

**UNDERGRADUATE  
RESEARCH  
SYMPOSIUM  
WEDNESDAY  
MAY 9, 2012  
KEN OLSEN  
SCIENCE CENTER**



**GORDON**  
COLLEGE

## **PROGRAM CONTENTS and SCHEDULE**

### **Poster Entries, Competitive Session**

Ken Olsen Science Center, Loggia, 2:00-6:00 pm

Students are required to be at their posters from 4:30-5:30 pm for judging

- Biological Sciences, p. 3
- Physical Sciences, p. 7
- Social Sciences, p. 16

### **Oral Presentations**

Ken Olsen Science Center, Room 109, 3:30-4:20 pm

- List of Talks, p. 20

### **Poster Entries, General Session:**

Ken Olsen Science Center, Chairman's Room, 2:00-6:00 pm

Students are requested to be at their posters from at least 4:30-5:30 pm

- Biological Sciences, p. 23
- Mathematics/Computer Science, p. 26
- Physical Sciences, p. 27
- Social Sciences, p. 35

### **Announcement of Awards:**

Ken Olsen Science Center, Loggia, 5:45 pm

#### **Disclaimer:**

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**Biological Sciences – Competitive Poster Session**

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**B-01****Evaluation of Small Mammal Movement Patterns  
Based on Human-Induced Fragmentation**

Kenneth Freedom\* &amp; David Llerena, Gordon College

Continued habitat fragmentation in eastern Massachusetts has placed importance on understanding how animals react to human-induced edges and naturally-occurring edges. We measured species abundance and movement patterns of focal small mammal species during September-October 2011 in human induced (forest-field) and naturally-occurring (wetland-forest) edge types. Small mammals were captured using Sherman live traps and were weighed, sexed, and measured. After processing, captures of the two focal species, White-footed Mouse (*Peromyscus leucopus*) and Deer Mouse (*Peromyscus maniculatus*), were coated in phosphorescent powder and released for tracking after dark. We followed tracks left by mice using a UV light after sunset, and we evaluated movement behaviors based on direction of movement and distance traveled. The locations were split into three categories to determine movement preferences. These included interior habitat, exterior habitat, and edge habitat. GIS mapping software was then employed in order to determine forest cover surrounding study sites. Although movement patterns and abundance did not differ based on edge category, we did find that landscape-level data impacted movement. Specifically, we found that the distance of movement along the edge decreases with a higher human presence (typically correlated with it being a human induced edge). The amount of forest near an edge did not affect movement. This study indicates that even subtle responses to habitat fragmentation, such as differing movement patterns, may be representative of an important response by small mammals to fragmentation.

[Biological Sciences: Competitive]

Sponsor: Greg Keller

**B-02****Influence of Human Development and Gull Abundance  
on Shorebird Distribution in Northern MA**

Travis Keeler\* &amp; Greg Keller, Gordon College

On several islands off the coast of Rockport, Massachusetts, such as Thatcher Island, gull abundance has become so great that due to their number and aggression they force other bird species out of an area. These islands that once were inhabited by several species of shorebirds now are solely occupied by gulls and cormorants. This study was conducted to determine if there was any correlation between shorebird

and gull abundance on the mainland beach sites during the fall migratory period. We also tested to determine if human development influenced shorebird and gull abundance positively or negatively. Twelve beach sites from Beverly to Salisbury, Massachusetts, were surveyed over a 5-week period. At each site, counts were taken weekly to determine the abundance of five shorebird species and three gull species. These species were chosen because they were the most common species in the area and representative of the migratory period. Data were analyzed using stepwise regression tests. Our results showed no correlation between shorebird and gull abundance for any of the shorebird species. However, the results did show that certain shorebirds have higher abundance on smaller beaches perhaps due to a concentration effect. In addition, gull abundance was reduced with an increase in road proximity. Because shorebirds are losing habitat to development and beach erosion, it is vital for conservationists to know which habitats provide vital habitat for these declining species. This study gives insight into which habitats might be most beneficial to certain shorebird species.

[Biological Sciences: Competitive]

Sponsor: Greg Keller

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### **B-03**

## **Identification of the Domain(s) Required for Alsin Localization to Autophagosomes**

Spencer Lord\* & Justin Topp, Gordon College

Amyotrophic lateral sclerosis 2 (juvenile) (ALS2) is a familial form of the neurodegenerative disease ALS, which encompasses a broad spectrum of disorders that all are due to motor neuron dysfunction. ALS2 is due to point mutations within the gene encoding alsin. The majority of these mutations result in premature truncation of the alsin protein such that ALS2 is due to loss of alsin function. Alsin has been shown to regulate vesicle trafficking and endosome-endosome fusion. Specifically, alsin is known to function as a Rac1 and Rab5 guanine nucleotide exchange factor (GEF); activities that are associated with the DH/PH and Vps9 domains respectively. GEFs specifically catalyze the exchange of GDP for GTP on a family of small monomeric G proteins called GTPases, which include Rac1 and Rab5. GTP-bound Rac1 and Rab5 have several roles, including the regulation of membrane trafficking along the endocytic pathway (from plasma membrane to endosomes to lysosomes). A specialized endosome, known as an autophagosome, forms during cellular stress and its inability to be trafficked to the lysosome in ALS2 knockout mice has been proposed to lead to apoptosis of neuronal cells. Autophagosomes carry intercellular elements to the lysosome and degradation of autophagosome cargo is dependent on fusion with a late endosome/lysosome and Rab5. Therefore, we postulate that alsin's Rab5 GEF activity may be important to autophagosome trafficking. In this study, we transfected HeLa fibroblast cells with different alsin domains, with and without known GEF activity, and observed whether these domains localize to autophagosomes. Understanding the roles of individual domains of alsin in autophagosome maturation may help clarify the protein's role in vesicular trafficking.

[Biological Sciences: Competitive]

Sponsor: Justin Topp

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## B-04

### **MLSA of *clpX*, *recG*, and *uvr* Genes Reveals *Borrelia burgdorferi sensu stricto* Homogeneity in Chicago Area Ticks**

Luke Versland\*, Gordon College; HaYoung Nam, Gordon College; Tyler Carlson, North Park University; Jakob Ondrey, North Park University; Matt Schau, North Park University; & Justin Topp, Gordon College

Lyme borreliosis, commonly known as Lyme disease, is the most prevalent arthropod-borne illness within the United States. Human contraction occurs following the transmission of gram-negative spirochetes of the group *Borrelia burgdorferi sensu lato* from the bacterium's arthropod host, *Ixodes scapularis* (deer ticks). The geographic range of *I. scapularis* has spread to Illinois from neighboring Wisconsin and Indiana over the past decade. Among the diverse genospecies of *B. burgdorferi sensu lato* complex, two strains have previously been found in the Chicago area, *B. bissettii*, which is an indefinitely pathogenic strain, and *B. burgdorferi sensu stricto*, which is known to cause disease. *B. bissettii* has only been isolated from rodent reservoirs, and it remains unclear whether tick populations in the area are also infected by this species. If host tick populations are infected solely by the definitively pathogenic *Borrelia* species, the risks to public health will be greater; therefore, a widespread screening of this region is crucial. To address this issue, ticks were collected from five counties in the Chicago and neighboring area. *Borrelia* spirochetes from infected ticks were cultured in selective media and genomic DNA was isolated and characterized using multiple genotyping methods. In addition to traditional methods, multilocus sequence analysis was also utilized as this has recently been shown to be the ideal method for species delineation and identification. By each of the methods used, our data indicates that tick hosts within the greater Chicago area are infected by a homogenous population of *B. burgdorferi sensu stricto*. Because this species is definitively pathogenic, these findings are of significant public health importance. They reveal that the 10 million residents of the greater Chicago area may be at greater risk for Lyme disease than previously considered.

[Biological Sciences: Competitive]

Sponsor: Justin Topp

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## B-05

### **Bat Habitat Use during the Pre-Hibernation and Migratory Period in Essex County, Massachusetts**

Thomas Horsley\*, Mike Muthersbaugh, Rafaell Rozendo, & Greg Keller, Gordon College

The nine species of bat occurring in Massachusetts play a vital ecological role and make significant contributions to human well-being through the ecosystem services they provide, specifically the control of insects. Minimal research has been conducted on seasonal bat habitat use; therefore, it is critical that this void be filled in order to attain a more complete understanding of New England bat ecology. We set out to determine what specific edge habitat types bats are utilizing during the pre-hibernation and migratory period via population sampling using mist nets and modified point counts. Study sites were later analyzed using GIS software. Three habitat types were considered: human edge habitat, wetland

natural edge habitat, and trail natural edge habitat. Mist net counts were very low and were not included in analyses. However, we found a significantly higher population abundance of bats in the human edge sites ( $p < 0.05$ ). These openings may provide greater access to insects, particularly if insects are drawn to lights or other structures. Although these data represent a single field season, this study corroborates previous research and illustrates that differences in habitat use do exist and may be biologically meaningful during this time period.

[Biological Sciences: Competitive]

Sponsor: Greg Keller

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**Physical Sciences – Competitive Poster Session**

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**P-01****Nanoscale and Microscale Hardness  
of Hydroxyapatite – BisGMA/TEGDMA Composites**

Jesse Thompson\* & David Lee, Gordon College;  
Jessica Kaufman, Endicott College

We have investigated BisGMA-TEGDMA dental composites with varying mass fractions of hydroxyapatite and silica. Commercially available dental composites with 60% silica filler were synthesized in the presence of nanometer-sized hydroxyapatite crystals. We have compared the mechanical properties of BisGMA-TEGDMA samples filled with silica only and those filled with silica and hydroxyapatite particles. We report on hardness as a function of crystalline content as determined by nanoindentation and microindentation.

[Physical Sciences: Competitive]

Sponsor: David Lee

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**P-02****Measurement of Elastic Constants  
in the Cu(50)Ni(8)Ti(20+x)Zr(22-x) x= 0,5,10,15 Bulk Glass Forming System  
Using a Resonant Impulse Excitation Technique**

Darrell Montonera\*, Gordon College

Amorphous metal alloys can be formed in a number of ways and are characterized by an atomic structure with no long range periodic order. Such a glassy structure results in unique properties which are of commercial interest. Elastic constants in the quaternary Cu- Ni-Ti-Zr metallic glass system were measured by a impulse excitation technique (IET) using 1.5mm cylindrical rods. A series of alloys were made by arc melting the pure metals and suction casting into copper molds. The Young's modulus and Shear modulus were measured as a function of Ti-Zr dependence.

[Physical Sciences: Competitive]

Sponsor: David Lee

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### **P-03**

## **Reverse Engineering and Building of an Infinitely Variable Gear-Driven Transmission, With a Study of Maximum Torque, Power Output, and Efficiency**

Nathan Bedell\*, Gordon College

It has been shown that CVTs (Continuous Variable Transmissions) offer a constant range of gear ratios between low and high gears all without the use of a clutch system. The downfall is that CVTs only have a limited range of ratios they can work through and in order to achieve variability in the gear ratio they almost always use some sort of friction device. To overcome these problems the idea of an IVT (Infinitely Variable Transmission) was explored. The purpose of this project was to reverse engineer and build an IVT to test its maximum torque, power output, and overall efficiency. An IVT requires no clutch system so there is variability from top gear through neutral and even into reverse. The power is always transmitted from input to output through gear teeth rather than a friction device. In order to control the speed of the transmission shafts a certain amount of energy needs to be inputted into the system. The designer and builder of this project plans to show that the amount of energy needed to control this speed is only a tiny fraction of the energy normally associated in changing gear ratios in other transmissions.

[Physical Sciences: Competitive]

Sponsor: David Lee

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### **P-04**

## **Nd: YAG-based LIBS for Elemental Analysis**

Danielle Duggins\*, Gordon College

Laser Induced Breakdown Spectroscopy (LIBS) is a technique by which focused laser light ablates the top few atomic layers of a material, creating a plasma just above its surface. The light emitted from the plasma is collected by a spectrometer and the resulting emission spectra are representative of the composition of the material. In this project, a Spectra-Physics pulsed Nd:YAG laser was used to generate the plasma and the emitted light was collected by a Horiba Jobin-Yvon microHR™ spectrometer for analysis. This setup was used to examine the spectra from plasma plumes of ablated pure metal samples. Our results demonstrate the power of this technique as a method for elemental analysis.

