GORDON
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2018 Undergraduate Research Symposium

Wednesday, May 3, 2018

Program Content and Schedule

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Poster Display

Posters will be displayed in the Loggia in the Ken Olsen Science Center.

Students will staff their entries for a minimum of one hour on
Wednesday, May 2 between 2:30 a.m. and 4:30 p.m.

Posters must be taken down immediately after the event.

Please enjoy refreshments during the event.

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Poster Entries

Natural Sciences, Mathematics, and Computer Science

Listed in alphabetical order by lead author's last name

Electrochemical and Electrogenerated Chemiluminescence Study of Organolead Halide Perovskite Nanocr

Victoria Arau

Dr. Yiliyasi Wusimanjiang, Dr. Shanlin Pan

Perovskite nanocrystals (PNCs) are a material with solar and LED applications. The compounds synthesized were methyl ammonium lead bromide—octylammonium bromide, methyl ammonium lead bromide—octadecylammonium bromide, methyl ammonium lead chloride—octylammonium chloride, and methyl ammonium lead chloride—octadecylammonium chloride. The bromide possess green photoluminescence while the chloride compounds possess blue photoluminescence. The fluorescence and absorbance spectra studies done present sharp peaks, with -OABr fluorescing λ maximum at 529 nm, -ODABr fluorescing λ maximum at 532 nm, -OACl fluorescing λ maximum at 433 nm, and -ODACl fluorescing λ maximum at 392 nm. Electrogenerated chemiluminescence (ECL) studies have been done with capped PNCs both in solution and immobilized on an electrode, and coreactant and ion annihilation studies. The optimized coreactant ECL conditions were used to collect the ECL spectrum of the nanocrystals using a charged coupling device (CCD) ECL setup, and these spectra were compared with the fluorescence spectrum.

The Effect of Coral Bleaching on Fish Abundance in Boulder Coral Habitats

Lian Atlas, Gabrielle Brucker, Jordan Dorelus, Jessica Harper, Sara Lareau

Dr. Gregory Keller

This study focused on the impact of coral bleaching on fish abundance in the South Water Caye Marine Reserve, Belize. Coral bleaching is the loss of pigment or whitening due to reduction of its symbiont zooxanthellae (Glynn, 1993). Minor coral bleaching caused by grazing of herbivorous fish allows for recovery. However, the increase in water temperature due to environmental changes causes significant loss of zooxanthellae, leading to permanent bleaching and death of coral reefs. Decreasing coral cover and health causes parallel decreases in fish abundance and biodiversity (Jones, 2004). We recorded coral size, percentage bleached and fish abundance from 64 boulder coral sites in four locations. Using an ANOVA test for statistical analysis it was found that fish abundance was strongly correlated with coral size, rather than our original hypothesis. In addition, we found that larger corals generally had larger amounts of bleaching. This study can be applied to future conservation efforts and ecotourism with greater understanding of interactions between fish species and their coral habitats.

Developing Optimized Sortases for Investigating Cellular Trafficking in Animal Models

Yeeun Bae

Dr. Craig Story

New biochemical tools continue to provide ever more detailed insights into cellular and organismal function. The enzyme sortase is used by Gram-positive bacteria to join new protein subunits onto the growing pilus structure, and has been employed as a peptide ligase to perform interesting biochemistry as a purified enzyme. The sortase A enzyme (SrtA) from Staphylococcus aureus has been enzymatically optimized by us and other researchers through mutagenesis, and is typically purified from an E. coli. expression system [1].

SrtA substrates include one containing a 5-amino acid motif, the so-called sorting signal, Leu-Pro-Xxx-Thr-Gly, at or near the C-terminus, and a second substrate has a poly-glycine sequence on its N-terminus. The sortase reaction results in a peptide bond between the Thr of the sorting signal and an N-terminal glycine of the second substrate, creating a peptide bond between the two substrates. Sortase together with LPXTG-containing artificial substrates such as fluorescent dyes have been used to fluorescently label cells, via available N-terminal glycine residues displayed on the cell surface [2].

We recently reported a new sortase variant that combines multiple mutations, yielding an enzyme that was both calcium-independent and highly active [3]. This variant has superior activity over other previously described calcium-independent sortases for both N- and C-terminal labeling, as well as cell surface modification under physiological conditions. Here, we further characterize sortases optimized for mammalian expression. A potential use of this mammalian-optimized sortase would be to label cells that encounter tissues expressing the sortase in vivo, such as in mouse tumor models.

1. Chen, L., Cohen, J., Song, X., Zhao, A., Ye, Z., Feulner, C. J., et al. (2016). Improved variants of SrtA for site-specific conjugation on antibodies and proteins with high efficiency. Nature Publishing Group, 1–12. http://doi.org/10.1038/srep31899
2. Swee, L. K., Lourido, S., Bell, G. W., Ingram, J. R., & Ploegh, H. L. (2014). One-Step Enzymatic Modification of the Cell Surface Redirects Cellular Cytotoxicity and Parasite Tropism. ACS Chemical Biology, 10(2), 460–465. http://doi.org/10.1021/cb500462t
3. Jeong, H.-J., Abhiraman, G. C., Story, C. M., Ingram, J. R., & Dougan, S. K. (2017). Generation of Ca2+-independent sortase A mutants with enhanced activity for protein and cell surface labeling. PLoS One, 12(12), e0189068. http://doi.org/10.1371/journal.pone.0189068

Greener Friedel-Crafts Acylation Using a Deep Eutectic Solvent: An Undergraduate Research Method

Julia Bonney

Irv Levy

The Friedel-Crafts reaction is an important part of the undergraduate Organic Chemistry curriculum; however, it is not ideally suited to undergraduate laboratories. This is due to the fact that Lewis acids, which are typically used as the catalyst, are difficult to separate from the product and are often used in more than stoichiometric amounts, causing environmental problems. In addition, the Lewis acid $AlCl_3$, the most commonly used catalyst, is a hazardous substance, making it a target for replacement with a greener alternative.

We have studied a published procedure to determine whether it is suitable for the undergraduate laboratory curriculum. By making and then using ([choline chloride][$ZnCl_2$]$_3$), a deep eutectic solvent, as the catalyst, the desired product can be synthesized and separated from the catalyst. In addition, since this catalyst also functions as solvent, we eliminate complex isolation and recovery procedures necessary when using organic solvents. Because this deep eutectic solvent is safer, used in smaller quantities, and results in a easier isolation, and recovery process, a laboratory procedure for undergraduate organic chemistry laboratories was designed using the ([choline chloride][$ZnCl_2$]$_3$) catalyst for a greener Friedel-Crafts reaction.

Comparison of Lycopene Content in Fresh Tomatoes, Diced Tomatoes, and Tomato Sauce

Quincy Dougherty, Paige Blake, Kevin Crowshaw, Sunny Shin

Dr. Jennifer Noseworthy

Lycopene is the principal pigment found in ripe red fruits, such as tomatoes, and their products. Tomato is valuable source of lycopene, a natural antioxidant, and is an important component of a healthy diet. In this experiment, we quantified the concentration of lycopene in three different forms of tomatoes (fresh tomatoes, diced tomatoes, and tomato sauce) using high-performance liquid chromatography (HPLC) and a greener extraction method. The traditional extraction method uses solvents that are hazardous and the greener solvents reduce hazardous exposure and reduce solvent volumes. Lycopene concentration can vary between fresh and processed food products. We found that canned diced tomatoes had the highest concentration of lycopene (134 υg/g) and tomato sauce has the lowest concentration of lycopene (22 υg/g).

