| **Poster #** | **Presenters** | **Title** | **Major** | **Mentor** |
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| 1 | Abigail Savage, Zach Galberd, Madison Durrance | Key Encryption Through Quantum Optics | Physics | Hauke Busch |
| Abstract | Cryptography has been around since the dawn of human civilization to send private messages for commercial, military, and political purposes. Some of the most important ciphers are the Vigenère cipher, the enigma, and the more modern RSA. Because of the development of the internet, private encryption has also become increasingly more important. The weakest link of encryption is the key creation and key distribution. A key is needed to encrypt and decipher codes and is needed by both the user and sender. A solution to this problem is the generation of quantum key distributions. In our ongoing experiment, we are now trying to send and receive coded messages through photons after we build our quantum key distribution apparatus. The device will be secured against any form of eavesdropping because of the Heisenberg uncertainty principle. We will be able to know immediately if someone is listening in and if our key is compromised. The device consists of a 630nm laser with beam splitters and wave plates. |   |   |   |
| 2 | Alexis Crawford | Thermal Analysis of Hydrated Salts: An Undergraduate Inorganic Laboratory Experiment | Chemistry | Peter Rosado Flores |
| Abstract | Developing laboratory activities that make use of thermogravimetric analysis; a characterization technique that measures the loss of mass of a sample as temperature is increased in a controlled atmosphere using (e.g. under Ar or N2). Using this technique, physical and chemical events, such as decomposition, dehydration, melting, vaporization, sublimation, absorption and more can be analyzed. The focus of this work is to develop laboratories that make use of our new SDT-650 in the inorganic chemistry undergraduate teaching laboratory. Of interest, are the different degrees of hydration of common metal salts, and their decomposition profiles. Thermal analysis of these salts provides information on the amount of water molecules that are present in samples, giving a molar ratio of water to salt. Analyzing these profiles and developing experimental methods, provides the undergraduate researcher with a handle of how the technique of thermal analysis works and instrument operation. In the case of this work, different salts such as MgSO4 and Na2CO3 were analyzed. A 15 mg sample of magnesium sulfate, also known as epsom salt, was analyzed at a ramp heating rate of 10 °C per minute from 22 °C to 800 °C under an Ar atmosphere. It was calculated that there was approximately a (1:1) ratio of water to MgSO4, indicating 1 water molecule was lost during the heating cycle. A 13.633 mg sample of sodium carbonate anhydrous was analyzed using the thermogravimetric analysis method at a ramp heating rate of 10 °C per minute from 22 °C to 800 °C under an Ar atmosphere. A ratio of (0.5:1) of water to sodium carbonate was calculated, indicating half a molecule of water was lost. |   |   |   |
| 3 | Brian D. Skoglind and Jacob A. Brewer | The Development of a Pupil Controlled Prosthetic Device for Human Augmentation | Physics | Hauke Busch |
| Abstract | We are using LabVIEW to design and build a retina controlled prosthetic limb that can be used to help augment individuals with disability. Due to the recent wars, there has been an increase in injured veterans returning with the need of a prosthetic limb. Traditionally, prosthetic limbs have been passive devices; our design would make it an active device. The immediate objective of this research project is to understand the capabilities of LabVIEW and construct an original artificial limb. We have assembled the hand with working joints and have successfully created a LabVIEW program that tracks the pupil using the integrated vision software. Currently we are in the process of integrating the motors to the 3D printed hand and reading input from the camera to send signals to the motors. The prototype will be controlled through Virtual Instruments (VIs) and a National Instruments device called, MyRIO. Other applications of this research can be implemented into wheel chair operations with individuals with more severe disabilities. There have been other attempts to make prosthetic limbs active devices however, our attempt is unique as we are controlling the prosthetic limb based on pupil position and movement. |   |   |   |
| 4 | Cameron Skinner, Samuel Long, Alexander Morley , Kaleb Clifford  | Wetland Delineation Using IRIS Tubes and Hydric Soil Properties in Central Georgia | Environmental Science | Allison VandeVoort |
| Abstract | The process of defining and depicting wetland boundaries has become increasingly important to environmental professionals. Wetlands are characterized by hydric soils, which are formed in saturated conditions. The anaerobic environment of hydric soils begins near the surface layer, and leads to a variety of chemical processes, such as the reduction and oxidation of iron oxides. Previously conducted wetland delineation studies have used Eh measurements via platinum electrodes and alpha-alpha-dipyridyl dye to detect iron (Fe) reduction. However, these can be costly, time-intensive and complex. An alternative method of assessing Fe reduction potential is through the use of Iron Reduction in Soils (IRIS) tubes. These tubes are fabricated from PVC pipes that have been sanded and coated with a synthetic iron (oxy)hydroxide paint, and inserted into wetland soils for approximately 4 weeks. We anticipate the reducing environment of the wetland soils to facilitate reductive dissolution from Fe(III) to Fe(II). The research question this study aims to explore is if IRIS tubes, physical soil properties, and hydric soils identification procedures outlined by the Hydric Soils Technical Standard are effective in delineating wetland gradients in Central Georgia. Percent Fe removal from reductive dissolution from IRIS tubes was quantified using X-ray fluorescence (XRF). Water-table elevation and saturated hydraulic conductivity of soil samples from each study site were assessed to determine drainage class. Evidence of redoximorphic features such as gley and oxidized root channels were also gathered through observational analysis. Data from XRF analysis suggests that the highest Fe removal, some values as high as 88%, occurred deeper into the soil profile. The IRIS tubes have showed promise in demonstrating Fe reduction and delineating wetland areas in Central Georgia while efficiently managing expenses and time spent in both the field and laboratory. |   |   |   |
| 5 | Kaleb Clifford. Cameron Skinner, Samuel Long , Alexander Morley  | Delineating Wetland Ecosystems Using GIS Technologies at Lake Laurel | Environmental Science | Allison VandeVoort |