[Physical Sciences: Competitive]

Sponsor: David Lee

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**P-05**  
**Supercapacitor Charging**  
**with a Permanent-Magnet Linear Electric Power Generator**

Stephen Collins\* & David Lee, Gordon College

A novel approach to linear electric power generation harvests the gravitational potential energy of magnets dropped through a series of coils. An apparatus has been constructed to transfer the maximum amount of energy from the magnet to the supercapacitors. The efficiency of the apparatus is determined by the ratio of stored electrical energy in the supercapacitors after a drop to the gravitational potential energy of the magnet before the drop. Many factors affect the efficiency of this generator including coil inductance and spacing, magnet mass and strength, and the design of the electronic charging circuit.

[Physical Sciences: Competitive]

Sponsor: David Lee

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**P-06**  
**Noncontact Determination of Surface Tension by Means of Focused Acoustics**

Zachary Capalbo\*, Gordon College

A focused acoustic transducer is used to form a small mound on the surface of a water glycol solution. The transducer is then used to ultrasonically measure the height of the mound at successive intervals as the mound relaxes. The relaxation curve can be used to determine the surface tension of the solution. Various concentrations of water and glycol are analyzed, and the results compared with surface tensions for known concentrations.

[Physical Sciences: Competitive]

Sponsor: David Lee

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**P-07**  
**The Effect of Crosslink Density on the Durability of Acrylic-titania Composite**  
**Photocatalytic Support Materials**

Bria Pelletier\*, Clyde Daly, Ben Stewart, & Joel Boyd, Gordon College

The goal of this research is to find the optimal crosslink density for acrylic to be used in photo-catalytic water purification reactors. The photo-catalytic properties of nanoparticle Titania ( $\text{TiO}_2$ ) are being researched for use in water purification and there are several methods of conducting this purification. Using a slurry method works effectively to degrade the water pollutants but the nanoparticles are difficult to filter out of solution. An alternative to this is depositing the nanoparticles on a UV permeable

acrylic such as Poly-methyl methacrylate (PMMA). The water purification is brought about by the photocatalytic properties of Titania ( $\text{TiO}_2$ ). This creates free radicals in the water which then attack the organic water pollutants. Because acrylic is an organic material, it must be chemical resistant in order to make a long lasting reactor. A greater crosslink density will result in a greater chemical resistivity but it will also result in a brittleness of the acrylic. In order to synthesize an acrylic that will have adequate chemical resistivity and while still being resilient enough to be used in a photo-catalytic water purification reactor, an optimal crosslink density must be found.

[Physical Sciences: Competitive]

Sponsor: Joel E. Boyd

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## **P-08**

### **Photocatalytic Water Purification: The effect of porosity on the photocatalytic activity of acrylic-titania composite photocatalytic materials**

Ben Stewart\*, Clyde Daly, Bria Pelletier, & Joel Boyd, Gordon College

It has been shown that aqueous contaminants can be degraded through the photocatalytic application of nanoparticulate  $\text{TiO}_2$  (titania). These photocatalytic reactions can be carried out in a reactor constructed from acrylic-titania composite wherein a titania film has been solvent deposited on the surface of poly(methylmethacrylate) (PMMA). The ideal photocatalytic support material would possess a high porosity to maximize the active titania surface area, and enhance the surface residence time of the target contaminants. The current study explores production of porous PMMA through the use of a surfactant mediated substrate formation process. The photocatalytic degradation of aqueous methyl orange was used to investigate the photocatalytic activity of the acrylic-titania composites formed from porous PMMA.

[Physical Sciences: Competitive]

Sponsor: Joel E. Boyd

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## **P-09**

### **Graphite Furnace Atomic Absorption Spectroscopy for the Detection of $\text{TiO}_2$ -Ti Removed from the Surfaces of Acrylic-titania Composite Photocatalytic Materials**

Clyde Daly\*, Bria Pelletier, Ben Stewart, & Joel Boyd, Gordon College

Titania ( $\text{TiO}_2$ ) is an effective photocatalyst for water purification. However, to be efficiently used in this way, the titania particles must be on the nanoscale. Since it is quite difficult to remove post-use nanoparticles from solution, it is usually necessary to deposit the titania onto a surface over which water can flow during photocatalysis. The adhesion strength and durability of the support-titania composite material should be maximized to assure the longevity of the photocatalytic reactor and minimize the release of nanoscale titania, which may have adverse affects on human health and the environment. Graphite Furnace Atomic Absorption Spectroscopy (GFAAS) is able to quantify  $\text{TiO}_2$ -Ti dispersed in water down to 5 ppb despite the highly refractory nature of  $\text{TiO}_2$ . The mechanical and photocatalytic

durability of reactors constructed from poly(methylmethacrylate)-titania composite materials was investigated by the GFAAS detection of  $\text{TiO}_2$ -Ti in the aqueous contents of the reactors after sustained mechanical shaking and prolonged UV exposure of the reactor.

[Physical Sciences: Competitive]

Sponsor: Joel E. Boyd

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### **P-10**

#### **Optimizing the Use of the $\text{Fe}^{\text{III}}$ -TAML System for a Methyl-amine to Ketone Conversion**

Ariel Guiguizian\*, Dwight Tshudy, & Andrew Worth, Gordon College;  
Terry Collins & Alexander Ryabov, Carnegie Mellon University

The degradation of active pharmaceutical ingredients found in the environment is becoming more important. In this study, we are investigating the conversion of methyl amines to ketones through the use of the TAML activators. TAML catalysts are hydrogen peroxide activators and can be used for oxidative transformations. A secondary aliphatic amine moiety based on Sertaline (the active ingredient of the antidepressant Zoloft) is used in this work as a model compared to study this conversion. In this study we investigated the experimental variables of pH, time, catalyst concentration, and peroxide concentration in order to obtain the highest yields of the ketone product. The reaction was monitored using high pressure liquid chromatography (HPLC).

[Physical Sciences: Competitive]

Sponsor: Dwight Tshudy

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### **P-11**

#### **Structural Determination of a Phenolic Polymer Produced Using the $\text{Fe}^{\text{III}}$ -TAML System**

Kristen Entwistle\* & Dwight Tshudy, Gordon College  
Terry Collins, Carnegie Mellon University

Phenolic compounds are common in industrial practices and procedures, despite the fact that many phenols are also known to be environmental toxins and endocrine disrupting compounds. 4-ethylphenol has been used as a model compound to study the polymerization of phenols using the TAML activator catalytic system. We have worked to optimize the conditions for this polymerization reaction. The resulting polymer has been characterized by GPC, FT-IR, NMR, TGA, DSC and MALDI and we will describe these results in the context of the light shed upon the likely reaction mechanism.

[Physical Sciences: Competitive]

Sponsor: Dwight Tshudy

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## P-12

### Kinetic Studies of the Degradation of Orange-II Dye using $\text{Fe}^{\text{III}}$ -TAML System

HanByul Chang\* & Kristen Entwistle, Gordon College;  
Terry Collins & Longzhu Shen, Carnegie Mellon University

The  $\text{Fe}^{\text{III}}$ -TAML system is a powerful catalytic oxidative system that can perform a number of different types of chemical reactions. Catalysis is one of the twelve principles of green chemistry and a driving force for using the TAML system. At Gordon College, this catalyst is being used in projects that explore organic dye degradation, phenolic polymerization, and deamination of methyl amines to ketones. In this work, the  $\text{Fe}^{\text{III}}$ -TAML system is used to degrade Orange-II dye as a way of exploring kinetic rates of a degradation reaction using visible spectrophotometry. The reaction rate of a degradation process can be determined by varying one reaction parameter while holding others constant. The observed relationship between the initial reaction rate and the TAML concentration is linear. The observed relationship between the initial reaction rate and the peroxide concentration is non-linear. Information obtained from this work will be transferred to degradation of more common food dyes to develop an undergraduate laboratory experiment focused on studying the kinetics of oxidative degradation.

[Physical Sciences: Competitive]

Sponsor: Dwight Tshudy

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## P-13

### Influence of Stance Width, Squat Depth, and Psychological Focus on Maximum Vertical Jump Height

Jared Scoville\*, Austin Holt, & Kris Camelio, Gordon College

Many athletes rely on a vertical jump in their sport. Often the height of that jump determines the outcome of the particular play they are involved in. Thus it is crucial that athletes be able to reach a maximal height each time they jump. The goal of this study was to learn about vertical jump height and how it can be maximized. We looked at how stance width, squat depth, and psychological foci affected maximal jump height. Four male athletes were our subjects. Each of them performed a series of jumps for 3 different variables. A control was used as well. We gathered the data using the Vicon Nexus motion capture system and analyzed it with Microsoft Excel. The more optimal stance widths were the “preferred” and 12” stance widths. However, we found that no particular stance width showed a consistently optimal jump height among all subjects. Goal-focused jumping showed greater jump heights when compared with the normal or external focus parameters. Differences may be due to more efficient motor strategies, however more research is needed. Jump heights increased with increasing depth of squat. Maximum jump heights were elicited from the preferred squat depth (~90 degree knee angle). With training it may be possible to increase one’s maximum jump height using a deeper squat depth and involving a countermovement. The data shows that all three variables had a significant effect on maximal jump height and can be manipulated to elicit an optimal, or at least a better, vertical leap.

[Physical Sciences: Competitive]

Sponsor: Jessica Ventura

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## P-14

### How Does Carefulness Affect the Mechanics of a Timed Trial?

Samantha Goedeke\*, Evan Williamson, & Travis Masters, Gordon College

Fitt's law states that speed and accuracy will at times contradict each other and are often exchanged during certain motor actions. If a subject is instructed to perform a motor action while applying both speed and accuracy, how will their performances differ with varying levels of difficulty? The purpose of this study was to investigate the change in performance during a timed trial with varying levels of difficulty. Subjects were instructed to transport three symmetrical bowls from one table to another as fast as they can without a spill. The level of difficulty for each trial was dependent on the three varying amounts of water; full, two thirds, and empty. The subjects were penalized with additional time for spilling water. Vicon Motion Capture System was used to observe trunk angles, phase times, and acceleration. The greatest deceleration time value was observed during the full bowl trials, followed by the two thirds and empty trials, respectively. The trunk angles decreased correspondingly from the full bowl trials to the empty trials. Phase times lengthened and also followed the previously stated progression from full to empty trials. Water spillage was inconclusive in regards to the level of difficulty. Implications of prioritizing accuracy over speed regardless of level of difficulty are considered.

[Physical Sciences: Competitive]

Sponsor: Jessica Ventura

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## P-15

### Athletes versus Non-Athletes:

#### Balance and Reaction Times During Up-On-Toes and Squat Exercises

Kerry McPartlan\*, Cassie Buchanan, & McKenna Minor, Gordon College

Background: Athletes are commonly found to have faster reaction time and balance than non-athletes. Previous studies have shown that athletes have faster reaction time than non-athletes when asked to respond to a stimulus and lower sway factors and distribution of pressure readings when asked to preform one legged and two legged static tasks. The focus of this study was to analyze the reaction times and balance of athletes and non-athletes when asked to complete dynamic tasks. Methods: Subjects consisted of four female college age athletes and non-athletes. Subjects were presented with four randomized actions that were written on notecards. Subjects were instructed to complete each task upon reading the notecard in its entirety. The tasks included one and two-legged up-on-toes actions as well as one and two-legged squats on two different surfaces: foam and non-foam. Findings: The reaction times of the athlete subjects proved to be faster than the non-athletes. The findings for balance were inconsistent with the up-on-toes task showing better balance for athletes but the squat task showing better balance for non-athletes. These results may be due to the limited population of our study and the different training affects of the athletes. Interpretation: These results provide insight into

the analysis of balance and reaction time between athletes and non-athletes. Further investigation and controlling will need to be done in order to determine why there is inconsistency in the athlete balance abilities.