Comparision of Ascorbic Acid Concentrations in Organic and Non-Organic Bananas Using HPLC

Quincy Dougherty

Dr. Otonye Braide-Moncoeur

Ascorbic acid (Vitamin C) is a water-soluble vitamin that is commonly found in fruits and leafy vegetables. It is required for the biosynthesis of collagen, an essential component of connective tissue, and is also involved in protein metabolism. Ascorbic acid also acts as an antioxidant, helping to prevent cell damage caused by free radicals. Its function as an antioxidant has made it a target for the prevention and treatment of gastrointestinal cancer. Due to its many health benefits, ascorbic acid is an essential component of the human diet. According to a study published in the British Journal of Nutrition, organic crops contain significantly higher concentrations of antioxidants compared to non-organic crops. In this experiment, the concentration of ascorbic acid in organic and non-organic bananas was quantified using HPLC. A linear calibration curve was generated with ascorbic acid concentrations ranging from 1.6 to 52 µg/mL. To extract ascorbic acid from the bananas, the bananas were blended with a metaphosphoric acetic acid solution and centrifuged. The supernatant was removed and filtered prior to being analyzed using a Jasco HPLC system and a Kintex 5u XB-C18 column. Organic bananas are predicted to contain more ascorbic acid than non-organic bananas.

Analysis of Gasoline through Gas Chromatography

Colin Dowd

Dr. Otonye Braide-Moncoeur

The degradation of gasoline of two different octane ratings was studied using gas chromatography and mass spectrometry. The procedure was conducted to see if higher octane gasoline will degrade less than lower octane gasoline because it contains a greater amount of stronger hydrocarbons. Through this study, gasoline of the higher octane was shown to have no more degradation than gasoline of lower octane.

The Effects of Coral Bleaching on Squirrelfish and Total Fish Abundance in the Caribbean Sea

Jack Gilbert, Grace Peppler, Gabrielle Capone, Victor Sanchez, Evangeline Kim, Micaiah Bushnell

Dr. Greg Keller

This study tested the hypothesis that higher levels of bleaching in coral reefs will result in an increased abundance of squirrelfish. Correlations were expected to be found between the coral bleaching levels and the total fish abundance and relative abundance of squirrelfish. The research was conducted off of the South Water Caye of Belize amongst four different snorkeling locations. For four days, 41 sites across four locations were evaluated on both the level of coral bleaching (low, moderate, and high) and the abundance of fish. Our data analysis showed no significant information that indicated any correlations between squirrelfish and bleaching levels, so we therefore failed to support our hypothesis. However, significant correlations were found between total fish abundance and both moderate and high bleaching levels, which suggested either positive benefits or severe ramifications to the fish abundances respectively.

Tongue Stability in Elite and Dystonic Horn Players

Timothy Gouveia

Dr. Peter Iltis

Embouchure Dystonia (ED) is a variant focal task-specific dystonia in musicians, commonly referred to as Musicians Dystonia, which is characterized by the loss of control in facial and oral muscles while controlling airflow into the mouthpiece of a wind or brass instrument. This study looks at the performance of 13 French hornists, of which eight are healthy elite horn players and five are players with embouchure dystonia. Two sessions were conducted in which the first session contained seven subjects - five elite and two with ED - while the second session consisted of six subjects - three elite and three with ED.

The study examined the performance of three different exercises for a duration of 10 seconds at three different dynamic levels (pp/soft, mf/medium, and ff/very loud). All thirteen subjects performed Exercise 1 which consisted of playing a sustained Eb4 for ten seconds at each of the three different dynamic levels. The six subjects in session 2 also performed Exercises 2 and 3, consisting of sustained notes on Bb5 and Eb2, again, at each of the three different dynamic levels. During each exercise, high-speed real-time (RT) magnetic resonance imaging (MRI) was used to capture cine images of a mid-sagittal view of the oropharyngeal musculature of all 13 subjects. The RT-MRI data gathered was analyzed using MATLAB software. In MATLAB, seven grid lines, were created to cover the oral cavity as depicted in the RT-MRI images. Movements of the tongue edge along these gridlines during each note were subsequently compared between health and dystonic players to assess differences in stability.

Organometallic Catalysis

Daniel Gray

Dr. Michael Paul

Ferrocene and its other homoleptic transition metal carbonyl derivatives have been the focus of many recent projects because of their unusual structure and robustness. Ferrocene has been used in antimalarial drugs and as fuel additives. Organometallic compounds like ferrocene are commonly used in catalysis. To assess the effect of protonation on the homoleptic transition metal carbonyl clusters, computational modeling simulations have been carried out. The binding energies were measured and compared at different positions and sites on each different cluster. The analysis then compared the changes in the proton's positions on each of the protonated clusters. Ferrocene, iron pentacarbonyl, nickel pentacarbonyl, chromium hexacarbonyl, dimaganese decacarbonyl, diiron nonacarbonyl and dicobalt octacarbonyl nanoparticles were built using Material Studio and evaluated using density functional theory on VASP.

The principal findings show that nickel pentacarbonyl demonstrated the largest change in binding energies, while dimaganese decacarbonyl exhibited the least change. Meanwhile, ferrocene exhibited the most stable structure. The protonation led to some very interesting bond changes. In dicobalt octacbonyl the cobalt clusters detached from eachother and the hydrogen bonded inbetween both cobalts. Similar effects were observed in dimaganese decacarbonyl as the decacarbonyl clusters were not bonded very strongly, but more often than not, the proton bonded with the nearest carbon

Computational Fuel Cell Research

Daniel Gray, Nathan Gill, Meredith Carlile, Michael Hahn

Dr. Michael Paul

As the need for sustainable energy continues to grow, people have been searching for creative and different ways to develop diverse forms energy in the most cost effective and environmentally friendly ways. The use of Proton Exchange Membrane Fuel cells (PEM-FC), which produces electricity with water being its only by-product, has the potential to be a very efficient way to create usable energy. PEM-FCs manipulate oxidation-reduction reactions (ORR) ($O_2+4e^-=2O^-$), however their efficiency is limited by the strength of the O=O bond. At this time, platinum has proven to be the most efficient metal in use, however latinum has a diminishing supply and is quite expensive.

Ruthenium, iridium, gold, nickel, and iron 13 and 15 atom nanoparticle clusters were built using Material Studio and evaluated using density functional theory on VASP. An O_2molecule was bonded to a variety of different positions on each cluster. Over the course of the trials, the ruthenium crystals proved to be most effective in both breaking the O_2bonds as well as maintaining their stable crystal structures. Despite resizing and reshaping the iridium crystals, they were never stable enough to be optimized with an

O_2 molecule. Additionally, testing has begun on nickel-13 and iron-15 crystals, and have yet to provide any conclusive results.

While these results provided intriguing data on possible alternatives to platinum for PEM-FC reactions, the crystal structures were still comparatively small, and further testing on larger, more complicated crystals would be beneficial for any extrapolation into real world application.

Cellular Response of Human Embryonic Kidney Cells to Bacterial Lipopolysaccharide Exposure

Leanne Hallenbeck, Hannah Postma, Zachary Daly, Tochi Anioke, Dilanjan Anketell

Dr. Angie Cornwell

Lipopolysaccharide (LPS) is a large molecule found on the plasma membrane of a gram negative bacterium. LPS is the instigator for the NF-kB pathway which is a cascade of events that results in inflammation, a vital response to infection. A gram negative bacterial infection can be lethal in a situation such as sepsis during surgery. This causes approximately 20,000 deaths per year in the United States (Pinner 1996). To understand the pathway signaling, we used a twelve well plate filled with human embryonic kidney cells (T293). Four plasmid treatments were applied, each in three wells. EGFP plasmid was the control, dominant negative IKK-alpha and dominant negative IKK –beta plasmids were designed to block the inflammation pathway, while the constitutively active IKK-beta caused continuous inflammation. Using an Evos fluorescence microscope to analyze the wells before and after LPS treatment, we observed increased cell growth and fluorescence in both dnIKK plasmids in comparison to the EGFP plasmid cells. For the constitutively active plasmid we observed cell death, shrinkage, and reduced fluorescence, because the inflammation pathway resulted in apoptosis. This is significant because introducing a specific plasmid can influence the NF-kB pathway.