| Abstract | The Lake Laurel research station at Georgia College & State University East Campus is an eighty-three-acre site, home to an array of ecosystems including: upland forests, a lentic environment, and most importantly, wetlands. Wetland ecosystems are defined in a myriad of ways by scientists. Almost all definitions describe an area frequent inundation containing hydric or anaerobic soils, and hydrophytic vegetation adapted to these conditions. Geospatially, wetlands are identified as ecotones, or transitional spaces that divide terrestrial and aquatic biomes. However, classifying wetlands based solely on spatial data can sometimes lead to inaccurate delineation. Distinguishing these dynamic ecosystems and their borders is important in protecting the biodiversity they sustain by supporting bird, fish, amphibian, reptile, and plant species. Understanding ecosystem services, and anthropogenic impacts are essential in mitigation and preservation. This study aims to combine geographic information systems (GIS) and technical field research to develop a better understanding of the transition from upland to wetland environments. The field techniques used in this study consist of assessing oxidation-reduction conditions generally affiliated with inundated environments. These parameters are measured using the Indicator of Reduction in Soils (IRIS) tubes technique. IRIS tubes measure iron oxyhydroxide removal rates affiliated with hydric soils. General soil composition, and hydraulic conductivity are also assessed as supplementary factors. This data, digitized as an array of inputs in ArcGIS, will provide an effective platform for spatial analyses. ArcGIS, a computer mapping software, allows us to manually manipulate data, providing a precise representation of recorded parameters. We predict that technical studies will result in a more authentic portrayal of the extent of wetland ecosystems. Cross-analyzing existing wetland maps from the Web Soil Survey (WSS) and National Wetland Inventory (NWI) with the collected field data, provides greater accuracy in delineated wetlands at Lake Laurel. |   |   |   |
| 7 | Des'ree Groover | Mechanism of Rpt6 Nuclear Translocation in Saccharomyces cerevisiae | Biology | Ellen France |
| Abstract | The proteasome is a highly conserved protein complex responsible for cellular protein degradation. It consists of a 28-subunit proteolytic core particle (CP) and 19-subunit regulatory particle (RP), which further divides into base and lid subassemblies. The base contains six ATPases (Rpt1-Rpt6) that form a hetero-hexameric ring that sits directly on top of the core particle. While proteasome function is essential in regulating many cellular processes, in mammalian neurons, the 19S particle is involved in regulating gene expression that is linked to synaptic changes that affects both memory and learning. We are investigating the nuclear shuffling behavior of one of the base subunit named Rpt6. Since proteasome subunits are highly conserved across species, we decided to use Saccharomyces cerevisiae as our model system to identify the amino acids required for nuclear translocation of the neuronal Rpt6 gene. We first tested the growth rate of GFP tagged S. cerevisiae strain that was obtained from a yeast GFP consortium collection. This would ensure that the addition of the GFP gene on Rpt6 does not interfere with its normal cellular function. Measuring the optical density of yeast growing in liquid culture for three days confirmed that the growth rate Rpt6 is comparable to that of wild type cells. We then verified the localization of Rpt6 by examining the localization of Rpt6-GFP under normal growth conditions. Currently, we are working on testing different growth conditions to generate observable Rpt6 nuclear translocation. Once we determine the condition that triggers the translocation of Rpt6, we plan to generate serially truncate Rpt6 with c-terminal GFP tag to track its localization to identify specific portions of the protein required for nuclear translocation. Understanding the key mechanisms governing the nuclear translocation of Rpt6 in neurons will pave the way for elucidating the role of Rpt6 in transcriptional regulation. |   |   |   |
| 8 | George Bennett | Constructing Fossil Storage Jackets using Polyester Felt | Biology | Heidi Mead |
| Abstract | The conservation of fossils after they are unearthed is an important subject in paleontology. Long-term storage of large fossils involves protective storage jackets, which have traditionally been created using materials such as burlap, plaster, medical plaster bandages, paper towels, and toilet paper. Some of these materials (such as paper products) contain acids or other chemicals that can be damaging to the fossil or act as an attractant to pests while in storage. Substituting polyester felt, a chemically neutral padding, for paper products has been a recent trend for creating long-term storage jackets. In our current analysis, we are testing the ease of application of polyester felt and whether medical bandages have enough plaster to adhere to the felt or if additional plaster needs to be applied. Wooden blocks and pretzels rods are being used as substitutes for “stable” and “fragile” fossil material. The expected results should confirm that the bandages do have enough plaster to adhere to the felt, and applying medical bandages directly to the felt would be a viable alternative to the traditional technique of layering loose plaster and fabric. |   |   |   |

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| 9 | Jacob Deitch and Rachel Nabors | Georgia College Compost: Divert Dinning Hall Food Waste from Landfills to the Gardens | Environmental Science | Lori Strawder |
| Abstract |  Composting is the process of mixing various food waste with decomposing organic matter such as sawdust or leaves to use a fertilizer for soil. This process makes use of food waste that otherwise would end up in a landfill, contributing to environmental degradation. Georgia College is committed to addressing environmental challenges, and the compost project is just one of the ways resources are being used and reused. In 2014 Georgia College, through a student Green Fee grant initiated the compost project. This project diverts thousands of pounds of food waste a semester, while also providing research opportunities for students. While food waste is being diverted, research is being conducted weekly on site. On a weekly basis, there is variation in the types of carbon sources and the ratio used for mixing. The current approach is to use a 1:1 ratio of carbon and nitrogen; however, given the natural variation in composition of the food waste, the ratio fluctuates between 1:1 and 3:2 ratios to maintain proper moisture consistency. In addition to studying the ratio, students are discussing ways to make the site sustainable with rain water collection, and solar panels. There is no shortage of food waste, so it is imperative to continuously assess the approaches to collection, sorting, emptying and use of the compost. It is the hope of the student interns, project PIs, and the Office of Sustainability that this process be streamlined and sustainable. |   |   |   |
| 10 | Jillian Turner | Qualitative Determination of the Adherence of VOCs to Building Materials | Chemistry | Catrena Lisse |
| Abstract | Cigarette smoke is harmful – approximately 431,000 yearly deaths are caused by smoking in the United States alone.1 Since most smoking occurs in vehicles and indoors, the effects of cigarette smoke on building materials is also a cause for concern. A qualitative analysis method for the adherence of volatile organic compounds (VOCs) to building material samples was developed. Samples of vehicle floor mat and drywall, painted and unpainted, were exposed to side stream cigarette smoke produced using standard machine smoking protocols. To determine the adherence of the VOCs, samples were analyzed using gas chromatograph/ ion trap mass spectrometry (GC/MS). This presentation highlights the experimental design and method development of the project. |   |   |   |