**P-16****The effect of surface stability and balance during squat exercises**

Abigail McManus\*, Claudia Amado, &amp; Krysti Leach, Gordon College

This study examined how surface instability would affect three measures during the performance of a deep squat. The measures analyzed were ankle angle, hip angle and center of pressure (COP) displacement. Three different surfaces were used to gradually increase instability during the squat: a force plate (most stable), foam mat, and BOSU ball (least stable). 8 female division III athletes volunteered for this study. Each subject performed 7 deep squats on each surface. Anthropometric data was recorded prior to each trial, and kinematic data was collected using VICON motion capture system. A deep squat was defined as having a knee angle of 90°. Data showed that subjects on the BOSU ball had lower overall ankle flexion throughout the squat, as well as a lower starting ankle angle. Overall ankle angle was similar on the foam and BOSU ball, but subjects had a higher starting ankle flexion on the BOSU ball. At their lowest point during the squat, subjects flexed less at the hip on the BOSU ball compared with the other two surfaces, having lower hip flexion angles. At their highest point, subjects on the BOSU ball failed to extend at the hips and had greater hip flexion angles. As surface instability increased, anterior-posterior deviation of COP increased. Increased instability affects the three measures analyzed, increasing COP deviation, ankle flexion and hip flexion at the highest point of the squat. Surface instability also decreased hip flexion angle at the lowest point of the squat. Our results suggest that changing surface stability during exercise will target different muscle groups. Surface instability may be used in therapeutic rehabilitation to target specific muscle groups.

**eP-17****The Impact of Minimalist and Mid-Foot Strike Running Shoes on Running Kinematics**

Brett Haschig\* &amp; Claudia Amado, Gordon College

Recent literature shows that runners who land on their heel at foot strike have a greater vertical impact force with the ground than those who mid-foot or fore-foot strike. Landing on the mid- and fore-foot at foot strike (MFS and FFS, respectively) are characteristic of barefoot running, while runners who wear traditional cushioned shoes tend to rear-foot strike (RFS). Because RFS are associated with high impact forces, many companies are now marketing minimalist and midfoot-strike running shoes as an alternative to cushioned shoes. Which of these shoes are more effective at helping a RFS runner achieve a MFS or FFS? Should a FFS runner invest in them? In this study, two adult runners transitioned from their traditional cushioned running shoes to Skechers Pro Resistance shoes over four weeks of running. Foot and leg joint angles were measured for two RFS and two FFS runners running at their training pace

in their own cushioned shoes and either minimalist or midfoot-strike shoes. Each runner's kinematics were measured pre- and post-training. The pre-training trial indicated that the first runner was a fore-foot striker in his cushioned running shoes and a mid-foot striker in the Pro Resistance shoes. After the training period, this runner became a mid-foot striker in his cushioned running shoe and maintained the same mid-foot strike for the Pro Resistance. The second runner was a rear-foot striker in the pre-training session in both her cushioned running shoes and the Pro Resistance shoes. Although she exhibited similar joint angles during stance between the cushioned and Pro Resistance shoes, the differences decreased even more after training as the runner adjusted to the new shoes. The runner gradually returned to the running kinematics she held in the cushioned running shoes. The FFS minimalist shoe runner slightly increased his FFS in the minimalist shoes. The RFS minimalist shoe runner exhibited MFS in the minimalist shoes. For both subjects, the minimalist shoes decreased pronation during stance and increased knee flexion at heel strike. The FFS midfoot-strike shoe runner exhibited MFS in the mid-foot-strike shoes, which also increased ankle range-of-motion during stance. The RFS mid-foot-strike shoe runner had no significant changes in kinematics. These results suggest that training in Pro Resistance running shoes can cause changes to running kinematics in fore-foot strikers, but not necessarily to rear-foot strikers. Also, midfoot-strike shoes guide both FFS and RFS runners to MFS, whereas minimalist shoes not only guide runner towards a more FFS but also change running kinematics. Further studies will include a larger subject population with longer training times and will measure ground reaction forces.

[Physical Sciences: Competitive]

Sponsor: Jessica Ventura

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## Social Sciences – Competitive Poster Session

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### S-01

#### Left Behind: What it is like to be DITCHED by a FRIEND

Michaela Chadwell\*, Zac Adams, & Hannah Bentum, Gordon College

Despite prior research on shifts in attachment from friends to romantic partners, little is known about the experience of being left behind when a friend gains a romantic partner. 36 college aged students completed a mixed methods survey to explore how people feel when they are ditched, the occurrence of this phenomenon, and if there is any difference between how people feel they have been treated by a friend who did and did not ditch them. Participants felt more exclusion, less inclusion, more hate, and less love towards friends who ditched them compared to those who did not ditch them. Qualitative findings similarly suggest that being ditched is a negative experience. This knowledge helps expand our understanding of close relationships, provides further evidence that rejection is a hurtful experience, and could be helpful to college students and counseling services offered at college campuses, specifically Gordon College.

[Social Sciences: Competitive]

Sponsor: Jonathan Gerber

### S-02

#### Counting by Color: Event-Related Brain Potentials in Grapheme-Color Synesthetes

Jocelyn Rioux\* & Bryan Auday, Gordon College

Electrophysiological recordings of individuals with synesthesia have revealed interesting differences in their neurological processing patterns compared with non-synesthetes. A previous study by Brang et al. (2008) identified several significant and unique event-related EEG components in grapheme-color synesthetes by using contextually primed sentences like, "The sky is 2," in which "2" was perceived by the synesthete as a blue photism, creating a meaningful association. Subsequently, investigators attempted to simulate the synesthetic experience by training non-synesthetes to associate numbers with specific colors, and event-related brain potentials (ERPs) were found to be similar between synesthetes and trained control participants, except for the P2 component. To further examine the brain activity of synesthetes and the P2 component, we presented five grapheme-color synesthetes and ten control participants with 150 sentences which primed for a color, but ended with one of 5 types of stimuli that was either congruent or incongruent to the context. Sentences ended with either a color patch; a word printed in black ink; a word written in colored ink; an achromatic number known to induce a photism; or a number presented in colored ink that is incongruent to the evoked photism. We used three distinct groups of participants: synesthetes, a control group of non-synesthetes who were



trained to know synesthetic color-number associations, and a naïve non-synesthete control group. There were five participants in each group. We were interested in whether the P2 component would be more positive for synesthetes when the colored ink is incongruent as opposed to when a number is presented that elicits an incongruent photism. EEG electrophysiological recordings were made using 32 Ag/AgCl sintered electrodes embedded in an elastic Quik-cap, and referenced using both mastoid sites. EEG signals were acquired using Neuroscan's Synamps system. The EEG signals were epoched using a 1000 ms window based off of the last item presented in each sentence. These event-related epochs were averaged for each participant for both congruent and incongruent trials. Grand averages were also computed for each condition. The P2 component from electrode CPz (located near the top of the head, midline) was analyzed. Results revealed that mean voltages for P2 were approaching statistical significance ( $t(4) = 2.49, p = .067$ ) when comparing synesthetes on two tasks that involved conflicting information (congruent number/incongruent ink color with congruent ink color/incongruent number). We predicted that the mean amplitude would be higher for P2 within the condition that used an incongruent number (eliciting the wrong photism) even though the color of the number was congruent. Although the mean differences did not reach our alpha level of .05, we believe this was due, in part, to low levels of statistical power associated with our small sample of grapheme-color synesthetes.

[Social Sciences: Competitive]

Sponsor: Bryan Auday

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### **S-03**

#### **Willingness to Forgive Among Gordon College Students: The Role of Intrinsic and Extrinsic Religiosity**

Philip Clossey\* & Dylan Toucey, Gordon College

In recent years, there has been growing interest in the relationship between religious beliefs and practices and willingness to forgive. Some studies have shown that Christians are more likely than people of other religious backgrounds to forgive particularly heinous offenses. However, not all Christians are uniformly willing to offer forgiveness in these situations. Drawing from prior research, we hypothesized that the differences between Christians can be attributed to an individual's tendency towards either intrinsic religiosity (which describes a genuine, heartfelt faith) or extrinsic religiosity (which describes a utilitarian faith, where religion is a means to an end). In our study of Christian college students ( $N=42$ ), a series of questionnaires were administered, including an established measure of religiosity and a measure of willingness to forgive high, medium, and low intensity offenses that was created for this study. We found that intrinsic religiosity is significantly associated with willingness to forgive for medium and high level offenses. Additionally, qualitative data provided insight into the reasoning utilized by Christians when making the decision to forgive an interpersonal offense.

[Social Sciences: Competitive]

Sponsor: Christina Riggs-Romaine

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**S-04**  
**The Gift of Veracity:**  
**Trait Emotional Intelligence and the Ability to Perceive Facial Authenticity**

Derek Schoffstall\*, Alyssa Barkley, & Kimberly Sandiford, Gordon College

Over the past decade, society's fixation on emotional intelligence (EQ) has proliferated into mainstream media. Prior studies have investigated the relationship between EQ and one's ability to conceal their own facial expression. Our research, however, is the first study to specifically address the correlation between trait emotional intelligence and accuracy in differentiating between genuine and deceptive facial expressions in others. We first presented two participants with 27 sad, happy, and neutral images and asked them to respond with a genuine or deceptive (simulated, neutralized, or masked) facial expression. Each frame was extracted and condensed into a representative 18 frames that were chosen based on pre-determined criteria. Forty-two participants (N=42) were then asked to view the 18 handpicked portraits and judge whether or not the facial expression shown in each portrait was genuine or deceptive, what they believed the portrait's true emotion was, and how confident they were in their responses. Afterwards, the 42 participants were presented with a 153-question trait emotional intelligence exam (TEIQue). Our analysis of the data found that there was no correlation between EQ and participant's accurate discernment between genuine and deceptive facial expressions. Our results are in alignment with current untested theory. Interestingly, Gordon College participants in our study received slightly above average EQ scores (mean of 4.95 on a 7 point scale in which 3.5 is the average). They also were able to distinguish between genuine and deceptive facial expressions at a rate higher than chance. Although they were collectively higher in both aspects, individual scores did not show correlation between EQ scores and perception of genuine vs. deceptive facial expressions.

[Social Sciences: Competitive]

Sponsor: Suzanne Phillips

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**S-05**  
**Cognitive Dissonance in a Group Context**

Rebekah Wold\*, Christian Shahzade, & Laura Cande, Gordon College

Many studies have discovered that people are reluctant to act in a way different from the group that they are in, even when the individuals know the thing they are doing as part of the group is wrong. Packer (2009) discovered that the motivation for dissent exists in groups, but "the challenge is for groups to capitalize on this fact." In other words, even though there may be people who disagree in a group setting, they lack the boldness to speak in resistance to the group. This applies to real life examples, such as military injustices and hazing in high school sports. The present study was slightly different: we examined how the group as a whole responds to situations of cognitive dissonance. We recruited students from Gordon College of all grade levels, and put them into six four-person groups. In order to reduce the possibility of confounding because of gender, three of the groups were composed entirely of males and three of females. Each group was given a task to discuss and write down five ways music makes one's day better. They were then given an individual measure of cognitive dissonance. The

group was then given a cognitive-dissonance-inducing task: to discuss and write down five ways idol worship improves one's spiritual well-being. Then, they were once again given an individual measure of their cognitive dissonance. The entire experiment was videotaped, so that their conversation and behavior could be analyzed. We aimed to understand the experience of group-wide cognitive dissonance, and its effect on comfort levels and contribution to the conversation. It was discovered that groups largely deal with cognitive dissonance by using humor, avoiding on-topic discussion, withdrawing from the conversation, fidgeting and displaying antagonistic body language. One possibility for further study could include examining how certain personality traits influence the group's reaction to cognitive dissonance. Another option could be looking at relationships within the group, such as if they are strangers or friends, and how the relationship affects the group's response to cognitive dissonance.

