increased need for astaxanthin in the commercial world requires new sources for the carotenoid. Previous research has developed methods for isolation of novel astaxanthins from algae (Haematococcus pluvialis) and lobster (Homarus vulgaris). The presented research was conducted in order to determine whether these techniques can yield similar samples of astaxanthin from the closely related crawfish, Procambarus clarkii. If similar methods are used for the control, Homarus vulgaris, and Procambarus clarkii then spectroscopic analysis will yield similar results for both species. Ultraviolet/visible spectroscopy showed absorbance at different wavelengths for the lobster and crawfish isolates. High performance liquid chromatography analysis yielded different peak retention times for the isolates. It was concluded that the techniques for astaxanthin isolation from lobster resulted in isolation of a different compound when applied to crawfish.

Discipline: Biochemistry & Biology

7:45 – 8:00

"Macroinvertebrate Diversity and Water Quality at a Trout Hatchery Stream Entering the Obey River, Clay County, Tennessee"

Andrew E. Wicke
Faculty Advisors: C. Steven Murphree & Darlene Panvini

Macroinvertebrates were sampled from the Obey River both above and below a trout hatchery stream effluent and

identified to the lowest practical taxon. Numbers of each taxon were entered in a biodiversity program and the following biodiversity indices were obtained for upstream and downstream collections: Simpson's, Shannon, and Species Equitability. Temperature, pH, dissolved oxygen content, and total dissolved solids readings were also taken above and below the hatchery stream. Though it was predicted that the stretch of river below the entrance of the trout hatchery stream would have a lower macroinvertebrate diversity, more species were found below the hatchery effluent. A possible explanation for this result is that the trout stream provides nutrients to support a greater diversity of macroinvertebrates than can be supported upstream and just below the Obey River dam. The results of the macroinvertebrate diversity survey will be compared to previous studies conducted in this region of the Obey River.

Discipline: Environmental Studies