| 11 | Robert Hughley, Campbell Axt, Jillian Turner, Sydney Ninneman  | The Refinement of Production Grade Biodiesel | Chemistry | Ken McGill |
| Abstract | The modified Burton method for the thermal hydrogen-cracking of peanut oil has been investigated in McGill Research Group since 2009. The successful and reliable production of biodiesel has been achieved since 2014. A hydrocarbon with viscosity similar to Production Grade Diesel will work in modern diesel engines. The current product has a viscosity significantly lower than production grade diesel. The starting material has a viscosity significantly higher than Production Grade Diesel. Current research is investigating methodologies to mix starting material and product to achieve target viscosity. |   |   |   |

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| 12 | Jordan Yacoub | Larval Development of Hawaiian Shrimp | Biology | David Weese |
| Abstract | Larval biology can be used to provide insight into the ecology and evolution of organisms. Although the immature stages of organisms may time-dominate the life span and/or vary markedly in natural histories, much of the biology of larval stages is remarkably unknown, especially organisms from unique and/or understudied habitats. Anchialine ecosystems—coastal landlocked bodies of brackish waters that fluctuate with the tides due to simultaneous subterranean connections to both the ocean and freshwater aquifers—is one such ecosystem whose organisms remain a mystery. One organism endemic to these habitats is the Hawaiian shrimp, Halocaridina rubra. Neither gravid females nor larvae have been found in the sun-lit portions of its ecosystem that males and non-gravid females routinely inhabit, which has led to the hypothesis that reproduction and growth of these shrimp is restricted to the subterranean portion of the aquifers. While rarely encountered in the wild, however, immature shrimp (termed zoea) are being successfully reared in the laboratory here at Georgia College. The objective of this research is to observe the larvae in order to document for the first time the complete larval development of H. rubra. To obtain accurate data on the development of this shrimp, we will separate larvae into culture plates at regular time intervals, take detailed images of each of the presumed four zoeal (larval) stages and the post-larval metamorphosis, and record the developmental changes. High resolution images will be taken utilizing a state-of-the-art Visionary Digital BK Plus system in the Department of Biological and Environmental Sciences at Georgia College. We will then formally describe the larval development of H. rubra and submit our work to a peer-reviewed journal for publication. |   |   |   |
| 13 | Christina Cortes | Examining the Relationship Between Nitrification and Millipede Survival | Biology | Bruce Snyder |
| Abstract | Millipedes play an important part in ecosystem function. However, millipede ecology is understudied, and this is especially true for nutrient cycling and decomposition, where the effects of millipedes have rarely been documented. Quantification of millipedes’ ecological roles is important in the context of global change, because impacts on millipedes have the potential to impact ecosystem functions. Nitrogen cycling is one aspect of conspicuous global change: terrestrial ecosystems are receiving increased nitrogen from nitrogenous fertilizers as well as from fossil fuel combustion. Available nitrogen is possibly limiting to millipede populations, and millipedes affect N-mineralization by increasing decomposition rates and preferentially selecting litter and soil sources. However, neither the effects of nitrogen concentrations on millipedes nor the effects of millipedes on nitrogen transformations are well understood. The millipedes used in this experiment were Cherokia georgiana, collected from a mixed forest in Central Georgia. To test the impacts that millipedes have on nitrification and the impacts that added nitrogen can have on millipede weight maintenance, there were four treatment groups, including ambient soil with and without millipedes and added-nitrate soil with and without millipedes (n=9). Added-nitrate soil was made by adding the equivalent of 10 kg/ha nitrate to the soil. Mesocosms were filled with 65 grams of sieved soil and 1 gram of shredded maple leaves. To test nitrification potential, a nitrification potential assay was performed on both soil samples at the beginning and end of the experiment. A nitrate-specific ion selective electrode was used biweekly to measure nitrate from subsamples of soil in individual mesocosms. Previous studies supported that added nitrate may increase millipede weight maintenance and survival, and we hypothesized that the millipedes will increase the nitrification potential of soil samples, regardless of added nitrates. |   |   |   |

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| 14 | Kariann Lamon, Stephanie Forsman, Jordan Yacoub , Caroline Fowler  | Improving Amplification of the CO1 Gene: Primer Optimization for Buprestidae | Biology | Nathan Lord |
| Abstract | The coleopteran family Buprestidae includes a diversity of species that are difficult to identify due to morphological similarity between species. A technique commonly known as DNA barcoding is utilized to make clear distinctions between similar species by comparing sequence similarity and divergence of specific genes between taxa. Analysis of the mitochondrial CO1 gene has been used for DNA barcoding within a variety of invertebrates, such as other Coleoptera and reef brittle stars. We aim to use sequencing of the CO1 gene within Buprestidae in order to build a DNA barcode database. This would provide a cost-efficient way for agencies such as the USDA to determine the relative taxonomic placement of an intercepted buprestid by searching the generated CO1 sequence against known sequences in our database. Our current research focuses on optimizing primers pairs that will allow efficient amplification of the CO1 gene within Buprestidae. We are using Buprestidae that have been collected into high-grade ethanol using standard methods from different areas of the world by Dr. Lord and collaborators, including Australia, Vietnam, USA, Rwanda, Chile, and Costa Rica. We extracted DNA from dozens of Buprestidae using Qiagen DNEasy extraction kits and amplified gene regions of interest via PCR with primers traditionally used in insect systematics. By performing gradient PCRs, the optimal annealing temperature of various primer pairs may be determined as well as their efficiency. Our ultimate objective is to find a small number of pairs that are efficient in amplifying the entirety of the CO1 gene for Buprestidae to create a sufficient DNA database for these beetles. Our next steps are to send the amplified CO1 gene of numerous Buprestidae to Eurofins Genomics (Louisville, KY) for Sanger sequencing. Gene sequences will then be assembled and edited using Geneious R11 and a database will be built alongside the USDA |   |   |   |
| 15 | Kariann Lamon, Stephanie Forsman, Jordan Yacoub , Caroline Fowler  | An Investigation into the Visual Systems of Cerceris fumipennis using Transcriptomes and Phylogenetically-Informed Annotation (PIA) | Biology | Nathan Lord |