[Social Sciences: Competitive]

Sponsor: Suzanne Phillips

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## **S-06**

### **Social Ethics and Values of Multicultural Christian College Students**

DongGun Sim\* & Samantha Senna, Gordon College

The cognitive characteristics of bilingual individuals have been a topic of interest within psychology for several decades. Social and moral development, however, deserve as much attention as cognitive. In this project, in contrast, we explore the cultural similarities and distinctives of bilingual and bicultural Christian Korean and American individuals. Fifty individuals—twenty-five bilingual Koreans and twenty-five monolingual Americans—were surveyed and interviewed in English. The survey consisted of the 16 Scenarios for the Measurement of Collectivism and Individualism (which measures horizontal and vertical individualism and collectivism; Triandis & Gelfand, 1998). In horizontal patterns, the culture values equality and assumes that one self is more or less like every other self; in vertical patterns, hierarchy is valued and one self is different from other selves. Using these four categories, Korea has been identified as a culture which values horizontal individualism and collectivism equally, whereas the United States has been identified as a horizontal individualist culture. The interviews measured Shweder's (Shweder, Much, Mahapatra, & Park, 1997) ethics of Autonomy, Community, and Divinity using two questions (Arnett, Ramos & Jenson, 2001). Although the multilingual Koreans did not significantly differ from the monocultural Americans in their overall responses to the 16 scenarios, the linear interaction between cultural pattern and ethnic group was significant with moderate effect. In response to the interviews, all participants held Christian values in tension with cultural values, producing ethics of autonomy (to be expected culturally) and community (perhaps reflecting their faith commitment). In regards to Schwartz's values, Americans favored the values of benevolence ( $\chi^2 = 7.605$ ,  $p < 0.01$ ) whereas multilingual Koreans favored security ( $\chi^2 = 8.533$ ,  $p < 0.01$ ). Results are interpreted in light of the surveys being conducted in English, recent cultural changes in Korea, and the high Christian commitments among sample members.

[Social Sciences: Competitive]

Sponsor: Kaye Cook

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**Oral Paper Session**
**KOSC 109****3:30 to 4:20 pm**


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**3:30 pm****Noncontact Determination of Fluid Properties by Means of Focused Acoustics**

Zachary Capalbo\*, Gordon College

A focused acoustic transducer is used to form a small mound on the surface of a water glycol solution. The transducer is then used to ultrasonically measure the height of the mound at successive intervals as the mound relaxes. The relaxation curve can be used to determine the surface tension of the solution. Various concentrations of water and glycol are analyzed, and the results compared with surface tensions for known concentrations.

[Physical Sciences: Oral]

Sponsor: David Lee

**3:40 pm**

**The Intersection of Gender, Education, and Health:  
A Community-level Survey of Education and Health Outcomes  
for Women in Southeastern Togo**

Trevor Mattos\*, Miranda MacKinnon, &amp; Dorothy Boorse, Gordon College

Gendered education and health outcomes are of great importance for developing regions of the world where low standards of human health and low levels of education persist. Low levels of female education are common in low-income countries, where priority is often given to educating boys. The literature demonstrates that, in the African context, gendered education affects family health. Our research examined gendered education and health outcomes at the community level in southeastern Togo. Very few studies document the socio-economic realities for women in southeastern Togo, and fewer still evaluate community-level data for these variables. Data from the community of Ganavé, Maritime, Togo were collected by way of a household survey—administered home-to-home by field researchers. Data were analyzed using SPSS. Chi-square tests were used to assess the relationship between levels of maternal education and several measures of family or community health. We found that levels of education were much lower among mothers than they were among fathers, but that education levels were very low for both. Maternal education, in particular, was found to be a significant determinant of family hygiene and sanitation, child labor participation rates, and home birth rates. Relationships were not found with respect to school attendance or child mortality. A small sample size may be the cause for some unexpected patterns in the data, such as the lack of a relationship between maternal education and child mortality. These data seem to support the idea that higher rates of female education in the West African sub-region would be expected to have a positive effect on maternal health, as well as family and community health. Our data from Ganavé, a village community in southeastern Togo, support the findings of other studies in sub-Saharan West Africa, that maternal

education affects family health. Further research, with samples from a broader range of economic strata and possibly degrees of urbanization, may assess the strength of the relationship between female education and family health in West Africa.

[Social Sciences: Oral]

Sponsor: Dorothy Boorse

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**3:50 pm**

**Nanoscale and Microscale Hardness  
of Hydroxyapatite – BisGMA/TEGDMA Composites**

Jesse Thompson\*, Gordon College; David Lee, Gordon College;  
Jessica Kaufman, Endicott College

We have investigated BisGMA-TEGDMA dental composites with varying mass fractions of hydroxyapatite and silica. Commercially available dental composites with 60% silica filler were synthesized in the presence of nanometer-sized hydroxyapatite crystals. We have compared the mechanical properties of BisGMA-TEGDMA samples filled with silica only and those filled with silica and hydroxyapatite particles. We report on hardness as a function of crystalline content as determined by nanoindentation and microindentation.

[Physical Sciences: Oral]

Sponsors: David Lee & Jessica Kaufman

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**4:00 pm**

**Community Structure of Seep-sea Coral Communities in the Gulf of Mexico**

Lydia Roush\* & Walter Cho, Gordon College

Deep-sea corals are found worldwide throughout the global oceans. They provide a unique habitat for roughly a million species of associated fauna. Deep-sea corals were discovered in the 18th century, but due to their inaccessibility, there has been limited information collected about deep-sea coral ecosystems. Technological advancements in vehicles used for deep-sea exploration, such as submersibles, autonomous underwater vehicles (AUVs) and remotely operated vehicles (ROVs), have allowed the scientific community to increase its understanding of these deep-sea communities. I analyzed a total of 178 hours of video footage recorded by the ROV Jason II during the 2009 LOPHELIA II research cruise in the Gulf of Mexico, focusing specifically on characterizing coral species and their invertebrate associates. I documented a total of 263 deep-sea coral communities distributed at twelve different sites within the Gulf of Mexico and compared them using multivariate analyses to study the influence of depth and geographic location on patterns of abundance, biodiversity, and community structure. As this footage was recorded before the Deepwater Horizon oil spill, the results of this study can be used as a baseline to coordinate and plan future research cruises and facilitate the comparison of deep-sea communities pre- and post-spill in order to assess the potential impact from the oil spill in deep-sea ecosystems in the Gulf of Mexico.

[Biological Sciences: Oral]

Sponsor: Walter Cho

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**4:10 pm**  
**Nd: YAG-based LIBS for Elemental Analysis**

Danielle Duggins\*, Gordon College

Laser Induced Breakdown Spectroscopy (LIBS) is a technique by which focused laser light ablates the top few atomic layers of a material, creating a plasma just above its surface. The light emitted from the plasma is collected by a spectrometer and the resulting emission spectra are representative of the composition of the material. In this project, a Spectra-Physics pulsed Nd:YAG laser was used to generate the plasma and the emitted light was collected by a Horiba Jobin-Yvon microHR™ spectrometer for analysis. This setup was used to examine the spectra from plasma plumes of ablated pure metal samples. Our results demonstrate the power of this technique as a method for elemental analysis.

[Physical Sciences: Oral]

Sponsor: David Lee

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**Biological Sciences – General Poster Session**


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**A Phylogenetic Study of the Deep-sea Shrimp *Mirocaris* Species Complex Based on Genetic Distance**

Aaron Gehr, Mekdes Getaneh, Kelcy Rich, Sarah Rosenstein, & Walter Cho\*, Gordon College

*Mirocaris fortunata* and *Mirocaris keldyshi* are species of shrimp found at deep-sea hydrothermal vents along the Mid-Atlantic ridge. There has been debate regarding the taxonomic classification of *M. fortunata* and *M. keldyshi* as distinct species. *M. fortunata* was originally collected and described from the northern range of the Mid-Atlantic ridge, while *M. keldyshi* was originally collected and described from the southern range of the Mid-Atlantic ridge. Morphologically, the species present similar characteristics so the shrimp are currently considered conspecific, leaving *M. fortunata* as the only species in the genus *Mirocaris*. The goal of this study is to use molecular techniques to determine the classification of species in the genus *Mirocaris* using a genetic species concept, that defines species based on genetic distance. To determine if the species are genetically distinct, DNA was extracted from shrimp samples collected at four hydrothermal vent sites spanning the range of the Mid-Atlantic ridge and the mitochondrial gene cytochrome oxidase subunit I (COI) was sequenced. Phylogenetic analysis will indicate whether the individuals from different hydrothermal vent sites are conspecifics if their sequence divergence is within the 1-3% range, which is the typical intraspecific sequence divergence for other marine crustaceans.

[Biological Sciences: General]

Sponsor: Walter Cho

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**Identification of miRNAs Regulated by PGC-1 $\alpha$  in the Skeletal Muscle**

Ben Sebuufu\*, Gordon College

Peroxisome proliferator activated receptor gamma coactivator one alpha (PGC-1 $\alpha$ ) is known to control gene regulation in metabolism through different pathways. However it has not been elucidated whether PGC-1 $\alpha$  also regulates genes through miRNAs, despite their established involvement in several gene regulation pathways of other regulators. We therefore set out to find out whether miRNAs are involved in the gene regulation pathways of PGC-1 $\alpha$  in skeletal muscle. We performed a microarray screen to identify which miRNAs are regulated by PGC-1 $\alpha$  in mice and in human myotubules. We found 106 miRNAs differentially expressed in mouse myotubules and 7 miRNAs in human myotubules. We next sought to determine whether miRNAs are required for the induction of PGC-1 $\alpha$  regulated genes in skeletal muscle. To answer this question, we used isolated satellite cells from dicer floxed/floxed mice which we differentiated into myotubules and infected with adenovirus overexpressing Cre recombinase (AxCre) to make Dicer KO myotubules. We next infected the Dicer KO cells with PGC-1 $\alpha$  adenovirus (AxPGC1 $\alpha$ ) and looked at various PGC-1 $\alpha$  target genes. However, we did not see any effect on a subset of PGC-1 $\alpha$  target genes when we deleted Dicer from the myotubules acutely. This data suggests that acute deletion of Dicer does not have any effect on PGC-1 $\alpha$  target genes. However, given the long half-life of miRNAs, this does not rule out the possibility that long term deletion of Dicer will have an effect. In summary, deletion of miRNA processing machinery does not affect downstream PGC-1 target genes although PGC-1 $\alpha$  is able to induce miRNA expression in both mouse and human skeletal muscle.

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### **Enzyme Kinetics of Lactaid® and Generic Lactase Tablets Compared**

Craig Story\*, Daniel Adam, Chloe Cunio, Annika Dixon, Kristen Entwistle, Whitney Fenton, Carissa Filip, Elise Gershman, Ariel Guiguizian, Molly Guthrie, Spencer Lord, Bria Pelletier, Luke Perkins, Sarah Rosenstein, Benjamin Stewart, & Lucas Versland, Gordon College

Lactose intolerance is a relatively common and distressing condition wherein adults are not able to digest the major sugar found in milk due to lack of production of lactase (beta-galactosidase). Lactase enzyme supplements may be taken with milk to solve this problem. The purpose of this study was to compare the effectiveness of three different brands of lactase enzyme supplements. We compared the overall enzyme activity, the specific activity, as well as the Michaelis constant ( $K_m$ ) and related kinetic parameter  $V_{max}$ . A sample of each enzyme was subjected to gel electrophoresis to determine the nature of the polypeptides present for the three brands. The name brand product used was Lactaid® and the generics tested were from CVS and Market Basket. Both Lactaid® and CVS brand contain 9000 FCC lactase units per tablet, while one tablet of Market Basket brand contains 3000 FCC lactase units. Our results indicated that Lactaid® brand and CVS brand were somewhat more highly active under the conditions of our assay, having a higher activity and specific activity, a low  $K_m$ , and a higher  $V_{max}$ . Finally, the polypeptides chains of Lactaid® were clearly distinct from that of the generics, which appeared identical to each other.

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### **Genetic Structure of the Populations of the Deep-sea Shrimp Species *Mirocaris fortunata* along the Mid-Atlantic Ridge**

Julia DiCanzio, Travis Keeler, Katie Han, Elyse Vierra, & Walter Cho\*, Gordon College

Hydrothermal vents are formed at the boundaries of tectonic plates along the ocean floor, typically where new crust is being formed and spreading out. The heated water that flows through the crust has many minerals dissolved in it, which precipitate out and form the chimneys found at these hydrothermal vents. These minerals also act as the food source for chemosynthetic bacteria, which are the primary producers in hydrothermal vent systems. The deep-sea shrimp species *Mirocaris fortunata* lives around hydrothermal vents along the Mid-Atlantic ridge feeding on this chemosynthetic bacteria. Hydrothermal vents occur in clusters along the ridge, separating the shrimp into several populations at separate sites. Shrimp were collected from four populations on the ridge that span approximately 2900 km: Menez Gwen, Sintra, Broken Spur, and Logatchev. In order to study the genetic diversity of this species and the levels of gene flow that exist between the separate populations, we extracted DNA from multiple shrimp samples from each population. We amplified the cytochrome oxidase subunit I (COI) mitochondrial gene using the polymerase chain reaction (PCR) and sequenced the molecular marker. We will compare the genetic sequences from the different populations and study the relationships between the populations using a variety of genetic analyses including an analysis of molecular variance (AMOVA) and statistical parsimony. The results from this study will give insight into the communities located at these deep-sea hydrothermal vents. With more information about the vents and communities we can gain a greater understanding of how populations at hydrothermal vents interact with each other, and expand our understanding of the dynamic processes that can influence the distribution of ocean life.