Comparing the Iron Concentrations in Filtered, Tap, and Bottled Water

Yanjun Huang

Drinking clean water is necessary to keep healthy. Nowadays, many people are searching for ways to improve the quality of their drinking water. Bottled water advocates thinking that it is cleaner and more convenient and of a higher quality. Therefore, people are becoming reliant on bottled water. Americans spend roughly $11 billion a year on bottled water and tons of non-biodegradable plastic bottles are produced. In addition, data shows that it takes1.63 liters of water to make every liter of bottled water.[1] Bottled water comes from natural springs or public sources and goes through a purification process, including filtration, to remove heavy metals and bacteria and is then bottled and distributed to retail stores. On the other hand, tap water is regulated by the U.S.[2] Environmental Protection Agency and delivered through a system of pipes, pumps and purification systems to homes and buildings in the

developed and developing world.[2] Professionally-installed water filters at home can also help to clean the water. Iron is a naturally occurring element commonly found in Massachusetts groundwater and wells.[3] It can be removed through filtration system used either in tap, filtered, or bottled water. The aim of this study is to determine and compare the iron level in bottled, filtered, and tap water using GF-AAS.

Citations

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2. Postman, Andrew. "The Truth About Tap." *NRDC*, 6 Apr. 2018, www.nrdc.org/stories/truth-about-tap?gclid=CjwKCAjw2dvWBRBvEiwADllhn2Ma3nFpL1LoLYlJ4qtmqGXgFX0iqJmHkfpbIQxkRzewrx-OsGy-4RoCm9YQAvD_BwE.

3. Anonymous. "Iron and Manganese in Private Drinking Water Wells." *Center for Agriculture, Food and the Environment*, 22 Mar. 2018, ag.umass.edu/cafe/fact-sheets/iron-manganese-in-private-drinking-water-wells.

Phenotypically Distinct Subset of Eosinophils Is Recovered with Intestinal Intraepithelial Leukocyte

Yanjun Huang, Courtney L. Olbrich, Anketell Dilanjan

Dr. Evangeline W. Cornwell, Dr. Lisa A. Spencer

In health, intestinal eosinophils contribute to mucosal immunity. In disease, eosinophils are associated with GI disorders such as food allergies and eosinophilic gastrointestinal diseases (EGIDs). However, the phenotype and functions of intestinal eosinophils in health or disease are poorly understood. This study assessed the phenotype, *in situ* localization, and capacity for *in vivo* antigen acquisition of intestinal eosinophils from naïve and allergic mice. Eosinophils were isolated from intestinal lamina propria (LP) and intraepithelial (IE) leukocyte populations and their surface phenotypes were assessed by flow cytometry. *In situ* localization of intestinal eosinophils was assessed by fluorescence microscopy from tissue sections from mice expressing eosinophil-targeted GFP. *In vivo* uptake of lumen-derived antigen in live mice was accomplished using an intestinal loop surgical model. Compared to blood eosinophils, LP eosinophils had increased surface expressions of CD11b, CD11c, MHC II and CD80. A subset of eosinophils was also detected within IE preparations from naïve and allergen-challenged mice. IE eosinophils were phenotypically distinguished from LP eosinophils by increased expressions of Siglec F, CD11b and CD11c, and with low to no detectable surface MHC II. Both LP and IE eosinophil populations from allergen-sensitized mice acquired fluorescently-labeled soluble antigens deposited directly into the intestinal lumen within 45 minutes of allergen delivery. These findings identify a novel subset of tissue-dwelling eosinophils present at baseline within the intestinal IE niche and provide phenotypic insights into the unique preparedness of resident intestinal eosinophils to engage in antigen-specific functions *in vivo*.

Relative Comparison of Omega-3s in Enriched Eggs by Gas Chromatography-Mass Spectrometer

Rachael Anne Jjorgenson

Dr. Otonye Braide-Moncoeur

Omega-3 fatty acids are an essential nutrient vital to brain and immune system health. The three main omega-3 acids, A-leniolic acid (ALA), docosahexanoic acid (DHA), and eicosapentaenoic acid (EPA) are not sufficiently present in most Western diets. Eggs enriched with omega-3s can be a good alternative source. However, the eggs are not enriched with only the most significant omega-3's – DHA and EPA. ALA is inefficiently converted to DHA and EPA and therefore less nutritionally significant. In order to quantify the relative amounts of each omega-3 fatty acid in enriched eggs, a total of five egg samples were analyzed in triplicate by gas chromatography-mass spectrometry (GC-MS).

Detecting Bias in DNA Fragmentation

Sunghyun Kang

Dr. Mike Veatch

DNA fragmentation is essential for DNA profiling. Here, probability models are studied to predict the number of reads required to achieve desired coverage depth and to estimate the results from this data.

This project focuses on two methods: Enzymatic Fragmentation and Acoustic Shearing. Enzymatic fragmentation uses an enzyme to cut a given genome. These enzymes are prone to cutting the genome at certain positions thus start-site bias is expected. By comparing this data with probability models, we can evaluate the significance of the start-site bias and determine if there exist other biases for acoustic shearing.

Two different approaches are used to understand DNA fragmentation coverage. In the first approach, we assume the locations of the reads are randomly and uniformly distributed across the whole genome. This is called the unbiased model. The second approach assumes the locations of the reads are neither randomly nor uniformly distributed across the whole genome.

The data sets used for this study contain various genetic information collected and provided by New England Biolabs (NEB).

Tongue Movements During Horn Performance Among Elite and Dystonic Musicians

Kevin Kozakowski, Timothy Gouveia

Dr. Peter Iltis

Embouchure Dystonia (ED) is a variant focal task-specific dystonia in musicians, commonly referred to as Musicians Dystonia, which is characterized by the loss of control in facial and oral muscles while controlling airflow into the mouthpiece of a wind or brass instrument. This study looks at the performance of 13 French hornists, of which eight are healthy elite horn players and five are players with embouchure dystonia. Two sessions were conducted in which the first session contained seven subjects - five elite and two with ED - while the second session consisted of six subjects - three elite and three with ED.

The study examined the performance of three exercises for a duration of 10 seconds at three dynamic levels (pp/soft, mf/medium, and ff/very loud). All thirteen subjects performed Exercise 1 which consisted of playing a sustained E^b4 for ten seconds at each of the three different dynamic levels. The six subjects in session 2 also performed Exercises 2 and 3, consisting of sustained notes on B^b5 and E^b2, again, at each of the three different dynamic levels. During each exercise, high-speed real-time (RT) magnetic resonance imaging (MRI) was used to capture cine images of a mid-sagittal view of the oropharyngeal musculature of all 13 subjects. The RT-MRI data gathered was analyzed using MATLAB software. In MATLAB, seven grid lines were created to cover the oral cavity as depicted in the RT-MRI images. Movements of the tongue edge along these gridlines during each note were subsequently compared between healthy and dystonic players to assess differences in stability.

FRET to Elucidate the Lipid Trafficking Mechanism of SP-B C and N Terminal Peptides

Kayla Kroning, Amanda Page

Dr. Otonye Braide-Moncoeur

Infant Respiratory Distress Syndrome (IRDS) is a disorder which commonly affects premature babies. It is caused by a complete or partial deficiency of lung surfactant (LS), a film that lowers the surface tension of the alveoli; permitting inflation and oxygen exchange at ambient pressure and preventing collapse during respiration. Specifically, surfactant protein B (SP-B) has been shown to play an essential role in surface tension reduction, though how it functions is largely unknown. A structurally simpler synthetic peptide, called KL_4, is used for IRDS treatment. It mimics the carboxyl-terminus of SP-B and has been shown to

lower the alveolar surface tension at the air-fluid interface. We compared the functions of SP-B's two functional units, its carboxyl-terminus and amino-terminus, with KL_4 by individually studying the proteins' interactions in a liposomal environment. Specifically, we studied how the peptides mediated membrane fusion of liposomes by observing the FRET phenomenon when the two probes NBD-PE and Rhodamine-PE were in close proximity. This allowed us to see how SP-B amino and carboxyl terminal peptides and KL_4 interact with surface lipids and, therefore, lower surface tension. Through this study, SP-B's complex function can be further elucidated.