| Abstract | Cerceris fumipennis is a natural predator of the invasive beetle species, Agrilus planipennis, more commonly known as the Emerald Ash Borer (EAB). Our interest in this study is to discover which genes are expressed within C. fumipennis that allow this species to locate their prey. In order to understand their visual and chemosensory systems, we generated transcriptomes for C. fumipennis. We extracted the RNA from two specimens preserved in RNA-later. The extracted RNA was then used to generate a cDNA library using Illumina Next-Gen sequencing technology. The data from this library was then used to assemble the transcriptomes for our specimens. The next step in our research is to utilize phylogenetically-informed annotation (PIA) to search for the phototransduction genes that are expressed in C. fumipennis. The EAB has caused a tremendous problem for ash trees in North America, and current surveillance methods have not been fully effective in tracking the spread of the EAB. Surveying the genetic markers within C. fumipennis would give an indication as to how these wasps locate their prey at a molecular level. Data collected from our transcriptome assemblies could give this insight and thus potentially aid in improving current biosurveillance techniques in tracking the EAB. Additionally, the molecular data could indicate coevolution between C. fumipennis and its prey. |   |   |   |

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| 16 | Kori Ogletree | Identifying Roadkill Hotspots by Using a Running Average | Biology | Al Mead |
| Abstract | The identification of roadkill hotspots is necessary prior to the application of mitigation measures by resource managers otherwise, an increase in roadkill is possible with unnecessary modifications to the roadway. Placing wildlife barriers where hotspots are not known or found has shown to increase the mortality of animals in that particular location because the animals go around the barrier instead of walking away. To prevent such cases in our location, we are analyzing a baseline study with no existing data of hotspots. In a previous study, 178 roadkill specimens were recorded via a driving survey along 13.2 miles on three connected roadways in Baldwin County, Georgia. Two of the roadways were subject to heavy traffic, but they differed by the number of lanes and width of the road. Roadkill locations were recorded based on the mileage counter of a vehicle odometer. In the current study, the location data was used to generate a linear graph by a running average of three-tenths of a mile. Initial analysis indicates various peaks where hotspots may occur. Our next step in this analysis is to measure the position of the peaks in relation to roadway features such as vegetative boundaries, stream crossings, hills, and curves by comparing each peak to its respective location on the road. Taking these locations into consideration will help determine what mitigation measures are needed to minimize future roadkill without creating nonessential changes to the roadway, possibly increasing roadkill. |   |   |   |
| 17 | Kristen Pack | The Future of American Currency Through Improved Artistic and Security Elements | Mass Communication | Abraham Abebe |
| Abstract | Paper currency is the source and identity of a government and country, and the long-standing design of the United States’ currency is deficient compared to current international standards. The proposed project will produce a new standard for American paper currency. Through a unique graphic design approach, a new design proposal of an American twenty-dollar bill is presented. The purpose of this project is to make American currency more interesting for the public to appreciate as an art form. This project will alter people’s interaction with money and transform the American bills from being a commodity to an appreciated art form. Other countries such as Switzerland change their currency designs every three to five years to reflect principles of art and reduce counterfeiting. The US has not changed their twenty-dollar bill design since 2003. The security features incorporated into the design of currency should change as technology advances to generate a more sophisticated design to prevent counterfeiting efforts. Through sophisticated computer software like Adobe Illustrator and Photoshop, I have created intricate patterns and engraving techniques to improve the currency’s security features. With detailed formation of lined patterns and shaded colors to create the forms of my composition, this process is unable to be copied. This design will ensure that designers cannot duplicate the currency creation techniques, as well offer as a new field of study for security design. With thorough research into the security and technicalities of currencies around the world, the proposed project is a direct reflection of the new international design standards that the United States’ currency could benefit from. The attention placed on creating a new currency design will strike interest in security and currency creation through a unique design approach, and a new standard of currency design will be expected from the United States. |   |   |   |

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| 18 | Melissa Creviston | Spatial Distribution of Crayfish on Sapelo Island, GA | Environmental Science | Sam Mutiti |
| Abstract | Crayfish are important because they are source of nutrition for humans, are ecosystem engineers (soil movement), and are also used for water quality monitoring. Crayfish are burrowing organisms that spend a part of their lives in the water, and the other part burrowed in the soil. There is still very little published literature on the factors that control the spatial distribution of crayfish, but evidence has shown a preference in the soils and waters they reside in. The purpose of this study was to determine the environmental, hydrogeological and pedological factors associated with crayfish distribution on Sapelo Island, Georgia. Understanding these factors provides insight to the habitats that crayfish prefer, which is crucial to their survival and conservation efforts. Different soil parameters were evaluated including grain-size distribution, macronutrients, hydraulic conductivity, and salinity (electrical conductivity). Soil characterization was performed using a variety of methods that included, soils sieves, LaMotte soil kits, X-Ray Fluorescence, Munsell Color books and distilled water extraction methods. Water parameters were measured both in the field and lab using the YSI Multiparameter probe and LabQuest 2 ISE probes. These parameters included pH, temperature, salinity, specific conductance, and dissolved oxygen. The most limiting water parameters were specific conductance or salinity, indicating the range of water salinity that these crayfish can reside in. All other water quality parameters did not have strong correlations with the presence and/or absence of crayfish. Most of the crayfish habitats identified had fresh to brackish water. Since most of the crayfish are freshwater organisms, it appears that even in these transitional environments, they are still not fully adapted to higher salinities. |   |   |   |
| 19 | Nicole Ackerman | The Correlation Between Inmates' Mental Health and Victimization | Criminal Justice | Carrie Cook |