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**Mathematics/Computer Science - General Poster Session**

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**e-Poster**  
**Log Analyzer & Viewer Application (LAVA)**

Maria Street\* &amp; Amy Hammond, Gordon College

The Maine Army National Guard (MEARNG) maintains a network that consists of a large number of servers, network routers, and network switches. These devices form the critical backbone of the MEARNG network. To monitor these devices a logging mechanism is required. Currently, the MEARNG has implemented a Linux based rsyslogd server, using a MySQL backend database to collect logs produced by these devices on a twenty-four hour, seven days a week basis. The rsyslogd server is the MEARNG's first step to present logged data to system administrators in an easy to use format. They lack a modern and easy to use interface for this information. The objectives for the Computer Log Viewer Application project are to develop a web based front end product that would be accessible from a variety of end user devices. These devices include hand-held mobile devices such as tablets and smart-phones, and traditional desktop or laptop computers. The final application will provide an easy to use interface that allows a user to navigate down to individual devices and error, information, or warning messages. The application will also provide querying and filtering capabilities for further analysis of the devices.

[Other: General]

Sponsor: Russell Bjork

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**Physical Sciences – General Poster Session**

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**Ultra Upgrade: Using Ultrasound to Synthesize the Elusive Grignard Reagent**

Trevor Hinshaw\* &amp; Owen Williams, Gordon College

When the spring 2012 Gordon College Organic Chemistry class tried to complete the Grignard reaction in laboratory, 95% of the class was unable to generate the Grignard reagent. While this synthesis is typically somewhat difficult to initiate we have never had such difficulty. This was our motivation to seek a way to improve the first step of the Grignard reaction. Following a published procedure, we used an ultrasound bath to activate the magnesium so the reaction would proceed much more effectively. We found that the ultrasound was so effective that the reaction could be initiated in about two minutes at room temperature. We also investigated the possibility of using the ultrasound "catalytically" to make a single ultrasound bath sufficient for an entire lab section. The goal is to use these findings to create a greener and more effective lab protocol for the Organic Chemistry class.

[Physical Sciences: General]

Sponsor: Irvin J. Levy

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**Quantifying Oil in Lane French Fries  
Using Fatty Acid Methyl Ester Derivatization and Gas Chromatography**

Rachel Otto\*, Gordon College

The goal of this project was to quantitatively determine the amount of fat in a standard size serving of Lane French Fries. For the purposes of this experiment, the amount of fat was assumed to come solely from the oil introduced into the fries while in the fryer. This is valid approximation because potatoes themselves have much less than 1 gram of fat per serving. The oil was extracted using two different methods in order to compare the effectiveness of each. The first method involved mixing the sample with heptane by shaking, while the second method was a soxhlet extraction with heptane. The fatty acids within the extracted oils were then derivatized into fatty acid methyl esters (FAME). These components were quantified using gas chromatography based on a series of standards containing known amounts of fryer oil.

[Physical Sciences: General]

Sponsor: Dwight Tshudy

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**An Analysis of Lead Concentration in Soil at Gordon using Elemental Analysis**

Jonathan Stephan\*, Gordon College

Lead (Pb) can be found in the soil around old buildings because of the historical use of lead-based paint. Lead can enter the soil from paint through falling paint chips and leeching from rainwater. This increase of lead concentration can result in an increase of occurrence of lead poisoning in people in contact with severely contaminated soil. A popular and effective technique used to determine trace elements levels in soil samples is graphite furnace atomic absorption spectroscopy (GFAAS). GFAAS is commonly used because of its high sensitivity and low limit of detection. Using EPA methods for soil sample collection

and sample preparation, soil samples were analyzed from around one of the oldest buildings on campus that may have had been painted with lead paint. Samples were taken at numerous distances from the building to determine the relationship between distance and lead concentration. Lead concentration is expected to increase as the distance from the hall decreased.

[Physical Sciences: General]

Sponsor: Dwight Tshudy

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## Hysteresis

Kelly Ortendahl, Gordon College; Alegra Aulie, ; Ruben Cabrera\*,

This is a study on the concept of hysteresis, and how to induce a permanent magnetic field in an iron based torroid. We were able to observe the effect of hysteresis as our torroid was magnetized in both directions and displayed the behaviors we expected to see when studying hysteresis. As we increased the current in the positive direction, we were able to see an increase in magnetism up to a threshold value, and upon reversing the current, we observed the same effect in the opposite direction just as we expected.

[Physical Sciences: General]

Sponsor: David Lee

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## The Detection and Quantification of Methyl Ether Hydroquinone in Methylmethacrylate Monomer using High Performance Liquid Chromatography

Bria Pelletier\*, Gordon College

Polymer synthesis occurs when monomers bond to one another to form a long chain. This reaction is initiated by the addition of an initiator. Monomers such as methymethacrylate (MMA) are normally stored in regular chemical storage bottles, but have the tendency to self-polymerize if not stabilized. To prevent this, an inhibitor such as methyl ether hydroquinone (MEHQ) is added in very small concentrations to the monomer while in storage. Because the inhibitor interferes with polymerization it must be removed before polymerization studies can occur. There are several ways to remove the inhibitor and one method is filtering the monomer through a specialized column which binds the inhibitor resulting in unstabilized MMA. As the column ages, it can lose capacity which means that not all of the MEHQ would be removed. This experiment will determine the amount of MEHQ in the MMA monomer after it has been filtered through the separation column. Reverse-Phase High Performance Liquid Chromatography (HPLC) was used to determine the amount of inhibitor present in the MMA monomer before and after the filtration.

[Physical Sciences: General]

Sponsor: Dwight Tshudy

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## **Making Green Greener: Using Less Catalyst in an Already Environmentally-friendly Aldol Reaction**

Brett Haschig, Madeline Kong, Mike Muthersbaugh\*, & Charles Shaw, Gordon College

In this experiment we analyzed aspects of the reaction in the paper "Proline catalyzed aldol reactions in aqueous micelles: an environmentally friendly reaction system". Our goal was to determine whether this reaction could still achieve high product yield in the presence of less surfactant or less catalyst. To test this, the first experiment was performed following the method described in the paper; however, the reaction was stirred for one week as opposed to being heated for one day. This methodology proved to be equally effective. The next two experiments reduced the amount of proline (catalyst) and still attained a high yield of the desired product. The next experiment kept all factors constant in the reaction except for the amount of SDS (surfactant) used. More research is being conducted to determine whether this altered the yield of the desired product.

[Physical Sciences: General]

Sponsor: Irvin J. Levy

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## **Recyclable Organic Solvents: Comparing Conventional Ionic Liquid Synthesis with Synthesis in a Conventional Household Microwave**

Justin Andrews\*, Jenny Goss, Michael Mann, Ean Mullins,  
Shanell Percy, & Andrew Swartzel, Gordon College

Ionic liquids, which among other benefits show potential as green and reusable solvents for organic reactions, are molten salts possessing a melting point below 100 °C. Two different ionic liquids (1-hexylbenzimidazolium tetrafluoroborate and 1-hexyl-3-methylimidazolium iodide) were synthesized by different methods. The synthesis of the 1-hexylbenzimidazolium species was attempted using conventional methods. An addition reaction was performed between benzimidazole and 1-iodohexane, and then purified by extraction with 1,1-dimethoxyethane. During the purification process (simple distillation), the sample decomposed. Separately, the 1-hexyl-3-methylimidazolium iodide species was synthesized using a solvent-free, microwave-assisted synthesis in a domestic microwave oven. The product was purified in a vacuum oven for seven days. NMR and IR spectra were recorded for product identification. The successful microwave synthesis method is here compared to the conventional method in terms of E-factor, ease and safety.

[Physical Sciences: General]

Sponsor: Irvin J. Levy

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## **Magnetic Precession**

Karen Craven\* & Morgan Shook, Gordon College

In this Magnetic Precession lab, we explored the relationship between the torque experienced by a magnetic dipole and the ball's change in angular momentum. We did this by studying the movement of a spinning cue ball with an internal magnetic dipole. By first spinning the cue ball and then turning on an external magnetic field, the ball experienced a torque which caused a change in the ball's angular momentum. This was seen in the precession of the ball. Through this experiment we were able to

measure the angular momentum of the cue ball and subsequently calculate the magnetic moment of the magnet within the cue ball.

[Physical Sciences: General]

Sponsors: David Lee & Lauren Mailman

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## **Tracking of the Photocatalytic Oxidation of CO by TiO<sub>2</sub> Nanoparticles Imbedded in a Porous Polymer Wafer Based Reactor with an FTIR Spectrometer**

Lee Andrews\*, Dwight Tshudy, Joel Boyd, Ben Stewart, & Bria Pelletier, Gordon College

Titania (TiO<sub>2</sub>) is a well known photocatalyst that can oxidize organic molecules in the presence of ultraviolet light and oxygen. TiO<sub>2</sub> nanoparticles can be deposited in a porous polymer wafer made of low cross-link density poly(methyl methacrylate) (PMMA) and used in a flow-through reactor consisting of a wafer sealed in a UV transparent cylindrical acrylic case for the photocatalytic degradation of aqueous pollutants via the formation of reactive oxygen species. Carbon monoxide (CO), an odorless tasteless gas that can be lethally toxic to humans, is a byproduct of incomplete combustion reactions such as car exhaust. This study shows that the porous polymer wafer reactors made in our lab can be used for the photocatalytic oxidation of CO into CO<sub>2</sub> in the presence of O<sub>2</sub> and directly exposed to ultraviolet light. Further testing was done to determine if the porous polymer wafer was being degraded into CO<sub>2</sub> by the ultraviolet light. A Bruker Fourier Transforms Infrared Spectrometer (FTIR) was used to track the levels of CO and CO<sub>2</sub>.

[Physical Sciences: General]

Sponsors: Dwight Tshudy & Joel Boyd

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## **The Ising Model**

Melissa Haire\* & Jon Hamill, Gordon College

In this lab, we explored the dynamics of a ferromagnetic system through the 2D Ising Model. We observed the magnetization and susceptibility of the system through the phase transition that occurs about the critical temperature. We implemented Monte Carlo simulations (rather than solving the model analytically) with Matlab using a Metropolis Algorithm. We plotted free energy, magnetization, and susceptibility versus temperature with and without an applied magnetic field. We found a critical temperature of  $T_c = 2.285$  for our Ising Simulation with magnetic field and  $T_c =$  without a magnetic field.

[Physical Sciences: General]

Sponsors: David Lee & Lauren Mailman

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## **Torsional Oscillation**

Ethan Davidson\*, Derek Skeen, & Jete Thames, Gordon College

This lab experiment explored various types of harmonic oscillation. These oscillations had a torsional restoring force due to the equilibrium state of the rotational disc. We effected the oscillation's period by damping and driving our system. By creating a constant magnetic field around the disc we damped the motion and were able to evaluate how the oscillation period responded. We then created a changing magnetic field in order to drive the system. In both the damped and driven system we were able to calculate the system's resonance frequency.

[Physical Sciences: General]

Sponsors: David Lee & Lauren Mailman

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## **Determination of the Optimal Crosslink Density for Polymers Used as Support Materials for Nanoparticle TiO<sub>2</sub> Water Purification**

Clyde Daly\*, Bria Pelletier, Ben Stewart, & Joel Boyd, Gordon College

Nanoparticle TiO<sub>2</sub> has been shown to be able to photocatalytically purify water when exposed to UV light. However, because nanoparticles are difficult to remove from water and generally have unknown toxicity, so the TiO<sub>2</sub> must be permanently deposited onto a surface over which water can flow. Polymethylmethacrylate (PMMA) materials are effective for this application. The TiO<sub>2</sub>-PMMA composite material should be designed to allow the maximum possible deposition of TiO<sub>2</sub> onto PMMA. The crosslink density of the PMMA materials is expected to be an important factor in total TiO<sub>2</sub> deposition. In this work, the PMMA crosslink densities of the TiO<sub>2</sub>-PMMA composite materials were varied and the rate of photocatalytic water purification, measured by UV-Vis spectroscopy, was used as a measure of the photocatalytic activity of the materials. It was shown that increasing crosslink density lowers the average rates of photocatalytic degradation.