Quantification of Xylitol and Sorbitol Content in Toothpaste by HPLC

Emily Leahy

Dr. Otonye Braide-Moncoeur

Xylitol and sorbitol are used in toothpastes for flavor and as a humectant, to retain water and maintain texture. The carcinogenic bacteria that result in dental caries feed on sorbitol but cannot digest xylitol. The aim of the study was to quantify the amount of xylitol and sorbitol in different toothpastes to determine which toothpastes has the highest content of xylitol by high-performance liquid chromatography coupled with a UV-Vis detector. A calibration curve was constructed using known concentrations of each of the compounds of interest. The absorbance was measured at the detector at a wavelength of 190 nm.

Gender Wage Differences, Intersectionality with Race

Shinae Lee, Fengdan (Maggie) Qiu

Dr. Mike Veatch

The United States Census Bureau, Department of Labor, and Bureau of Labor Statistics provide historical data on income and demographic information based on a population sample of around 60,000 households all over the country. This project seeks to investigate any statistically significant differences in median weekly and annual income, focusing on two specific factors: gender and racial background. Various methods can test if the independent variables, gender and race, have anything to do with one's income, the dependent variable; the control variable will be educational attainment. We will test if gender influences income, if race influences income and then test for any interaction between gender and race on income

A Comparison of Methods for Making Competent E.coli for Transformation

EunSeo Maeng (Anna), Lais Giulia Marcolan Sant'Anna

Dr. Craig Story

Escherichia coli has been used as a host organism to study DNA, often in the form of plasmids, which are small circular DNA elements containing several genes. Transformation of plasmid DNA into chemically manipulated *E. coli* using a brief heat shock has been widely used since it gives a high transformation efficiency. We compared the transformation efficiency of several different methods. These included NEB 5-alpha competent cells (New England Biolabs C2987), homemade chemically competent cells, and another method known as TSS (Transformation & Storage Solution). A wide range of concentrations of the plasmid pBR322 was used so that the transformation efficiency could be accurately assessed. The number of colonies and transformation efficiencies were calculated for each method. A secondary purpose of this study is to validate a method for assessing new batches of chemically competent *E. coli* in the future.

Review of Molecular Operating Environment (MOE): A Tool for Protein and Antibody Modeling

Madison Morin, Abigail Werner, Mikala Silvestri

Dr. Michael Paul

Molecular Operating Environment (MOE) is a computational software program released in 2001 by the Chemical Computing Group (CCG). Since its release, computational chemistry has seen dramatic developments in the ability of researchers to test and study the actions and behaviors of molecules. The purpose of this review is to explore the role of MOE in computational chemistry, to discover unique benefits of using computer based programming to study the behavior of certain proteins or other molecules, and how to apply the capabilities of MOE to current research being done. Specifically, MOE has advanced the field of homology modeling by providing a 3D visualizing platform to predict the structure of proteins. The protein and antibody modeling program's applications include the exploration and understanding of protein folding and continue into the field of protein-ligand docking. Both advanced and occasional users, through recognition of the parameters of MOE technology, are able to determine relevant, appropriate, implementations of research. Recognizing the advantages and limitations that arise when using the software allows users to analyze the accuracy and reliability of computer-generated results. This review will explore how MOE is currently used in research and the implications it has for the future of computational chemistry.

Remote Respiratory Allergen Challenge Increases the Frequency of Small Intestinal Eosinophils in Allergen-Sensitized Mice

Courtney Olbrich, Grace Peppler, Gabrielle Capone, Victor Sanchez, Evangeline Kim, Micaiah Bushnell

Dr. Evangeline Cornwell

Accumulated data suggest that allergic sensitization predisposes susceptible individuals for the development of eosinophilic GI diseases; GI allergic manifestations are observed in asthmatic, allergic rhinitis, and atopic patients, EoE patients exhibit higher rates of aeroallergen sensitization than the general population, and several clinical studies directly implicate aeroallergens in the pathogenesis of EoE. These findings suggest susceptibility to intestinal allergic inflammation may be enhanced by allergen exposure of the skin or respiratory mucosa. However, the interplay between allergen exposure to the skin or respiratory tract and remote eosinophilic GI inflammation remains enigmatic. Endotracheal administration of allergen to naïve or allergen-sensitized mice was used to provide allergen exposure to the respiratory mucosa while avoiding direct allergen exposure of the GI tract inherent in standard models of airway allergen challenges (i.e. intranasal inhalation or aerosolization). Eosinophilic inflammation was assessed in allergen-challenged mice through complementary approaches, including researcher-blinded counts of histological sections and flow cytometry analyses of disaggregated intestinal tissues. Remote allergen challenge increased the frequencies of eosinophils associated with both lamina propria and intraepithelial compartments of the small intestines of allergen-sensitized mice. In contrast, percentages of intestinal $CD4^+$, $CD8^+$, and $CD11c^+SiglecF^-$ (dendritic) cells remained static following remote (pulmonary) allergen challenge. Remote respiratory allergen exposure increases the frequency of small intestinal eosinophils in systemically allergen-sensitized mice. These data may shed light on the relationship between aeroallergens and eosinophilic gastrointestinal inflammation.

The Role of Notch 2 Receptor Signaling During Eosinophil Activation in a House Dust Mite Model of Inflammatory Asthma

Courtney Olbrich

Dr. Evangeline Cornwell

Cytokines such as granulocyte-macrophage colony stimulating factor (GM-CSF) are known to trigger the accumulation of eosinophils during inflammatory asthma. However, the mechanism of activation triggered by inflammatory cytokines is not well understood. The Notch 1 receptor on eosinophils has been implicated *in vitro* in granulocyte-macrophage colony stimulating factor (GM-CSF)-induced eosinophil migration using human eosinophils and *in vivo* in a mouse model of inflammatory asthma using an anti-Notch antibody (Liu et al. 2015). In order to study the role of the Notch 2 receptor in membrane signaling exclusively in eosinophils, we created a double-mutant knockout mouse with Notch 2 receptor expression ablated only in cells fully committed to the eosinophil lineage. We then characterized the eosinophil-specific Notch 2 knockout mouse in a house dust mite model of inflammatory asthma. Leukocytes were

extracted from wild-type and knockout mice from multiple compartments, including bone marrow, blood, and bronchoalveolar lavage fluid. Eosinophils were quantified by cell surface markers during fluorescence-activated cell sorting and by differential cell counts on H&E stained slides. Deletion of Notch 2 on eosinophils resulted in a decreased percentage of eosinophils in bone marrow and systemic blood, but not in bronchoalveolar lavage fluid (BAL). These data suggest that Notch 2 signaling may be important for migration of eosinophils in bone marrow and blood, but that other signaling pathways may be activated in the HDM model of mouse inflammatory asthma.

Monitoring FRET Due to the Crowding of Fluorescently-Tagged Liposomes

Amanda Page, Isabella Maida, Travis Singh

Dr. Otonye Braide-Moncoeur

Lung Surfactant is a protein-lipid film that lowers the tension at the alveolar surface. This enables the alveoli to expand during inhalation. It is suspected that surfactant protein B lowers tension by trafficking lipids to the alveolar surface during expansion. The membrane fusion of liposomes was used to measure the lipid trafficking abilities of SP-B. To measure membrane fusion, untagged and fluorescently-tagged liposomes were prepared. The tagged liposomes contained the FRET pairs, Rhodamine-PE and NBD-PE. These were combined with untagged liposomes to measure a decrease of FRET as the rate of membrane fusion increased. In order to establish a control for these studies, we measured the crowding of tagged liposomes, and how FRET occurs between the liposomes at high concentrations of lipids. Five different lipid concentrations ranging between 15 nanomolar and 70 nanomolar was tested. It is expected that 60 nanomolar is the minimal concentration needed to see FRET.