| Abstract | The topics of inmate victimization and inmate mental health have both been the subject of some criminological research. Most research has focused on the prevalence of victimization among those who have had prior mental health problems or diagnoses, rather than those who develop mental health problems in correctional facilities. The current research examines whether victimization correlates with an inmate’s mental health before incarceration and expands prior research by examining a national sample of over 18,000 inmates. The purpose of the research is to discuss and determine how an inmate’s mental health is associated with the victimization that can occur in prison. J. D. Wooldredge’s study, Inmate Experiences and Psychological Well-being, focuses on how victimization in prison can affect an inmate’s psychological well-being. Using this study as the driving force behind the research discussed, the expected results are as follows: those who experience more victimization will have more problems with their mental health. The data is derived from the Survey of Inmates in State and Federal Correctional Facilities Series, provided by the Department of Justice. Correlations will be run using variables and results provided by the Department of Justice. Using the SPSS statistical program, the variables sex, race, age, taken meds for a mental or emotional problem, a hospitalized overnight stay due to an emotional or mental problem, and whether the inmate has received counseling or therapy for an emotional or mental problem will be correlated with pressured or forced sexual contact and whether the inmate has been in fights, hit, or punched. |   |   |   |

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| 20 | Patrick M. Powers  | Determining the Presence of Sexual Dimorphism in White-tailed Deer (Odocoileus virginianus) Using Dental Measurements | Environmental Science | Al Mead |
| Abstract |  Paleontological and archeological studies would benefit if researchers could determine the sex of mammal remains from a particular site. Examining various aspects of a mammal’s anatomy could also reveal more information about intraspecific interactions within the environment. In the present study, 377 White-tailed deer (Odocoileus virginianus) mandibles collected from the Piedmont National Wildlife Refuge, located in central Georgia, were analyzed to determine the presence of sexual dimorphism through the comparison of various dental dimensions. The sample contained 289 male and 88 female mandibles. Ages were determined based on tooth wear and specimens were placed into 1.5, 2.5, or 3.5-year-old age classes. For each jaw, the mandibular width and depth were measured at the third premolar (p3) and second molar (m2). Male and female measurements within each age class were comparable, though male average measurements tended to be slightly larger. The coefficient of variation indicated that males showed a greater variability in 9 of the 12-characters measured. Scatter plots of m2 width and depth, p3 width and depth, and p3 width and m2 depth showed a nearly complete overlap between the sexes. Although males displayed slightly larger average measurements, the findings of this study revealed no definitive correlation in mandible thickness that would allow for male and female white-tailed deer to be distinguished. |   |   |   |
| 21 | Rachel Wellman, Colin Calvert , Julia Parrott  | Georgia College Compost Analysis through Chemical Characteristics, Rhizobia Symbiosis, and Nitrifying Bacteria | Environmental Science | Allison VandeVoort |
| Abstract | Georgia College’s in-vessel compost system yields sustainable practices through the conversion of post-consumer waste from the on-campus dining hall into a valuable resource. The waste is put into the in-vessel composter, and then allowed to cure in air-rows, which creates compost. In addition to reducing waste management costs for the University, the in-vessel composting system has the ability to provide nutrient-rich soil to local communities, and is currently delivering its product to campus gardens and landscapes. Compost quality can be assessed by chemical analysis; therefore, colorimetric analyses of nitrate, phosphate, and sulfate were completed. These tests revealed a high concentration of nitrate in some samples. The Clemson Agricultural Services Laboratory provided an agricultural compost analysis. The compost samples contained carbon to nitrogen ratios between 15.41 and 26.68, a slightly acidic pH of 5.2 to 6.7, low moisture content between 7.36% to 25.71%, and low amounts of EC soluble salts between 1.11 and 4.87. The next analysis is the study of nitrogen-cycling bacteria, such as Rhizobia and nitrifying bacteria. Rhizobia convert dinitrogen gas to ammonia and ammonium, which is a plant-available resource. Specifically, rhizobia form a symbiotic relationship with legume plants in which they live in nodules of the plant’s roots. Legume plants will be grown in soil amended with Georgia College compost and nodules will be recorded as indicators of symbiotic relationships. With legumes grown from compost, there will most likely be a decrease in nodules because plants will not need to gather nitrogen from rhizobium. A nitrification assay will also be conducted to determine the activity of nitrifying bacteria, which convert ammonium to nitrate. Compost with more nitrate should indicate a more mature condition. The purpose is to determine compost maturity and productivity through nitrogen availability, and other biological and chemical parameters. |   |   |   |

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| 22 | Sarah Martin and Garrett Layfield | Synthesis and Characterization of Novel Flavonoid Derivatives as Tau Self-Aggregation Inhibitors | Chemistry | Chavonda Mills |
| Abstract | Through recent discoveries, it has been determined that there are increased levels of the aggregated form of the protein tau in patients with Alzheimer’s disease (AD) when compared to healthy patient levels. Thus, inhibition of the self-aggregating properties of tau has been identified as a potential treatments for AD. Current progress in the identification and development of tau aggregation inhibitors has proven challenging with only one drug at Phase III clinical trials. Yet, the number of people affected by AD continues to grow with an alarming 16 million Americans expected to be living with the disease by 2050. As such, identification of novel tau aggregation inhibitors to treat AD is critical. Flavonoids, naturally occurring dietary compounds, have a variety of pharmacological activities, including anti-inflammatory, antiviral, and tau aggregation reduction properties. Furthermore, thioxothiazolidinones (rhodanines) exhibit strong inhibitory properties for tau aggregation. It is possible that combining the pharmacophores of flavonoids and rhodanine will lead to the identification of a strong tau aggregation inhibitor. The study presented herein identifies through rational drug design a promising novel compound consisting of both the flavonoid 15-carbon skeleton and rhodanine as a potential tau aggregation inhibitor. The novel compound was synthesized, characterized, and will be tested for its ability to prevent the self-aggregation of tau. |   |   |   |
| 23 | Thomas Kubiak and Haydn Westbrook | Effect of Chinese Privet (Ligustrum sinense) on Nutrient Cycling in Georgia’s Piedmont Region | Environmental Science | Christine Mutiti |