[Physical Sciences: General]

Sponsors: Dwight Tshudy & Joel Boyd

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## **A Surprising Color Changing Substance: Preparation of a Thermochromic Copper Compound**

Libby Wulfken, Leah Brown, & Sarah McCarron\*, Gordon College

One of the major problems chemistry teachers face, especially in introductory courses, is motivating student excitement about the chemistry they are learning. Color changes that can be seen with thermochromic substances can have that effect producing a "wow factor" during lab. For example, a substance that begins as bright blue crystals and colorless liquid that becomes a dark blue liquid, then a red solid, then a violet solid is exciting to watch. In this project we developed an organometallic synthesis of a thermochromic solid for use in the introductory chemistry laboratory curriculum. The existing lab procedure produces more waste than desired and therefore a more green option was sought. A lab was needed that could still be done within the three hour lab period and was also less toxic. After a literature search, keeping in mind the limitations, we chose a procedure for the preparation and thermochromic properties of bis(N,N-diethylethylenediamine)copper(II) nitrate ([Cu(deen)<sub>2</sub>][(NO<sub>3</sub>)<sub>2</sub>]) complexes. Our procedure is greener than the published procedure because we used less hazardous solvents and produced less waste. An unexpected discovery showed that this product also undergoes a reversible color change on exposure to humidity.

[Physical Sciences: General]

Sponsor: Irvin J. Levy

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## **Green Chemistry in the Laboratory Curriculum: Alkene Synthesis by Dehydration of Alcohols in the Presence of Montmorillonite Clay**

Rachael Albury\*, Gordon College; Irv Levy, Gordon College;  
, Gordon College

The synthesis of alkenes from alcohols has typically been carried out at high temperature in the presence of sulfuric acid or phosphoric acid. The purpose of this research is to find a greener alternative that can be implemented in the laboratory curriculum. The principles of green chemistry aim to minimize hazardous waste as well as harmful impacts on health and the environment. The aim of this research is to identify a readily available clay catalyst that can be used in place of mineral acid for dehydration of a variety of primary, secondary and tertiary alcohols. Students will be asked to evaluate this process in comparison to a standard textbook dehydration by referring to the 12 Principles of Green Chemistry.

[Physical Sciences: General]

Sponsor: Irvin J. Levy

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## **Taking the Pep Out of Peppers: Quantitative Determination of Oil in Pepper Seeds**

Mollie Enright, Brittany Marshall\*, & Jose Soltero, Gordon College

The purpose of this project is to achieve a quantitative determination of oil from different varieties of pepper seed including: California Wonder and Aji Colorado. This work is in cooperation with the USDA to determine a system for quantitative analysis of the oil content of different varieties of pepper seeds in order regulate the quality of seeds by their oil content. In our method, a Soxhlet extractor and heptane solvent were used to extract oil from seeds to determine the number of flushes required to obtain all of the oil from the seed. We then extracted oils from pepper seeds to determine the maximum amount of oil that could be obtained from those seeds. We first determined the percent moisture in the seeds by using a drying oven and determining the initial and final masses of the seeds so that the change in mass after the Soxhlet extraction was only the change in the oil content of the seeds. So far the seeds have shown consistent loss of mass after using the Soxhlet extractor and have continued to produce a significant amount of oil that has yet to be quantitatively determined. Full results will appear in the poster.

[Physical Sciences: General]

Sponsor: Irvin J. Levy

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## **Thiamine-Catalyzed Quinoxaline Ring Condensation**

Alex Gordon\*, Dimitris Fanis, & Zach Hatch, Gordon College

Our experiment deals with analyzing the best way to introduce students to thiamine (vitamin B1; VB1) as a catalyst in organic chemistry. In specific, we followed a published procedure using VB1 to catalyze the preparation of quinoxalines from 1,2-diamine and 1,2-diketones. In our work, we have modified the published procedure significantly to make it more practical for a student lab. We have eliminated expensive equipment used in the original procedure and also accelerated the reaction. In addition, we varied the temperature and time for the reaction to take place. This has an effect of possibly lowering



the yield of the experiment, but making it more practical for teaching. Additionally, we have explored the necessity of submersing the reaction tube in an ultrasound bath, as was done by the authors.

[Physical Sciences: General]

Sponsor: Irvin J. Levy

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### **Magnetic Torque**

Jeff Ratzloff\*, Greg Gutsell, & Nathan Calandra, Gordon College

In this experiment we set out to determine Magnetic Torque exerted in between two Helmholtz coils with current,  $I$ , owing through them. Through examination of our data points we were able to determine the permittivity of free space as well as the magnetic moment of the two coils.

[Physical Sciences: General]

Sponsor: David Lee

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### **Where's the Plumbum?**

Ben Stewart\*, Bria Pelletier, Clyde Daly, Elise Gershman, Lee Andrews,  
Jonathan Stephan, & Rachel Otto, Gordon College

Gunshot residue (GSR) is of interest in forensic analyses. It is important to be able to track what happens to nearby objects when a weapon is fired. Trace amounts of lead (Pb) can be used to track the presence of gunpowder residue on objects such as clothing. If the concentration of lead on an object is known, then one should be able to estimate the distance the gun was from the object at the time the gun was fired. Reference samples of cotton, at different distances from the gun, were analyzed for lead content by atomic absorption spectroscopy. The lead distribution surrounding a bullet hole can then be related to the distance the cloth was from the gun.

[Physical Sciences: General]

Sponsor: Dwight Tshudy

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### **Selective Oxidation of Alcohols to Aldehydes**

Sam Mason\*, HanByul Chang, & Kelsey Bala, Gordon College

This research project focuses on the oxidation of benzyl alcohol to benzaldehyde. Techniques such as reflux and simple distillation were used to complete the oxidation reaction and to obtain benzaldehyde product. Benzaldehyde's identity was confirmed by infrared spectroscopy and purity was determined with gas chromatography (GC). The GC revealed that a second, non-target substance was also obtained during the distillation. Tetrakis(benzyltriethylammonium) octamolybdate catalyst was synthesized and used in the oxidations of the alcohol. The catalyst used in the initial oxidation of benzyl alcohol was recycled several times to determine the possible reusability of the compound in catalyzing the reaction. Using the oxidation process of benzyl alcohol as a reference point, cinnamyl alcohol was oxidized.

[Physical Sciences: General]

Sponsor: Irvin J. Levy

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## **Two Green Approaches to the Multicomponent Synthesis of Polyhydroquinoline Derivatives**

Lauren Burns, Ruth Chadwick, Mekdes Getaneh, Lauren Horsley\*,  
Damilola Junaid, & HaYoung Nam, Gordon College

This project focused on using two different greener methods, solar heating and grinding, to synthesize polyhydroquinoline derivatives (drugs used for cardiovascular diseases) via a four-component synthesis. Both methods are considered greener because the solar thermochemical way is “simple, environmentally friendly, economical, and high yielding,” while the grinding reaction is solvent free. One component of the reaction, the aryl aldehyde, was changed during each run to test how it affected the percent yield and if it led to the desired product. For the solar thermochemical reactions, benzaldehyde and 3-nitrobenzaldehyde were tested. For the grinding reactions, four different aryl aldehydes were tested: benzaldehyde, 3-hydroxybenzaldehyde, 3-nitrobenzaldehyde, and 4-nitrobenzaldehyde. Using both methods, product was successfully produced.

[Physical Sciences: General]

Sponsor: Irvin J. Levy

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## **A Comparison of Caffeine and Taurine Concentrations in Various Marketed Energy Drinks**

Elise Gershman\*, Gordon College

Energy drinks are popular beverages loaded with caffeine, taurine, and several other ingredients intended to increase alertness. Taurine can increase the stimulant power of caffeine, but both can be toxic at high doses. Therefore it is important to know exactly how much caffeine and taurine is actually being consumed. The concentrations of caffeine and taurine in various brands of energy drinks were quantitatively determined using reversed-phase high-performance liquid chromatography (HPLC) in conjunction with UV-Vis spectroscopy. Samples of Red Bull, Rockstar, AMP, Archer Farms, Essential Energy, Maximum Velocity, and Monster were run through the Varian ProStar HPLC system. The measured concentrations of caffeine and taurine were compared to the tabulated values found on the cans in order to check the accuracy of the companies’ marketing. Also the concentrations were compared to find the energy drink possessing the most caffeine and taurine.

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## Social Sciences – General Poster Session

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### Teaching Self-Regulation Skills in the Elementary Classroom

Katelyn Noonan\*, Gordon College

Many students display behavior that reflects a deficit in self-regulation. Research indicates that students diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) are likely to have difficulty self-regulating their emotions and behaviors. Strategies to improve self-regulation skills include: self-monitoring, self-monitoring plus reinforcement, self-reinforcement, and self-management. Factors that deter self-regulation include negative emotions, lapses, and missed cues. Factors that promote self-regulation skills are warmth, predictability, and organization. I conducted a study on self-regulation skills in a third-grade classroom with fifteen students. Three of the students were diagnosed with ADHD. Two weeks prior to implementing a plan, I used a tally sheet to track students' behavior during the daily Mathematics lesson. The categories included: playing with objects, disrupting peers, and out of seat. Tally marks were recorded during ten-minute intervals throughout the lesson. A separate chart with the same categories was used for the three students diagnosed with ADHD. Direct quotes from students were also recorded. The study sought to conclude if allowing students to monitor their own behavior during math lessons improved their engaged behavior and decreased their disengaged behavior. For two weeks students were given a list of three behavior goals the class decided on at the beginning of the Math lesson. They were given one minute to add a personal goal to the list. After the lesson, students rated their behavior on a scale from one to three indicating whether or not they reached their goals. Students recorded the reasons they rated their behavior this way. The same tally sheet used in the weeks prior to implementing the plan was used to monitor students' behavior. A comparison of the tally sheets collected before and during the plan was used to measure if having students monitor their own behavior resulted in a decrease of disengaged behavior. Results indicate that there was no dramatic change in students' behavior apart from the first day. However, students' goals and reflections grew more specific and accurate as the study went on. It seems that the results I had originally anticipated were too drastic for such a short period of time. Perhaps implementing self-regulation strategies at the beginning of the year and tracking students' behavior throughout the year would result in different data.

[Social Sciences: General]

Sponsors: Janet Arndt, Joyce Meeuwsen, & Priscilla Nelson

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### Will the Use of Manipulatives in a Third Grade Math Classroom Affect the Overall Academic Performance of Students Diagnosed with Hyperactivity

Timothy Drake\*, Gordon College

The point of this study is to determine if using manipulatives in a third grade math classroom will affect the overall academic performance of students diagnosed with hyperactivity. In this study, students overall academic performance will be based on student's comprehension of taught materials. This study will be administered over several weeks in a third grade classroom containing 23 students, but will focus on five specific students who have been labelled as hyperactive. These five students consist of two males and three females. The data collection for this study will compare assessment results of students

when using manipulatives, with assessments results of students when not using manipulatives. The non-manipulative assessment of students will be an average of all mathematic benchmarks, taken in third grade. The assessments using manipulatives will consists of two tests and one independent assessment. The final result of this study will compare non-manipulative assessments with assessments using manipulatives, in order to determine if using manipulatives will increase the overall academic performance of students diagnosed as hyperactive.