Ethanol Toxicity in Slo-1 Mutant and Wild-Type C. Elegans

Youngeun Park, Narah Kum, EunSeo Maeng, Lais Giulia Marcolan Sant'Anna

Dr. Evangline Cornwell

Caenorhabditis elegans is useful as a model organism for understanding the human neurological response to alcohol because many shared genes have been identified, including those that regulate the ethanol response. Alcohol abuse is estimated to affect more than three million individuals in the United States and its impacts are very significant in the current society. Ethanol is known to decrease the amount of body-bend during locomotion in wild-type *C. elegans.* Since *C. elegans* with mutations in *slo-1* gene have shown to exhibit strong resistance to ethanol, the two mutant strains of *slo-1* gene were tested to examine dose-dependent effect of ethanol on the wild-type, JPS428, and BZ142. In the previous research,

JPS428 showed resistance to the effects of ethanol on egg-laying and locomotion while BZ142 represented resistance to ethanol on locomotion, especially head-bending. We performed an ethanol dose response test over a range of concentration from 0µM to 450µM on two different mutant strains of *C. elegans*, JPS428 and BZ142. We compared their behavioral responses to the wild-type by measuring head bending locomotion. We expected that the wild-type would exhibit decreased locomotion in a dose-dependent manner, but mutants for JPS428 and BZ142, decreased locomotion would be predicted to occur than the wild-type at a significantly higher concentration. A better understanding of the genes that regulate behavioral response to ethanol could lead to better treatments for alcohol addiction and the intoxication response.

Computational Studies of O2 Binding and Activation Energy of O2 Dissociation Over Nanoparticles

Anne-Milda Pu

Dr. Mike Paul

In light of concerns over a limited supply of fossil fuels and climate change associated with burning such fuels, emphasis has been placed on the research of sustainable and economically advantageous forms of energy. Of particular interest is the Proton-exchange membrane fuel cell (PEMFC), which generates electricity without producing harmful greenhouse gases. However, the limited commercial use of fuel cells is due to poor kinetics of the reduction of the O2 molecule (the oxygen reduction reaction, ORR) even on expensive catalysts such as platinum. The focus of this work is to gather information regarding trends in activation energy and O–O bond length on a variety of 55-atom core@shell molecules, M13@Pt42 (where M is a number of Period 4-6 transition metals), with the use of computational molecular modeling. We have found that O2 bound to the central Pt atom and a corner site on the (111) surface with a Ni or Co core produces a favorable activation energy plot with activation energies less than that of Pt. Future work involves broadening the core metals with particular attention to Period 9-11 metals.

Modeling of Heat Flow During Quartz Tube Quenching of Bulk Metallic Glass Alloys

Mark Rainey

Dr. David Lee, Dr. Jonathan Senning

Bulk metallic glasses (BMG) are a relatively new class of metals which are non-crystalline (the atoms exhibit no long range order). This amorphous structure translates to interesting mechanical properties. A metallic glass can be formed by removing thermal energy from the melt rapidly enough to prevent

crystallization – a process known as “rapid quenching”. The BMG alloy is inductively melted under UHP Argon in a quartz tube then submerged quickly into water. We have constructed a computer model of this quenching process, coded in MATLAB, to solve the two-dimensional heat flow equation with conduction and radiation. The code utilizes finite difference method (FDM) and alternating direction implicit method (ADI) to achieve speed and stability. From this simulation, we can quantify the cooling rates achieved at different locations in the sample and for different sample diameters and quartz tube thicknesses. Results from our simulation will eventually be compared to experimental data taken during rapid quenching of a Ni-based bulk metallic glass to determine critical cooling rates for glass formation in these alloys.

Using Less Solvent for a Greener Frieden–Crafts Reaction

Kyra Skurcenski, Julia Bonney, Monet Marshall

Irv Levy

The Friedel-Crafts acylation is a significant part of undergraduate organic chemistry, however due to the catalyst $AlCl_3$ being toxic to the environment, and used in large amounts, the reaction is not green and causes many undergraduate programs to not perform the reaction. Previous research shows that using a deep eutectic solvent as a greener alternative for the catalyst will successfully synthesize the desired product. We are looking to see if using 50% less solvent will still yield the same results. If there is no significant difference in the amount of product synthesized, then this would result in a procedure that uses less waste, and is therefore greener.

Time-Resolved Laser Induced Breakdown Spectroscopy of Ti_1-x Cr_x Alloys

James St. Julien

Dr. David Lee, Dr. Tout Wang

Laser Induced Breakdown Spectroscopy (LIBS) is a technique used for elemental composition analysis. A high irradiance laser pulse ablates the material, causing its surface to ionize and become a plasma. The atomic line emissions from the plasma can then be analyzed spectroscopically to determine the sample’s elemental composition. We improved & upgraded our LIBS system to include time-resolved capabilities, higher resolution fiber optic spectrometers and a higher quality, more powerful beam. The laser was upgraded by replacing its Pockel Cell & tuning the laser cavity mirrors for maximum pulse energy, resulting in ~540 mJ per pulse at 1064 nm. We demonstrate the effectiveness of our upgraded system by performing time-resolved LIBS on a series of $Ti_{1-x}Cr_x$ alloys.

Analysis of Diphenylamine Residue on Apples by Gas Chromatography Mass Spectrometry

Jade Stern

After harvesting, apples tend to brown and produce discoloration on the peels. To prevent this scald while being stored, apples are usually treated with a growth regulator in order to slow the discoloration of the skin. Most apples found in a supermarket contain diphenylamine (DPA), a common pesticide to prevent the scalding of apples. DPA is applied post-harvest through methods such as spraying, drenching, or dipping. Banned in Europe in 2012 because of lack of evidence for the safety of the chemical, this pesticide is acutely toxic and may have the potential to break down into carcinogens. According to the Environmental Protection Agency, the maximum concentration limit of DPA on apples is 10 ppm. Organic crops are said to not use more than 5% synthetic or manmade chemicals, meaning that organic pesticides, are primarily used. Using gas chromatography mass spectrometry, the concentrations of diphenylamine in both organic and non-organic apples, sourced from a local supermarket, will be compared. The purpose of this study is to establish evidence that organic apples contain more than the maximum limit of diphenylamine.

Validation of Critical Power Determination Using a 3-min All-Out Cycling Test

Addison Tarr, Taylor Chechowitz

Dr. Peter Iltis

Validation of Critical Power Determination Using a 3-min All-out Cycling Test. **Purpose:** To test whether a more efficient method of determining critical power is feasible as compared to the standard method of determining critical power. This is to cut down the number of trials and laboratory visits for future studies involving muscular fatigue as it relates to critical power. **Methods:** Five subjects, three of which are accustomed to cycling, and two athletes without a large amount of experience with regards to cycling, will carry out seven tests. These will include an incremental test, two all-out 3-min tests with a fixed resistance to find the end power (EP) and the work above end power (WEP), and four tests at a fixed work rate to determine the critical power (CP) and curvature constant parameter (W') using the regression work-time and 1/time models. **Key Words:** Gas Exchange Threshold, VO2peak, V-slope method, VCO2.

Correlation of Salary and Success in Baseball

Jessica Wild, Brynn Grambow

Dr. Michael Veatch

Professional baseball players tend to earn astonishingly high salaries, the justification for which is that highly payed players translate to better results on the field. While this certainly appeals to common sense, our research project aims to test the validity of this claim using statistical analysis to determine whether data from the 1986 season shows a statistically significant link between players' salary and their runs, home runs, and runs batted in. Using a random sample from all the major league players active in 1986, we examine how these significant individual statistics affected the players' average salaries, information that provides insight into how effectively salary predicts performance.

Mechanical Properties of Investment Cast Si-Bronze from 3-D Printed PLA Models

Donald Ethan Williams

Dr. David Lee

Investment casting is a process whereby a model is reproduced as a metallic object by pouring molting metal into a ceramic shell that is formed around the sacrificial wax model. A modernized version of this casting technique uses a 3-d filament printer to create the sacrificial model from polylactic acid (PLA) for casting. Standardized test models of varying thicknesses will be printed and cast, and their tensile strength, bend modulus and hardness will be measured and compared to results published in literature. Casting will be done using silicon bronze (Si-Bronze) and microstructure and properties will be correlated to process parameters, such as mold temperature, casting temperature and weight percent silicon.