| Abstract | The decomposition of plant litter is an essential process in ecosystem nutrient cycling that returns nutrients back to the soil so they are available for use again. Studies have shown that invasive plants such as Chinese privet decompose faster than native plants, which impacts the rate of nutrient cycling. These studies have mainly compared decomposition rates for individual species’ litter but not much has been done to determine impact of Chinese privet on decomposition rates when it’s mixed with multiple native plants. The objective of this research was to assess how the mass and concentrations of nitrogen (N) and carbon (C) change as leaf litter samples with varying amounts of Chinese privet decompose. Litter was collected from the Oconee River Greenway and Bartram Forest in Milledgeville GA and separated into privet-only litter and non-privet litter and air dried. It was then sorted into mesh litter bags of three categories: all native, all privet, and half of each. Litter bags were placed in Bartram forest and samples were collected at zero, four, and eight weeks. All samples were oven dried, weighed, and ground into a fine powder. Samples were analyzed for their N and C content using a Perkin Elmer 2400 CHN elemental analyzer, and weighed to determine percent loss in mass. The preliminary results indicate that mass loss of the all-privet litter was twice (32%) that of no-privet litter (16%). Privet litter also had higher concentrations of nitrogen which would explain why all-privet litter decomposed faster than no-privet litter. While faster decomposition helps return limiting nutrients such as N back to the soil faster, it may be more harmful than beneficial if N is being released back to the soil during periods when plants are not growing, such as winter, as the N ends up being leached from the soil. |   |   |   |

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| 24 | Yingfan Wang | Molecular Detection Of Atrazine Degraders For The Detection Of Atrazine Contamination In The Caribbean | Biology | Dave Bachoon |
| Abstract | Atrazine (2-chloro-4-ethylamine-6-isopropylamino-1,3,5 triazine) is one of the most commonly used herbicide for the control of broadleaf weeds in the world. This herbicide acts by inhibiting the photosynthetic process in weeds, thereby killing them. Many studies have shown that atrazine has numerous negative impacts on non-target aquatic animal species including corals. It is found to be an endocrine disruptor in mammals, leading to hormone imbalance (e.g. abnormal sexual development in fishes and amphibians) and is linked to cancer in humans. Atrazine is a commonly detected herbicide in groundwater and can persist in the environment for over one year after it is applied. Atrazine catabolism gene, Atrazine Chlorohydrolase (atzA) can be used to detect the presence of atrazine-degraders through quantitative polymerase chain reaction (qPCR) assay. Pseudomonas sp. strain ADP is one atrazine degrading bacteria that utilizes atrazine as its sole source of nitrogen. The aim of this study was to assess the level of atrazine contamination in the Caribbean region by detecting the level of degrading- Pseudomonas in water samples from Trinidad and Puerto Rico. A total of 58 water samples were collected from Trinidad and 66 water samples were collected from the dry and wet seasons in Puerto Rico. QPCR detection of the atzA indicated that in both islands many of the rivers and beaches were contaminated with Atrazine. The presence of atrazine contamination on these islands represents a dangerous threat to the Caribbean costal ecosystems. |   |   |   |
| 25 | Zach Galberd, Luke Walsh, Adam Vu, Kenneth Adams, Hani Sharif, Joseph Cumming | Supercavitation Capabilities On a Submarine | Physics | Hauke Busch |
| Abstract | Supercavitation Capabilities On a Submarine Throughout history submarines have shaped the way wars have been fought and changed our understanding of fluid dynamics. In the past an idea has been used to increase the velocity of torpedoes in Chinese and Russian torpedos called supercavitation. The idea being that if you are traveling at a certain velocity underwater, and you begin expelling a gas out of the nose, you will be “flying” in that new medium. This allows the torpedo to travel at faster speeds making the location of the torpedoes undetectable by enemy submarines. The purpose of our project is to explore the benefits and limitations of supercavitation. This information will then be implemented into a submarine to hopefully increase the speed and efficiency. The obstacles we are facing include finding ways to exhaust air/gas out the nose of the vessel to create the new medium to travel through, as well as testing different shapes and nose designs for the scaled submarine. We are currently modifying designs of a small scale submarine to test and develop new designs that will be the most dynamic and efficient model that we are basing our submarine on. We hope to begin testing soon. |   |   |   |

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| 26 | Zachary Davis | Phosphate Transport Through Groundwater Systems at Babe and Sage Farm | Environmental Science | Allison VandeVoort |
| Abstract |  Within a watershed, increased phosphate concentrations can result in accelerated eutrophication. Eutrophication is caused by an excess amount of nutrients, such as nitrogen (N) and phosphorus (P) in a water body, which can ultimately lead to algae growth that could deplete dissolved oxygen when they decompose. The study site, Babe and Sage Farm, in Gordon, Georgia, is a small sustainable farm follows USDA regulations for Organic production. The farmers are seeking field research to determine the efficiency and sustainability of their practices. This study investigates phosphate movement though soils to assess the impacts of sustainable agriculture practices on the local watershed. We are investigating the possibility of particle-based transport and investigating desorption across a range of soil particle sizes on the millimeter to micrometer scale, achieved through a differential centrifugation technique. To assess the impacts of environmental or field-management conditions (e.g., fertilization regimes, acid rain, and/or liming) on phosphate desorption (release) from the soil, electrolyte concentration and pH were manipulated across phosphate desorption experiments. Additional measures to understand the phosphate transport by groundwater flow throughout the soil profile will be conducted, including in situ field measurements of permeability, ex situ Ksat determinations, and piezometer-based groundwater evaluations. Additionally, geographic information such as soil profile, relative elevation, and groundwater flow will be mapped using ArcGIS. We project that our results will indicate consistent phosphate concentration throughout the testing sites. Differing particle diameter expressed though the centrifuge could illustrate that the smaller particles would transport phosphate more effectively throughout the soil profile, due to its increased mobility. We also expect that electrolytes promoting high flocculation would lead to high soil permeability. |   |   |   |
| 27 | Zachary Stephen Bond | Effects of Organic Fertilizer and Spatial Analysis of Phosphate at Babe + Sage Farm Soils | Environmental Science | Allison VandeVoort |