[Social Sciences: General]

Sponsors: Janet Arndt, Joyce Meeuwsen, & Priscilla Nelson

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## **The Effects of Parenting Style on Academic Achievement**

Sarah Hawkins\* & Kaethe Brewster, Gordon College

Previous research shows that parenting styles affect multiple areas of children's lives, whether children are aware of the impact or not. Three primary types of parenting styles have been identified as permissive, authoritative, and authoritarian. Permissive parenting is nondirective, has little behavioral expectations and places less responsibility on the child. Authoritative parenting is more direct and involves rules and expectations that are discussed openly with the child. Authoritarian parenting is the most directive and involves strict parenting, high expectations of conformity, and compliance and no discussion regarding rules that are set forth. This study explored the relationship between parenting style and academic achievement, within the specific population of a liberal arts, non-denominational college; Gordon College. The focus of the study was on the permissive style of parenting, examining how many students with permissive parents are present at Gordon College and whether their academic achievement is impacted by this specific parenting style. A sample of 55 students, ranging from freshmen through seniors, was given a survey including the Parental Authority Questionnaire (PAQ; a well established measure of parenting style) and a qualitative survey to measure academic achievement and study habits. The results of the study showed that of the 55 participants, only 5 had parents with a permissive style, 14 had an authoritarian style, and 32 had an authoritative style, with 4 participants describing more than one parenting style. A one way analysis of variance (ANOVA) revealed no significant difference between the academic achievements of students with parents of the three different styles. Neither the SAT scores nor the GPAs of participants differed significantly between students with parents of the three styles. Qualitative results provide a picture of Gordon College students' study habits, describing textbook reviewing as the most common study technique (listed by 41 of 55 participants) the second most common being studying class notes (40 out of 55 participants). Overall, Gordon students spend more than 10 hours a week on homework (15-20hrs for authoritarian/authoritative and 10-12hrs for permissive). Implications of these results as well as the significance of the low prevalence of permissive parenting styles at Gordon College are discussed.

[Social Sciences: General]

Sponsor: Christina Riggs Romaine

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## **Implementation of Hand and Body Motions in Science Vocabulary Instruction for English Language Learners**

Katherine Rearick\*, Gordon College

This study examined the influence of interactive motion as students participated in hand and body motions used to assist the instruction of and enforce thematic science vocabulary. Observations made prior to the implementation of the hand and body motions revealed that English language learners knew fewer thematic science vocabulary words and had a harder time comprehending these words through

conventional vocabulary instruction. The study specifically targets students identified as English language learners who will need more thematic science vocabulary scaffolding. This study was conducted in a third grade science class of 28 students, with at least 5 students who are identified as English language learners. Over the course of two weeks, a hand or body motion was taught with each science vocabulary word. Data was collected by assessing student's performance on a written vocabulary test without body motion instruction and a written assessment after the two weeks of instruction with the motions. Data was also collected through teacher observations and checklists. The results of the study revealed that gains were made in students' acquisition and comprehension of thematic science vocabulary through the use of intentional hand and body motions that correlated with specific thematic science vocabulary.

[Social Sciences: General]

Sponsor: Janet Arndt

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## **Journaling and Literacy Achievement for English Language Learners**

Esther Ocock\*, Gordon College

This study examines the positive effect of journaling on the reading achievement of English Language Learners with language proficiency levels of L1 and L2 in a first grade classroom. The study looked specifically at whether journaling on a regular basis will increase literacy achievement in the areas of phonemic awareness, phonics, and oral reading fluency. In a sample first grade classroom with a mixed population of native English speakers and English Language learners, students were divided into two separate groups comprised of a mix of high level readers, low level readers, native speakers, and language learners. One group acted as the control with no change to their daily literacy instruction, and one group journaled three days per week for roughly six weeks. At the end of the six weeks, data was collected on the effects of the journaling on reading achievement using DIBELS progress monitoring, supplemented by sample student journals and weekly dictation tests showing evidence of growth over time. While data from the journals indicated significant growth over the six weeks, data from the weekly dictation tests showed no significant overall growth. The DIBELS progress monitoring indicated growth in the area of oral reading fluency but not phonemic awareness or phonics skills, as indicated by results of the phoneme segmentation and nonsense word fluency.

[Social Sciences: General]

Sponsors: Janet Arndt, Joyce Meeuwsen, & Priscilla Nelson

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## **Choosing Truth over Correctness, and Social Solidarity over Agreement**

Justina Cassidy\*, Aaron Noga, Aashley Thompson, & Bert Hodges, Gordon College

Participants were asked to speak from a position of ignorance after two better-positioned participants had indicated the correct answer. Virtually all psychological theories predict that the participants will agree with the answers given by the better informed others. Values-pragmatics theory (Hodges & Geyer, 2006), however, predicts that people in a position of ignorance will often choose to disagree with the correct answers of others. Forty-six participants answered questions while in position of ignorance, then in a position of knowledge (or vice versa), after hearing two others answer correctly. Results indicated that participants rarely if ever disagree with correct answers when in a position of knowledge, but when in a position of ignorance they frequently choose to disagree (about 30% of the time). Various measures of motivation supported the claims of values-pragmatics theory that disagreeing answers occur because participants are motivated to be truthful, not just correct, and by concerns for social solidarity, not

merely being agreeable. Pragmatic warrant for epistemic claims appears to be what is crucial to decisions about whether to agree or disagree, rather than concerns about conformity or independence.

[Social Sciences: General]

Sponsor: Bert Hodges

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## **The Allure of Television**

Rylee Rainwater\* & Ashley Pengelly, Gordon College

Since the rise of television popularization, there have been countless studies that have portrayed the after-effects of television consumption. This research included topics that demonstrated a correlation between violent programming and aggressive behavioral responses or the effects of television-viewing habits on individual intelligence. However, few studies have executed in-depth explorations of what it is that draws people to certain shows in the first place. This study aims to gain an essence of what television content American college students prefer and how those choices contribute to the wider popularity of any given show. Participants, seventy-five in total, were asked to complete a television survey in which they selected three shows that they watched on a regular basis. Given a scale of one to ten, one being the least and ten being the most, they were instructed to rate their overall enjoyment level, followed by amount of violence, comedy, and romance portrayed in each show. Along with these scales, open-ended questions were provided in order for the participants to explain why they enjoyed the show or how they believed the specific content in question added to the show as a whole. After the survey was completed, each participant was given a follow-up television diary in which they were use the structured format that was provided to log anything that they watched in the next five days. The format of the diary asked the participant to list what they had watched with a brief description and another rating of enjoyment on the same scale that was used in the survey. The hypothesized theory had anticipated that violence would be the persisting factor that would draw in viewers, but data analysis proved this was not the case. Through the data, it was revealed that shows with comedic elements have a stronger retention rate. We can conclude that humor is a vital component for high rates in program popularity.

[Social Sciences: General]

Sponsor: Jonathan P. Gerber

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## **Telling the Truth under the Pressure of Conformity**

Justina Cassidy\*, Aaron Noga, Aashley Thompson, & Bert Hodges, Gordon College

Values-pragmatics theory (Hodges, 2007; Hodges & Geyer, 2006) argues that people may agree with incorrect answers, or disagree with correct answers, in certain situations because they care about truth, about others, and that others care about truth. Prior research has provided support for these paradoxical predictions, but there has been no attempt previously to manipulate people's motivations regarding truth-telling. In this experiment participants were told that the more correct answers they gave, the more likely they were to win a \$30 prize. Participants, however, were placed in a position where they could see clearly enough to answer correctly only a few times. Most of the time, the only way they could answer correctly was to repeat the answers provided by others in better positions who had answered before them. Half of the participants were primed to be especially sensitive to truthfulness, and half were not, by a few added sentences which mentioned cheating. Results indicated that primed participants chose not to agree with correct answers of better positioned others 45% of the time, while unprimed participants did so only 14% of the time. This result suggests that people are

willing to forego being correct, being agreeable, winning money, and helping others win money, for the sake of being truthful.

[Social Sciences: General]

Sponsor: Bert Hodges

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## **Improving Reading Comprehension**

Amanda Place\*, Gordon College

This study explores the need for developing comprehension skills in the classroom that extend reading beyond fluency, and promote deeper reading of texts so students could answer comprehensive questions about their readings, especially in an MCAS setting. This was explored through using differentiated instruction with a select group of students. The sample group for this study included six students, two boys and four girls, in a third grade classroom. The DIBELS scores of these students placed them in the average reading groups, and as a result, they did not receive additional support. Out of the twenty-seven students in this class, these six students were identified as having a difficult time with reading comprehension. Seven steps were created to help these students review and actively read different texts for comprehension. The data for this study was collected from three different areas. Personal observations from the student teacher were recorded and reflected upon, and the general classroom teacher was given a survey to complete about the effectiveness of this seven-step program. The final data sample came from collecting practice MCAS tests, both where they used the steps and did not use the steps, which the students completed. The data was coded and analyzed. The results revealed that using the steps to guide them, the students' comprehension of the texts increased and they were able to answer open-ended questions about the material that they had read. However, if the student did not use the steps, their performance suffered.

[Social Sciences: General]

Sponsors: Janet Arndt, Joyce Meeuwsen, & Priscilla Nelson

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## **The Engagement of ESL Kindergartners in Reading**

Rebecca Meekins\*, Gordon College

Does prediction journals and small reading groups improve the engagement of ESL Kindergartners in reading? As classrooms become more diverse it is important for teachers to implement strategies and methods that engage students of all backgrounds and languages. Identifying and building on a child's background gives a child access to the learning experience. For this research study the participants included 5 ESL Kindergartners. The study took place during two-one consecutive weeks. The Kindergartners were observed during a non-fiction read-aloud for one consecutive week and their engagement was recorded. The Kindergartners were observed for a second consecutive week during a non-fiction read-aloud and their engagement was recorded. During the second week the Kindergartners used prediction journals. The prediction journals were analyzed and used for qualitative data purposes. As a result of this study there was small improvement for 3 of the ESL Kindergartners; for the remaining 2 ESL Kindergartners there was no improvement. This research study provides valuable information for teachers working in a classroom with ESL students. Utilizing the prediction journal gives these students the opportunity to engage in reading and contribute to the learning experience.

[Social Sciences: General]

Sponsor: Janet Arndt, Joyce Meeuwsen, & Priscilla Nelson

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## **Changing Religious Denominational Commitments While At College and After Graduation**

Ashley Moulton\* & Samantha Senna, Gordon College

Among Christian college alumni (Wheaton and Gordon graduates from 2006, 2008, 2010), surveyed by Dr. Cook and her research teams, we explored changes in religious denominational commitment during college and post-college. We hypothesized that: --During college, most alumni would report that they shifted away from more conservative denominations and away from denominational membership . -- After graduation, there would be a shift away from conservative religious communities to either mainstream denominations or away from denominational membership, consistent with the emerging adulthood literature. Of the 765 alumni who participated in the study, 238 were recent alumni, 287 were 2-year alumni and 240 were four-year alumni. We found that, if asked their denominational choice when they entered college and when they graduated, people generally reported a shift toward conservative denominations. Of those whose church affiliation was conservative when they entered college, 13% switched to mainline denominations, most of which were Episcopalianism. Of those whose church affiliation was mainstream, 50% switched to a conservative denomination. Upon graduation, fewer stayed in their same denomination, particularly with time since graduation (recent graduates: 43% were in the same denomination they were in when they entered college; four-year graduates: 26% were in their same denomination). However, most continued in church, a number that did not decrease with time (88% overall, 92% for four-year graduates). Results are interpreted in light of assumptions in the literature about cultural shifts in the religiosity of emerging adults and recommendations for Gordon College alumni.

[Social Sciences: General]

Sponsor: Kaye Cook

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## **Religious Priming and Prosocial Behavior**

Keiry Nunez\* & Julianne Lambert, Gordon College

**Abstract** Prior research has found that religious priming, that is, prompting a person to have religious thoughts, influences hypothetical helping behavior. That is, people exposed to religious priming are more likely to say they would offer help. However, research has not examined the effect of religious priming on actual helping behavior. We hypothesized that religious priming would likewise have a positive influence on real-life helping behavior. Thirty-nine Gordon College students were primed either religiously or neutrally using a word search task. Pro-social behavior was measured by whether or not these students offered help to a researcher stacking chairs in the testing room. Participants were also administered a questionnaire inquiring about motivations behind their helping behavior. The overwhelming majority of participants helped. Contrary to our hypothesis, chi-square analyses revealed no association between priming and actual helping behavior.

[Social Sciences: General]

Sponsor: Christina Riggs-Romaine

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## **Secrets of Romantic Relationship Involvement**

Desiree Collins\* & Esther Seo, Gordon College

Past studies have shown that insecure attachment style is associated with decreased likelihood of being involved in or committing to a romantic relationship (e.g., Schindler, Fagundes, & Murdock, 2010). Our research study seeks to understand how insecure attachment style is associated with romantic relationship involvement among college students. For our research, we collected information from 54 students. We assessed their views on romantic involvement by conducting an open-ended survey. Then we used two questionnaires, the Relationship Questionnaire and the Relationship Scale Questionnaire to assess their attachment styles in close and romantic relationships. Fearful attachment style was the most prevalent factor for those who were not involved in a romantic relationship, while preoccupied was the most common attachment style among those that were involved in a romantic relationship. These findings support our theory that insecure attachment styles are one reason why more college students are not involved in romantic relationships.