Differential Scanning Calorimeter

Haonan Yan

Dr. David Lee

A Differential Scanning Calorimeter (DSC) is a device that measures the thermal properties of a material by measuring the difference in energy absorbed between a sample and a reference while heating them simultaneously in a manner to maintain them at the same temperature. We have designed and constructed a power-compensation DSC that uses a low noise instrumentation amplifier for thermocouple signal acquisition and pulse-width modulation through a solid-state relay to control sample heating. The PID control program is written in MATLAB and uses a National Instruments USB-6211 data acquisition box for experiment control. The DSC is able to measure thermal properties of gram sized samples up to 250.

GORDON
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Poster Entries

Social Sciences, Behavioral Sciences, and Education

Listed in alphabetical order by lead author's last name

Personal Intelligence, Emotional Intelligence, and General Intelligence: A Correlational Study

Rachel Allison, Stephanie Nicholson, Abby Curry, Alexandra Heinle

Dr. Jonathan Gerber

This study used John Mayer's theory of *personal intelligence,* or the capacity to reason about personality and to use personality and personal information to enhance one's thoughts, plans, and life experience, in order to empirically gauge how well our subjects can reason about the personality of others. During our research, we asked undergraduate students of Gordon College to take the series of tests to measure a vast array of intelligences. In pairs, participants completed The Relationship Closeness Induction Task followed by a series of intelligence tests. This study attempts to answer the question: if someone has strong personal intelligence scores, are the able to accurately predict their partner's personality?

Does Bias Cause Objectification?

Rachel Burgett, Kara Doughtie, Danielle Driscoll

Dr. Jonathan Gerber

It is well known that there is a severe stigma attached to mental illness. Previous research has not only revealed this stigma, but it has also shown that being objectified by others can lead to developing a mental illness. We wanted to test if the reverse is also true; does the stigma surrounding mental illness cause people to be objectified? We primed three groups of people to associate mental illness with positivity, negativity, or neither. We then measured their objectification of several fictional people with different conditions of mental health. Although our research is not yet complete, we believe that the results will show that the stigmatization of mental illnesses leads to the objectification of individuals with these mental illnesses. We are hoping that this research will help people re-examine how they view and interact with people with mental illnesses.

The Influence of Exercise on Stress, Anxiety and Depression

Victoria Caswell, Chrisopher Vangel, Johnny Barrera

Dr. Kaye Cook, Dr. Susan Bobb

A large amount of stress, anxiety, and depression was expected to be introduced as people start to attend college, while our proposed research was designed to address the potential lack of knowledge the general population may have on the benefits of exercising on mental health (including its potential positive benefits regarding stress, anxiety and depression undergrad college students). Our focus was to observe the effect of exercise on stress, anxiety and depression (by means of survey), and how it may possibly bring a relief to the subjects in regards to their mental health. Participants were 34 Gordon College

undergrads. Participating students were measured using Depression, Anxiety and Stress Scale (DASS), Student Stress Survey to assess their current mental health and the International Physical Activity Scale (IPAQ) to access their physical activity. The proposed research will have granted a lens to those not sure how exercise influenced their mental well-being. Results should support our hypothesis, that exercise supports a better mental health.

How Unique is Your Sense of What Is Attractive?: Exploring Individual Differences in Perception

Sabrina Chueh, Stephanie Boettiger, Jacques Erasmus

Dr. Jonathan Gerber, Dr. Susan Bobb

Past researchers have found that attractiveness is measured by familiarity (Halberstadt & Zeelenberg, 2013), by what is culturally good (Wheeler, 1997), and by what constitutes as mate value (Eastwick & Hunt, 2014). This study broadens the understanding of attractiveness by incorporating David's Kenny's Social Relations Model to explore the individuality in liking and how perception of one's own attractiveness change our perception of others' attractiveness. Our experiment is designed to measure dyadic reciprocities and in a repeated measures design to account for error variance in the likings of individuals. In Study 1, participants were asked to rate 20 faces from a database on an attractiveness scale of 1-7 repeating the procedure twice. In Study 2, participants received a mean score of their own attractiveness ranging from low, medium, and high, and were asked to rate the 20 faces a third time while being told that the received scores were from the faces they had previously rated. Results showed an interaction between the participants' rating of others based on attractiveness and their knowledge of how others have rated their attractiveness.

Examination of Tired Personality

Jenna Crosbie, Annalia Jordan, Brooke Dyson

Dr. Jonothan Gerber

Altered states change our consciousness but can they change our personality? Previous research has suggested that personality changes when drunk (An Experimental Investigation of Drunk Personality Using Self and Observer Reports). We extended this study to investigate whether personalities changed when becoming slightly overtired. To test this theory, 4 subjects completed a series of activities from the hours of 10pm until 2am. Self-rating of personality were taken at three time points, and thin-slices of behavior were also taken at three time points. These thin-slice videos were blind-rated afterwards. Results will be discussed.

Contexts of Forgiveness: Campus, Churches, and the Common

Carter Crossett, Adila de Souza

Dr. Kaye Cook, Dr. Grace Chiou

While some suggest recent modernist and globalist trends have homogenized values, research shows that people hold values distinct to culture, religion, and society. In the greater Boston area, we led discussions with groups of various cultures, ethnicities, and religious backgrounds to explore the values of forgiveness and suffering through use of surveys, media clips, and analysis of interviews. We concluded that one's tendency to forgive is associated with relationships with parents and others, as well as with the quality of one's faith. Brazilians are more likely than others to understand that forgiveness is a duty, a frame that is potentially more effective than choice. Forgiveness in particular, while difficult to realize, is commonly seen as both a civic and communal responsibility which benefits both giver and receiver. We use our findings to encourage individuals to be aware of the moral dimensions of their efforts.

Dark Triad Traits and Religion

Karollaynne Da Costa, Erin Marsh, Julia Bombassei

Dr. Jonathan Gerber, Dr. Susan Bobb

The world is filled with different personalities and different religious that tends to connect and demonstrate ultimate relationships. We have decided to test this relationship by performing a correlation study that explains and illustrates how these two subjects work together to become one. We are using the Dark Triad personality traits and test and relate that to religiosity and other personality variables from the darker side of evangelicalism. We want to know the amount of Dark Triad traits among our Christian campus. As well as to find out if our beliefs have an influence on religion and how that eventually interacts with behavior. Our study is based on a survey questionnaire in which we ask personal opinion based questions. We took our questions from the Joanson Skill, Social Dominance Orientation Scale, World Skill, and the Peter Hill religiosity skill. Our projects combine questions from all of these scales to test the ultimate personality traits in combination with religion. Ultimately, our study is planned to overlook specific religions but rather focus in religiosity as a whole concept. Faith makes us all tend to justify certain attitudes, and being able to see an individual's personality, can help us identify which dark personality traits can influence religion and behavior.

Influences of Security on Insecure People?

Khadijah Rose Desanges, Ashley Cordero, Sarah Ann Noyes, Caleb Chang

Dr. Susan Bobb, Dr. Jonathan Gerber

In our everyday lives we meet two different kinds of people, those who are secure in themselves and those who are insecure. Everyone in their lifetime will eventually engage with both types of people. Our study aimed to see if people who are secure can help those who are insecure feel more secure in themselves. We tested this by having students take a survey and pairing them up with a person of the opposite security type. They were then asked to play a cooperative computer game, and, afterwards, take another survey compared to the first to see if security levels of insecure individuals changed. We hypothesized that a participant who entered the study with a low level of emotional security, who was placed with a participant with a high level of emotional security, would leave the study with a relatively higher level of emotional security.

Facebook Versus Instagram: A Comparison of Effects on Self-Esteem

Rebekah Dostie, Lauren Edwards, Christina Fallone, Amanda Snyder

Dr. Susan Bobb

Much research has been dedicated to the effect of Facebook on self-esteem. Following the rise in popularity of Instagram, this study looked to compare the effects of Instagram on self-esteem to those of Facebook. Our study was designed to address whether Instagram has a more significant effect on self-esteem. A sample of 36 college students participated; they filled out a pre-survey asking demographics questions and social media use tendencies. Then participants logged onto one of the media platforms and took the Rosenberg self-esteem scale. This procedure was repeated on a second day with the alternate social media account. We hypothesized that our results would show a statistically significant, larger effect of Instagram on self-esteem compared to Facebook. For future implications, our research will help lead the movement towards greater awareness of the negative effects social media can have on self-esteem.