| Abstract | Eutrophication is one of the most important environmental issues concerning aquatic ecosystems today. Agricultural runoff is one of the primary sources of nutrients contributing to the oxygen depleting processes active in eutrophication. Phosphate, a key component of most fertilizers, is often the limiting nutrient in freshwater ecosystems. According to scientific literature, phosphate sorbs onto soil particles after application of these fertilizers and moves through the soil by similar desorption processes. By measuring the amount of phosphate in the soil, it can be determined if the phosphate is moving through the soil. The location for this study is Babe + Sage Farm in Gordon, GA. Babe + Sage is a small sustainable farm that has been using fish-based fertilizers for years. The purpose of this study is to assess how high soil phosphate in cultivated areas affects the surrounding environment. This study uses a soil desorption technique to quantify plant available phosphate originating from soil particle surfaces in the soils down-flow of the cultivated fields. The desorption and movement of phosphate is an important factor in surface water quality. This study aims to simulate runoff conditions in the coastal plain of Georgia. The desorption technique used in this study includes using 1.5 grams of soil in 30 milliliters of 4.6 pH calcium chloride solution, sitting on a mixer for 24 hours. Preliminary studies have high concentrations of phosphate in the soils in the active fields. In general, phosphate desorptive capacity decreases with increased distance from the fields, as expected. After testing overland runoff samples directly northeast of the soil testing sites, we found high concentrations of phosphate. The main concern with this research is whether phosphate is running off from the fields in use at Babe and Sage Farm and moving into local surface water bodies. |   |   |   |

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| 28 | Zamara R. Garcia Truitt | Molecular Detection of Fecal Pollution and Leptospira Interrogans in Puerto Rico | Biology | Dave Bachoon |
| Abstract | A total of 64 freshwater sites located across streams and rivers of coastal locations across Puerto Rico were sampled during both the wet and dry seasons in 2014. In addition, thirty-one freshwater samples were collected in the San Juan area for the detection of Leptospira interrogans after the passing of hurricane Irma in 2017. Spiral-shaped pathogenic Leptospira bacteria are found in the urine of rodents and other animals. The bacteria tend to spread after floods through drinking water or infection of open wounds. Puerto Rico has reported at least 76 cases of suspected and confirmed leptospirosis, including handful deaths in the month after Hurricane Irma 2017. Improper wastewater treatment is a threat to public health and aquatic resources, as human pathogens, such as Leptospira interrogans, and nutrient pollution are detected. Quantitative PCR was used to identify the source of fecal contamination through molecular source tracking (MST) techniques and the presence of Leptospira interrogans. Probe based Taqman qPCR assays were used in the targeting of Bacteroides human-specific (HF183) marker, and a ruminant-specific (BacCowP) Bacteriodales 16S rRNA gene for the samples located across rivers and streams of Puerto Rico. The human-specific HF183 assay detected the presence of human fecal contamination in 23.4% of sampled locations in both wet and dry seasons, whereas the ruminant-specific assay confirmed ruminant fecal contamination in 25% of the locations sampled. However, the presence of Leptospira interrogans was not detected in the 2017 samples collected in the town of San Juan. Assays to detect the presence of Leptospira interrogans for the 64 sampled areas are currently being conducted and results will be added to the final presentation of collected data. |   |   |   |
| 29 | Jacalyn Carper | Mobile Application to Assist Learning: Design Research to Increase Productivity | Art | Abraham Abebe |
| Abstract | In this study, through an examination of students, individuals and groups, I have created a phone application design to help decrease the amount of procrastination and distractions the average phone permits. By asking my fellow classmates to describe a major distraction in there lives, many replied 'smartphones'. There are multiple studies emphasizing how smartphones decrease productivity, but very few solutions to this problem. In this study, though still in the design stage, the application “Life First” provides assistance to those who find themselves overwhelmed by the attraction of social media and other phone applications. This app creates a central location where distracting apps can be placed by the user to be managed by a timer and calendar, which is determined and set up by the individual to suspend the use of placed app. The individual decides which apps will be under the control of others, therefore apps not placed in the control location will not be affected. “Life First” will then use this process to help solve the problem of procrastination, by enforcing a time limit upon the individual. Once the user has placed said apps in the central location and sets the timer, then the individual may place an exam date or any other event date on the calendar. “Life First” then regulates the apps placed within it, to allow the time permitted by the individual on said apps, thus preventing procrastination and increasing productivity. |   |   |   |

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| 30 | Keira N. Stacks | Application of Phage-Based Technologies in the Reduction of Escherichia coli Contamination in Ground Beef | Biology | Indiren Pillay |
| Abstract | Escherichia coli is a bacterium that naturally resides in the intestinal tract of most animals, including humans. Most E. coli strains are harmless; however, some strains, such as E. coli 0157:H7 can cause severe vomiting, abdominal pain, diarrhea, hemorrhagic colitis, and kidney disease. This Shiga toxin-producing bacterium can be found on fruits, vegetables, raw and undercooked meat, and hard surfaces. Even when disinfectants and antimicrobials are applied, bacteria are still found in many foods and food-contact surfaces. Studies in the Journal of Animal Science have shown that the extensive use of antimicrobial agents has led to the high tolerance of pathogenic bacterial strains to these agents. Bacteriophages are viruses that infect bacteria in a highly specific manner. With an increase in antibiotic-resistant bacteria, the application of phage-based technologies in controlling pathogenic bacteria is receiving more attention. This study investigates the lytic activity of bacteriophages isolated from meat, and its efficacy in reducing known concentrations of E. coli on experimentally contaminated meat. E. coli-specific phage was isolated from non-frozen ground beef samples (80% lean and 20% fat) obtained from two different supermarkets in Milledgeville, GA. Reference strains of E. coli ATCC 25922 were used in this study as the phage host. Meat samples were macerated in a stomacher machine and a sample of the resultant suspension was enriched for phage by incubating with E. coli. Phage titration was performed and plaque formation was recorded. Isolated phage was applied to beef containing endogenous E. coli and spiked with a known concentration of E. coli to see if it effectively reduced E. coli concentrations. Preliminary results showed that the isolated bacteriophages from raw meat were effective in the lysis of E. coli ATCC 25922 cells. These bacteriophages have the potential to serve as biological agents in the decontamination of ground beef. |   |   |   |
