## 2015 Undergraduate Winners

*Water Quality and Plankton Communities of the Blackwater Satilla River*
Mary E. Freund

Blackwater rivers in south Georgia have naturally low dissolved oxygen (DO) levels during the summer months. How can we recognize when we are observing naturally low DO levels or when we are observing low DO levels caused by various point and non-point influences? Are there planktonic organisms that can indicate excess nutrients, high turbidity, or low DO? To answer this, we must first understand the basic planktonic community composition in blackwater rivers. This study examined differences between two locations on the Satilla River (Woodbine and Burnt Fort) in relation to physiochemical parameters (e.g., DO, pH, salinity, conductivity, temperature, and secchi disk depth) and plankton communities (taxa richness, evenness, and diversity). Both Woodbine and Burnt Fort showed mean DO levels that fell below the state standard of 4.0 mg/L, even though only Woodbine is classified as a part of a DO-impaired segment. Results indicated that Woodbine had lower DO, higher turbidity, higher temperatures, and a greater salinity influence than Burnt Fort. Woodbine also had a greater number of plankton taxa, but the taxa were not as evenly distributed as at Burnt Fort, which therefore had a greater diversity index. The relative abundance of phytoplankton vs. zooplankton and five other subgroups differed significantly between the two sites; these should be further studied to better understand how plankton abundance and diversity change with the influx of nitrates, phosphates, and organic matter.

*Investigation of Bisphenol A contamination in Sharp Mountain Creek from a construction waste disposal site.*
Susan Scrivner

Bisphenol-A, also known as BPA, is a synthetic product used in the creation of many plastics, including PVC pipes and other materials used in the construction industry. BPA is a chemical of concern because it is an endocrine disrupter. This chemical has been shown to act as a hormone in the body and cause physiological abnormalities, especially in reproductive systems during specific periods of development. Furthermore, this chemical is prevalent in the environment and thereby could be affecting wildlife. Many studies have reported adverse effects in wildlife, particularly in aquatic organisms, at much lower concentrations than those deemed safe by the US Environmental Protection Agency. Even small effects on reproductive function in some species could reduce and eventually decimate their populations, therefore it is important to identify possible point sources of contamination and monitor our local waterways. In this study, an enzyme linked immunosorbant assay was used to determine BPA levels in water above and below a landfill used by construction companies. It was hypothesized that this landfill may be a source of BPA contamination in the stream. Researchers expect to detect BPA at greater concentrations below stream of the landfill than above stream.

## 2015 High School Winners

*The Use of Vibrio fischeri as an Indicator of Water Quality*
Paula Ruiz

"The Use of *Vibrio fischeri* as an Indicator of Water Quality" serves to determine how *Vibrio fischeri* signal the level of water quality. Efforts have been made world-wide to improve the condition of the world's water. *Vibrio fischeri* are a potential indicator of water quality. Exactly what aspect of water quality does this organism indicate by a reduction in bioluminescence? The purpose of this experiment is to determine which component of the water the *V. fischeri* react to. How will varying toxins impact *V. fischeri*? The research hypothesis is: if *V. fischeri* are exposed to toxins present in water, and their bioluminescence is able to be affected, then the bioluminescence of the *V. fischeri* will decrease with one toxin significantly more than with other toxins. This will show a trigger factor that causes *V. fischeri* to decrease their bioluminescence when exposed to toxic samples of water.
First, the researcher established a culture of *V. fischeri* in photobacterium broth. Using a 96-well plate, the researcher placed 150µL of different concentrations of KNO3 and NH4OH with 150µL of cultured *V. fischeri* in each of the wells. The researcher immediately put the plate into the plate reader. Six trials were run. Results conclusively show that the non-ideal nitrate conditions had a significantly negative impact, with a p-value of 0.04656, on the bioluminescence of the *V. fischeri*. The data also show that the non-ideal ammonia conditions did not have a significant impact, with a p-value of 0.08942 on the bioluminescence of the *V. fischeri*.

*Waste-Based Runoff Pollutant Biosorptive Permeable Barriers*
Aksal Vashi

Near domestic and commercial agricultural settings, fertilizer runoff is constant threat to freshwater ecosystems. Also, millions of tons of fruit peel waste and mollusk shells are disposed into landfills every year. Research by scientist Milena Beniolo and previous testing found that banana and orange peels effectively absorbed positively charged ions in aqueous solution while research shows CaCO3 ion exchanges with PO4-3. While Beniolo's focus was primarily metal ions, this project expands the scope by including phosphates, nitrates, and ammonia aqueous pollutants as the contaminants to remove from solution. This project examines the effect of ground banana peel, orange peel, pectin extract, and mollusk shells on ammonia, nitrate, and phosphate concentration in runoff while developing a novel engineering design of treatments within pervious concrete which serve as edging blocks. Water with all three pollutants was passed through permeable blocks that had various natural waste powder treatments (5 blocks of each- control, orange/banana, pure pectin, mollusk shell, pectin/shell, and orange/banana/mollusk shell [OBS]). The OBS treatment served as the best overall treatment. When contaminated runoff was passed through multiple blocks after 6 months of simulated rain, the OBS blocks reduced [NH4+] by 80%, [NO3-] by 80%, and [PO4-3] by 83.5%. ANOVA & Post-Hoc testing show results being significant from control. The blocks with OBS additives had the biosorptive strength of pectin powder and the consistency and physical strength of the blocks with mollusk shells: this experiment poses the possibility to fight fertilizer contamination at the source as opposed to in our freshwater ecosystems.