Reducing Student Chatter through Behavioral Bingo

Holly Gershman

Dr. Ellen Ballock

This inquiry examined the effects of a positive reinforcement system on the levels of idle chatter in a general education classroom and sought to answer the following question: "How does Behavioral Bingo affect students' verbal contributions in class-wide or small-group discussions?" The participants included 18 third graders. While interactions and conversations between students enhance learning and promote social and emotional growth, excessive chatter proves disruptive by negatively impacting the flow of learning, requiring more time to cover academic content, and raising the noise level at inappropriate times. Excessive chatter may look like a student interrupting another student, commenting or answering without raising his or her hand, sharing information or personal remarks without provocation, or talking of unrelated topics during independent work. Sources of data included event-recording charts, an observer's journal, and student questionnaires. Overall, the Behavioral Bingo strategy reduced levels of trivial chatter and increased appropriate participation and student engagement.

Projecting Jesus's Personality

Natalie Hoey, Erin Duffy

Dr. Jonathan Gerber

It has long been asserted by various philosophers and psychologists that Christians project themselves onto Jesus' personality. Freud suggested that God is a projection of the qualities we do not wish to acknowledge in ourselves. Feuerbach, on the other hand, suggested that God is the projection of characteristics common to the human species. Most modern atheist apologists use the God-as-anthropometry argument which suggests God is shaped into each of us. These contradictory accounts raise the question of the extent to which Christians project onto Jesus in a unique way compared to other historical figures. To answer this question, the present study used data from a survey completed by 13 undergraduate students to measure social projection toward Jesus and four other historical figures. If Jesus is treated uniquely, then we expected him to be an outlier when the effects of in-group status and positivity were taken into account. If Jesus was treated in accordance with the general laws of projection, we expected his correlations to be in line with the positivity and in-groupness he receives. The results of this study found correlations between projection and valence (positivity/negativity of perception), projection and similarity, and projection and in-group/out-group status to be significant at the 0.01 level. This data then suggests that all three factors play into our projection onto Jesus and the other historical figures.

The Need to Belong and Personality Switching Between Bilinguals

Yeonjae Jang, JinHee Kim, Makayla Noyes, Maggie Qiu

Dr. Susan Bobb

It is a common phenomena among bilingual speakers to experience a sense of personality change when speaking their first and second language. Research on this topic is still at a fairly young stage, and while studies have found results that fit the claim of personality change, there have not been many studies pertaining to people of other languages or backgrounds. For this partial replication study, we chose to observe Korean English bilinguals, as they have not yet been included as subjects for this research. In the current study, monolingual and bilingual participants took a personality assessment called TIPI. We then observed interactions between bilinguals and monolinguals as they participated in a get to know you activity, in order to assess the validity of the previous findings on language and personality. The results concluded that there was a significant personality change observed in the bilingual participants.

Reducing Blurting Through Increasing Self-Awareness and Goal-Setting

Courtney Lacson

Dr. Ellen Ballock

This project investigated how utilizing class goal-setting and increasing self-awareness through a “Blurt Box” could reduce the amount that students blurt out in the classroom focusing on the key question: How can blurting out be reduced through the implementation of use of self-regulation strategies and class goal setting? Blurting is when a student speaks without raising their hand to be called on, or speaks before they are called on. Blurting can have negative effects on the students and teacher in a classroom causing frustrations and chaos in the classroom. The study consisted of a class of 18 third graders. Students were given a pre- and post-survey on blurting and their experience with the “Blurt Box”. Data was collected through event-style recording and findings showed that the “Blurt Box” helped to reduce blurting in the classroom and generally made students more aware of how much they blurt out. d

More Runs and Fewer Strokes: Do They Expand Time?

Larissa Lemes, Emily Lundberg, Danielle McGibbon, Julissa Rodriguez

Dr. Bert Hodges

A common finding in time perception studies of short time durations (< 5 sec.) is a *magnitude effect*: Larger, heavier, faster, brighter, and louder objects or events are perceived as lasting longer. One version of this effect involves numbers: larger numbers seem to last longer (e.g., 8 > 3). Why this occurs is not

known. One possibility is that prior research has used numbers in contexts that are somewhat negative (e.g., the numbers referred to heavier weights to be lifted). We created two sports contexts, baseball and golf, in which larger numbers had either positive or negative meaning: More runs in baseball is good, more strokes in golf is bad. Seventy-two participants reproduced times of the digits 1-9 in one of these two contexts. Magnitude effects were not observed in either context. This supports other work that magnitude effects are not automatic but depend on contextual constraints that give meaning to the magnitudes. However, there was some evidence that many participants may not have had enough knowledge of the two sports to engage the task adequately.

Multiculturalism May Minimize Mental Health Mindfulness

Emily Lundberg, Sarah Karamba Uwandori

Dr. Jonathan Gerber

Mental Health among college students has been an issue in recent years. Studies have been done to look at the potential causes of failure to seek mental health treatment in college students. However, few look at multiple factors at once. In this study, we examined whether student status (International or Domestic) influences their attitudes towards treatment-seeking and how other factors (stigma, collectivism, mental health literacy, and general help seeking tendencies) may influence this relationship. We surveyed 100 students from Gordon College. Though previous findings have indicated that multicultural students were less likely to receive mental health treatment, we found that there was no significant difference between mental health help seeking tendencies in our sample between international and domestic students. We also found there was no significant difference between student status and mental health seeking tendencies when adding in the tested factors.

The Use of Foreign-Directed Speech During a Cooperative Game

Kristin Mello

Dr. Susan Bobb, Dr. Kathrin Rothermich (East Carolina University)

The Communication Accommodation Theory (CAT) states that people adjust the way that they talk in terms of vocalization, articulation, and vocabulary based on the perceived comprehension level of their interlocutors (Ryan, Hamilton, & See, 1994). One such speech change is foreign-directed speech (FDS), directed toward second-language (L2) learners (Scarborough, Brenier, Zhao, Hall-Lew, & Dmitrieva, 2007; Knoll et al., 2006; Biersack, Kempe, & Knapton, 2005). This two-condition study evaluates the existence

of FDS in a naturalistic setting. Participants played a cooperative computer game in which one participant instructed the other on how to disarm a fictitious bomb. The study consisted of native-native and native-nonnative conditions. Participants completed the State-Trait Anxiety Inventory before and after the game, as well as a variety of questionnaires and tests to control for personality, language background, and stereotyping. The interaction was audio and video recorded, and the instructor's voice was analyzed to determine whether FDS occurred toward the non-native L2 Korean vs. toward the native L1 English interlocutors. In addition to analyzing acoustic and linguistic speech elements on mean pitch, speech rate, vowel length, word frequency, and F1 and F2 extractions, the researchers analyzed data on instructor stereotyping and on interlocutor anxiety shifts.

L2 English Learners' Biological Responses to Casual and Foreign-Directed Speech

Kristin Mello, Emily Turco

Dr. Susan Bobb, Dr. Kathrin Rothermich (East Carolina University)

It is known that people accommodate their speech to those who they are talking to. Foreign-directed speech (FDS) is a speech type that is used when talking to those who are perceived to not have the same native language as the speaker (Hazan, Uther, & Granlund, 2015). This study looks at the physiological and behavioral effects of FDS on a second language (L2) learner of English. In order to observe theses effects, each participant listened to a book being read in either casual speech (Condition 1) or FDS (Condition 2) while connected to a Biopac MP35 amplifier collecting EEG data from the midline of the brain (Cz). Participants also completed the State-Trait Anxiety Inventory before and after listening to the speech sample. The EEG data yielded insignificant results when looking at the mean of the standard deviation of the alpha wave's amplitudes. Though statistically insignificant, the higher standard deviation in the alpha waves in Condition 1 (casual) trends toward confirming the hypothesis. The behavioral data from the State-Trait Anxiety Inventory yielded significant results for Condition 2 (FDS), showing that L2 English learners have less anxiety after listening to FDS.