| 31 | Parker Rhinehart | Eocene Terrestrial Fossils from Central Georgia | Environmental Science | Al Mead |
| Abstract | While localities containing fossil shark’s teeth from the late Eocene are fairly common in Georgia, terrestrial vertebrate fossil localities are exceptionally rare. In the current study, we are analyzing a small collection of terrestrial vertebrate material from the Hardie Mine near Gordon, GA. Previous studies have determined that these sediments are approximately 34.2-36.0 million years old. The Hardie Mine is an inactive open pit kaolin mine and well-known for its abundance of shark’s teeth. The terrestrial vertebrate material is represented by teeth or fragments of teeth. Thus far, we have positively identified material attributable to Megacerops, a member of a group of large herbivores known as brontotheres. While this is a work in progress, we do know that we have material from at least two carnivores, a rabbit, and another as yet unidentified perissodactyl. Even though this is a small collection of fossils, due to the relative lack of any terrestrial fossils of this age in the state they are significant. |   |   |   |

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| 32 | Hunter Martin | Cellular Stem Therapy for Knee Cartilage Regeneration | Athletic Training | Mandy Jarriel |
| Abstract | Objective: To present on a 76-year-old male with degenerative joint disease of the right knee, experiencing pain and reduced range of motion for the past six years, indicating cartilage degeneration. Background: The patient is 5’8” weighing 206 pounds, with an ectomorph body composition. He has no past medical history of knee pathologies. He stated that the sharp joint pain began approximately six years ago and has been constant since despite the use or NSAIDs, ice, and elevation. He received multiple corticosteroid injections with no permanent decrease in symptoms, causing a dramatic reduction of activity level. Differential Diagnosis: The physician noted the patient had right knee crepitus with a stable joint and no active inflammation. His differential diagnosis included osteoarthritis, bone spurs, or degenerated menisci. X-rays were performed and it was determined that the patient had degenerative joint disease, indicating degenerated cartilage in his right knee. Treatment: The physician determined that the patient would be an ideal candidate for a cellular stem therapy injection, a mixture of cryopreserved amniotic membrane and amniotic fluid also known as Palingen. One milliliter of the Palingen mixture was combined with one milliliter of one percent lidocaine and injected laterally into the joint capsule of the patient’s right knee. Uniqueness: Amino Technology LLC, has been through the process of preclinical research and development for their creation of the PalinGen fluid and is now in the clinical research and development stage of the product. The literature behind cellular stem cell therapy is not yet extensive enough for approval by the FDA. Most research has had positive results, however some of the trials have been contradictory and therefore require more trials. Trials such as this one are being performed with humans in clinics now, to hopefully give a basis for the FDA’s future approval. Since the intervention is noninvasive and causes minimal pain with little to no down time for patients, it could be a highly sought after alternative to total knee replacements paving the way for a new generation of medicine. Conclusion: Although this patient hasn’t yet reached the six-month post injection mark, his increase in joint space (2.69mm), drastic decrease in pain, and the ability to return to normal activity levels is a step in the right direction and promising sign for this innovative and life changing era of medicine. |   |   |   |
| 33 | Harrison MacNellis | Investigating the Population Structure and Genetic Diversity of Procambarus talpoides, on Jekyll Island, Georgia | Biology | David Weese |
| Abstract |  North America is home to more species of crayfish than any other country in the world, with the epicenter of global diversity located here in the southeastern region. Unfortunately, a third of crayfish in the United States are extinct or are at risk of extinction due to habitat destruction and pollution. Despite their abundance, the genetic structure and diversity of crayfishes from the southeast are poorly understood. Here, we investigate the distribution, diversity, and population structure of the Mole Crayfish, Procambarus talpoides, a primary burrower native to Jekyll Island, Georgia. Due to areas of saltwater intrusion and manmade pressures, Jekyll Island represents a fragmented habitat for P. talpoides. Given its sedimentary lifestyle and fragmented environment, it is hypothesized that populations of P. Talpoides on Jekyll Island will exhibit significant population structure and low levels of genetic diversity. However, given the relatively young geological age of the island (i.e., less than 50,000 years) not enough time may have passed for significant levels of genetic variation to have accumulated between populations. To distinguish between these two hypotheses, sequence variation at the mitochondrial cytochrome c oxidase subunit I (COI) gene will be investigated between three populations of P. talpoides on Jekyll Island. Understanding the levels of gene flow occurring between these populations has the potential to provide insight into the population structure of the species and could provide valuable information pertaining to the conservation and management of not only this species but also other crayfish found on the island. |   |   |   |
| 34 | Matthew Dallas | Using an Atomic Molecular Optics Laboratory for Undergraduate Research and Mentoring of Physics Students in Georgia | Physics | Hauke Busch |
| Abstract | An Atomic and Molecular Optical (AMO) Physics research lab is an excellent tool to train and mentor undergraduate students in advanced laboratory techniques. Students gain valuable basic experience in experimental designs, data acquisition techniques, working with high precision optical equipment, building electronics, and working in the machine shop. The current project is building and testing an enclosure for the diode laser to reduce sound and vibrational interference. In addition, we are developing and evaluating a new, more compact laser cavity which is 3d printed. Previously completed projects involved building a temperature controller, current supply circuit, machining the laser mount, milling the vacuum chamber mounts to support the chamber, and machining the Helmholtz coils for the chamber, which are being used to trap the atoms in a Magneto Optical Trap (MOT). This included designing, building, and baking out the vacuum chamber, constructing a trap for the Rb in the chamber, and building the lasers for a saturation-absorption system that is used to probe the 52S1/2→ 52P3/2 hyperfine energy transitions of the Rb-85 atom. These energy transitions have been used to frequency-lock a diode laser to trap Rb-85 atoms and then cool them to ultra-low temperatures. The atom cooling will permit observation and measurement of the fundamental properties of atoms. This lab has mentored and supported over twelve undergraduate students in the last four years, of which one became a High School Teacher, three joined Ph.D. programs, one continued in a master’s level engineering program, and one went to graduate school to study bioengineering.  |  |  |  |