Personality and Video Games

Hailey Moore, Kaylee Seward, Nathan McReynolds

Dr. Jonathon Gerber

Given the popularity of video games and the introduction of mobile phone apps, Moore, Seward, and McReynolds examined the correlation between players' and non-players' personality and their video game preferences using cluster analysis. Surveys were completed by 234 Gordon College students, with 230 viable for data analysis. This study was loosely based on a previous study which found personality differences between online game players and non-players (Teng, 2008). We hoped to provide a more detailed comparison of people with a wider range of video game preferences, including addiction, social factors, and gaming preferences.

Exercise and Learning

Natalie Moretto, Amanda Quintana, Abigail Bacon

Dr. Susan Bobb

Past research has shown that vigorous exercise before and after recalling vocabulary improves memorization of vocabulary. In the present research, college students (n=21) from Gordon College were tested based off the question of which condition is best in terms of memorizing English vocabulary words. The students were observed and tested in three conditions, which were sitting, walking and speed walking. The testing was done on a treadmill at the campus gymnasium. Participants studied one list with ten words each during every condition for six minutes in each condition. The lists were randomized as well as the order of the lists to counterbalance our results. Participants were told to meet with the researcher again in exactly seven days for a brief follow up recall test. The hypothesis for this study is that walking is the best condition for memorizing English vocabulary words.

Testing Impact of Transgression Size and Relational Status on Ability to Forgive

Liliana Paez, Molly O'Loughlin, Jessica Fox, Erika Rodriguez

Dr. Susan Bobb

Forgiveness between two people is often a difficult and confusing process. The focus of the study was to better understand the qualities of human nature within the context of forgiveness in different situations. Participants were selected from a random sample of college students at Gordon College. The study was a between-subjects design in which participants took a survey with different scenario questions asking about transgressions that occurred within both close and distant relationships. We created two surveys to counterbalance one another: each survey had identical scenario questions, only differing in the relationship of the participant to the transgressor in the scenario. Participants determined severity of transgression and likelihood they would grant forgiveness for each situation presented. This design allowed us to analyze the interaction between the nature of a relationship, perceived size of transgression, and the likelihood of forgiveness.

On Being Careful and Caring in Carrying

Julissa Rodriguez, Rachel Allison, Zita Nagel, Erika Fernandez, Sam McGuire, Larissa Lemes

Dr. Bert Hodges, Dr. Jessica Ventura

What is carefulness? Parents performed a series of stepping tasks across uneven terrain while carrying groceries, water, and their child. In the first experiment, we are analyzing stepping patterns in terms of time and force. In the second experiment, films of the walker's kinematic patterns were rated for

carefulness. We expect that physical, social, and moral dynamics will affect kinematic patterns and perceived carefulness.

Justice, Forgiveness, and Reconciliation

Saliha Shelton, Garrett Benzing, Sophie Clayton, Walker Tuttle

Dr. Susan Bobb

This research is designed to measure the effects of forgiveness and justice in addition to forgiveness on the likelihood of reconciliation. Our measurement system in regard to victim and offender relations in the context of forgiveness and justice will help determine what aspects plays a role in reconciliation. Participants will be 38 Gordon College students ranging from first year students to graduating seniors. The participants will be primed for Forgiveness then we propose participant with different scenarios to measure their reconciliation level where the participants imagine the offender is someone who is close to them. The participant will rate their likelihood of reconciling with offender. Then we will repeat the same task for Justice and again the participant will be primed then rate their likelihood of reconciling with offender based on given scenarios. The research will help us understand deeper how we can come about reconciliation in close relationship.

Phonological Rules and Grammatical Gender Processing in 30-Month-Olds

Mason Strawderman

Dr. Susan Bobb

This study looks at the effects of phonological rules on grammatical gender processing. Previous research has shown that infants rely on the phonological realization of gender in Spanish during word processing. For instance, feminine words in Spanish typically
end in '-a' ('la pelota'). When faced with two objects, one masculine, one feminine, upon hearing 'la', the child can already orient to the correct object. This study looks at this effect in German, which has less transparent phonological gender rules. 30-month-old
infants were presented with two stimuli at once, whose grouping matched one of four categories where items either matched or mismatched in gender or phonological rules. The results of this study did not replicate the findings of Lew-Williams and Fernald (2007)
and suggest instead that a less transparent gender system does not lend itself to being predictive.

Binocular Rivalry and Personality Replication Study

Jamie Tafoya, Renee Cooprider, Carter Crossett, Kari Lownes

Dr. Jonathan Gerber

This research project investigated if the personality traits that a person possesses impacts their visual experience. Specifically, this research focuses on binocular rivalry and the amount of time participants experienced mixed percept. To collect data for this, a sample of 5 Gordon College students completed a personality test as well as recorded their results in a binocular rivalry test. The personality questionnaire consisted of 2 different tests; the Big Five and the Dark Triad. In between taking these two tests, participants used binocular rivalry equipment and recorded the amount of time they saw each individual stimuli as well as when they saw both at the same time; or mixed percept. The results of both binocular rivalry and the personality tests were recorded and will be analyzed to determine any correlations.

Conversation in a Middle School Math Classroom and its Effects on Student Confidence and Comprehension

Angela Wickett

Dr. Janis Flint-Ferguson

This paper describes a study done on 8th grade middle school students, which involved rough draft talk and daily journaling. The focus question for this study was to see if conversation, both orally and in writing, in a middle school math classroom increases student confidence in their own mathematical ability. Rough draft talk was implemented during all lessons and a journal entry responding to a prompt about either the material taught in class or personal feelings was given each day. Students rated their level of confidence each day in their journals and completed the same survey at the beginning and end of the study. Two focus students were identified, one with high confidence and one with low confidence. They were asked a series of interview question at the beginning, middle, and end of the study. After the data was analyzed, the answer to the focus question was inconclusive. However, a trend was discovered between students with low academic ability and the positive outlook towards group work while students with high academic ability had an overall negative outlook on group work. Further investigation into what affects student confidence will help determine a conclusion of the focus question.

Implementation of Vision Posters to Increase Student Self Regulation

Sarah Williams

Dr. Ellen Ballock, Dr. Mindy Eichhorn

This study investigated the impact that vision posters would have on student self-motivation. The study took place in an urban classroom with 27 3rd graders in Revere, Massachusetts. To assess the effects of the posters, different strategies/systems were introduced that aligned with the behaviors the students identified that they would like to work on. Over the course of the three weeks where the strategies and systems were introduced and used, there was a self-recognizable decrease in the behaviors that had been previously identified as problematic. The students adapted an attitude of being responsible for their behaviors which resulted in them being more self-motivated to correct themselves. While it is hard to measure student-motivation due to it being an abstract qualitative attribute- the reflections of the students and decrease of identified behaviors indicate that the vision charts introduced assisted in increasing student self-motivation and therefore are continued to be used.

Physical Activity and Quality of Life in College Students

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Dr. Jonathan Gerber

We examine how trait level and daily fluctuations in physical activity influence trait level and daily life satisfaction. Previously, an effect has been shown in longitudinal studies where daily physical activity influences daily life satisfaction. However, whether trait level physical activity influences trait level life satisfaction conflicts in past research. Single surveys show a correlation, while cross-sectional analysis of daily diary surveys do not. Our experiment involved 20 student participants from Gordon college, both male and female, ranging from their freshman through senior years. We conducted a single (initial) survey and a set of daily diary surveys, while controlling for the same set of mediating variables in both. In the single survey, physical activity and life satisfaction were not significantly correlated with each other. In the daily diary surveys, daily physical activity and daily life satisfaction were very significantly correlated, and trait levels of physical activity and life satisfaction from daily diaries data showed a smaller, but still significant correlation. Our results supported previous research on this topic.