[Social Sciences: General]

Sponsor: Suzanne M. Phillips

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## **The Influence of the Implementation of Physical Activity on the Academic Engagement of First Graders in the Afternoon Hours During Math Class**

Ginger Moody\*, Gordon College

The level of academic engagement of a class of 30 first grade students was observed for 2 months. In comparison to the morning hours of the day, a general lack of academic engagement was observed during the afternoon hours of the day, which was when math instruction took place. Students often exhibited behaviors that proved a lack of involvement with the math instruction on a given day. This study seeks to find out whether or not the implementation of physical activity during the afternoon math class improves the academic engagement of a group of 30 first grade students. To begin intervention, first, the level of a lack of academic engagement of students without any sort of implementation of physical activity was observed for 1 week. The number of students who were not academically engaged was recorded every five minutes during each of the five math classes throughout the week; each math class was 1 hour long. The following week, physical activity was incorporated into the afternoon math class every day. Two types of physical activity were implemented during the lesson. Each activity involved students getting up and moving around for 5 minutes. Again, the number/names of students who were not academically engaged was recorded every five minutes during the class. Results indicate that, although the intervention plan only took place for 1 week, the implementation of 2 physical activities during the afternoon math class does improve the academic engagement of first grade students. An increase in academic engagement was evident by the lower number of students written down during the second week.

[Social Sciences: General]

Sponsor: Janet Arndt

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## **Student Outcomes Affected from the Implementation of Multiple Means of Representation in Reading Instruction**

Lindsay Malenich\*, Gordon College

In Mrs. Luciani's second grade classroom at Veteran's Memorial Elementary School in Saugus, MA students learn to the best of their ability, with the instruction provided. However, when many students are not making sufficient gains, it is not the children that we need to further investigate; it is the method of instruction. During the hour-long reading block, students were seated at their desks, reading from the textbook or completing a practice worksheet every day. Students were overall disengaged from the lesson, unmotivated to read, and were performing poorly on weekly spelling and reading quizzes. My action research sought to answer how implementing multiple means of representation during a whole group lesson, affected student-learning outcomes in academically struggling students. Through my research, I collected that a combination of whole group instruction, as well as small group reading instruction was the most effective balanced literacy approach. Utilizing a variety of means of representation including explicit auditory and visual direct instruction, kinesthetic learning activities, and use of different manipulatives allowed for students to engage on another level with the material. For the first week, I made observations of student engagement, understanding of learning objectives, as well as student motivation during the lesson. After the week of whole group lessons, I implemented three literacy centers, in which students were grouped based on DIBELS Next progress monitoring scores. Students rotated around the room, working on a different skill at each station. These centers were implemented for 2 weeks. I implemented multiple means of representation into each lesson, as described above. During lessons, I kept a running checklist evaluating students in three different categories: motivation, understanding and accomplishment of learning objective, and student level of engagement. Student motivation was measured by the completion of each activity. Students keeping eyes on the teacher during direct instruction, and engaging with the materials during activities measured student engagement. Each week, I collected student spelling and reading test scores, to evaluate data. Following centers, students were given an evaluation survey, in which they identified how the literacy centers helped to improve their motivation, engagement within the lesson, and overall improvement within the five components of reading. Overall, every student increased in motivation and engagement with the material. More students were looking at the teacher, and engaging with manipulatives than within the previous whole group structure. Scores on the spelling tests greatly increased, due to a better understanding of phonics. Reading comprehension was still weak in many students though. Through this intervention strategy, student learning, engagement and motivation increased, due to the multiple means of representation used during literacy instruction.

[Social Sciences: General]

Sponsors: Janet Arndt, Joyce Meeuwsen, & Priscilla Nelson

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## **Corrective Discipline**

Alexandra O'Connor\*, Gordon College

This study is researching the effectiveness of private correction versus public correction within a first grade classroom. Literature describes pulling a child aside as a more effective approach to behavioral correction, rather than addressing the student in front of the whole class (Moles, 200). The current classroom teacher believes that the most positive and efficient way to run a classroom is with student silence and respect for teacher authority. The teacher succeeds in creating this classroom environment by raising her voice when she believes that the students are behaving inappropriately in front of the

other students. She corrects the students publicly. Twenty-seven students between the ages of six and seven were corrected privately when dealing with a behavioral problem for one week by the student teacher. Data was collected through observations and checklists. The results reveal that the student's behavior did not improve with private correction, although a closer relationship with the student teacher was noted.

[Social Sciences: General]

Sponsors: Janet Arndt, Joyce Meeuwsen, & Priscilla Nelson

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## **The Effect of Classical Music in the Art Classroom**

Julia Mullins\*, Gordon College

This study explores the effect of classical music on students on-task performance and engagement in lesson within the art classroom. It seeks to discover the power in combining soft instrumental music with visual art, specifically in how that combination affects students' productivity and focus on their art projects. Classical music was introduced to grades kindergarten through fifth grade in an elementary art classroom. Students were observed on their reactions to it, and were asked for their personal connections and work preferences concerning the music. Data was collected through informal interviews with the students as they created their art projects, a formal interview with the cooperating teacher, and a record sheet describing class reactions as a whole based on noise level and work production. Through analyzing the personal reflections on the music, the students almost unanimously preferred to listen to classical music over silence, stating that they felt calmer, found it easier to concentrate on their work, and experienced a greater connection to their artwork. Classical music was also found to have an overall peaceful effect on classes as a whole, with the noise level of students generally decreasing after the music started playing, and a greater amount of students focused on their work.

[Social Sciences: General]

Sponsors: Janet Arndt, Joyce Meeuwsen, & Priscilla Nelson

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## **Work Decrement and Breaks in a Technological Context**

Adam Vogel\* & Charlie Dalton, Gordon College

Technology use in the workplace and higher education is constantly rising. The amount of work that requires technology to complete (creating reports, electronic correspondence, etc.) is also rising. Past research has indicated the importance of breaks for reclaiming productivity on sustained tasks. We tested whether the type of break an individual takes has any effect on the amount of productivity regained. We specifically tested this in a technological context by having participants type a single phrase for a continuous eight-minute block, take a three-minute break with or apart from technology, and type the same phrase for another eight-minute block. In addition to the experiment, a brief questionnaire was issued to explore students' break taking habits. A statistical analysis of productivity data found that breaks taken apart from technology does not increase their effectiveness at restoring productivity. We also found that most students' break taking habits are driven by both conditional factors and interval based breaks. Types of breaks students took were almost evenly split between technology absent and technology use. No correlations could be drawn between the qualitative responses.

[Social Sciences: General]

Sponsor: Jonathan P. Gerber

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## **The Effect of Perception Through Stepping**

Colby Esposito\*, Caitlin Montville, & Rachel Budhi, Gordon College

This study looks at the avoidance of obstacles through visual perception. In this study participants stepped over a series of three obstacles. The distance was then recorded between the foot and the top of the object which they were stepping over. However numbers of no significance were placed at the front of each object. These numbers, are suspected, to effect how our participants would "step" over each obstacle. Their perception of what the numbers mean would translate through their movement through the obstacle course.

[Social Sciences: General]

Sponsor: Bert H. Hodges

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## **Cerebral dominance: Are we learning the way we need to?**

Erika Abrahamsen\* & Nicole Turk, Gordon College

Cerebral dominance, or the concept of using one cerebral hemisphere more than the other, is a widely known but criticized concept in psychology. This study intends to reveal more about the brain and how it allows us to learn and absorb information. Our goal is to explore a relationship between cerebral dominance and problem solving style so that further implications may be made within the classroom. The participants consisted of 42 college students, varying in gender and major, who volunteered to participate. They were first issued an introductory survey asking for covariates (gender, major, and handedness), along with a copy of the Winning Colors test, which was used to depict the participant's cerebral dominance. They were then given the second part of the test, a problem solving questionnaire designed to show the type of problem solving skills the participant prefers. The two tests were then analyzed separately to eliminate bias, using a predetermined codebook for each section. The results showed that there is a relationship between a person's cerebral dominance and the way they solve everyday problems. People who tested positive for a left cerebral dominance displayed more typically left-brained qualities while problem solving (analytical, auditory-based, verbal, etc.) People who tested positive for a right cerebral dominance displayed more typically right-brained qualities while problem solving (creative, visual, emotion-based, etc.) Those who tested positive for integrated brain dominance displayed a mixture of the qualities. These results should urge teachers to differentiate their instruction in order to accommodate students' different learning strategies, based on their cerebral dominance.

[Social Sciences: General]

Sponsor: Suzanne Phillips

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## **The "Gordon Effect": Fact or Fiction?**

Jennifer Davies\* & Marie Ware, Gordon College

The research topic for this study is to determine if there is a pressure from the Gordon Community placed on individuals and couples to date or get married. The research problem is to determine if people noticed or felt a pressure to date and get married and then inquire if there were any mental or physical repercussions from it. In total 37 participants filled out surveys. Between the couples and singles surveys there were 5 identical questions. Four out of the 5 showed similar opinions between the two groups it was the 5th question which showed that singles thought some people were dating and that couples felt that not many people were dating. Out of the 37 participants 14 left their email to participate in an individual interview. The researchers selected eight out of the 14 based on their

answers given on their survey sheet, however only 5 returned and responded to the interview. The 5 participants were then divided by whether or not they felt pressure. Initially, participants were divided by their relationship status. Follow up interviews were conducted. The results of the interviews showed that the participants either felt pressure that impacted them daily here at Gordon or they didn't let pressure affect them however acknowledged that there is a pressure here at Gordon to be in a relationship. In conclusion the researchers determined that the quantitative data showed 3 groups of people- those aware of a pressure, those unaware of a pressure, and those in the middle. However, the qualitative data reflected only 2 groups of people those that felt pressure and those that didn't but were aware of a pressure. The researchers believe that it would be fruitful to continue studying this topic but in colleges throughout the United States. They think that the topic hasn't been studied very much at Gordon while there is always room to continue studying this topic at Gordon there isn't much need for further study.

[Social Sciences: General]

Sponsor: Suzanne Phillips

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## **Teaching Social Skills To Special Education Students**

Joseph Pulaski\*, Gordon College

**ABSTRACT** This study looks to find the effects that explicit instruction has on the social skills utilized by a student with learning disabilities when interacting with peers and adults in non-academic situations. The study looks at four different students with varying disabilities and the skills utilized in different aspects of the school day. These students all struggle with the social aspect of school and lack the social skills needed to form meaningful relationships, which are necessary for proper educational growth. Three of the students were second grade students, while one student was a kindergartner; all students were in a self-contained classroom. The second grade students were observed in the lunchroom. The skill that was assessed was being able to converse with peers during lunch. The Kindergartner was observed greeting adults and students when entering a room, as well as playing with peers. Through various explicit intervention methods the researcher looked to alter the social skills utilized by the student when in a non-academic situation. The researcher instituted different methods ranging from: small group activities, social stories, and written prompts. Data was collected through observation of the students before explicit instruction began, as well as once the instruction was underway. The researcher charted, logged, and analyzed the data that was found. In summary, the research supports the idea that explicit instruction is necessary and helpful in aiding students to become more socially acceptable and comfortable. The intervention and data were collected over a brief period of time, and even though only small improvements were found it is believed that results could be expanded if more time was allowed for the interventions. Other factors also may have affected the results in either negative or positive ways.

[Social Sciences: General]

Sponsors: Janet Arndt, Priscilla Nelson, & Joyce Meeuwssen

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## **Redeeming Lost Instructional Time for Mathematically Gifted Students**

Sally Musson\*, Gordon College

This study explored the issue of lost instructional time for mathematically gifted students in urban elementary schools. Based on suggestions from research (Diezmann & Watters, 2000; Tretter, 2010; McAllister & Plorde, 2008; and Heinze, 2005), a plan to challenge such students in the general education classroom was planned and implemented. Nine 2nd grade students, identified as performing above

grade level math at an inner city school in Lynn Massachusetts, were given the opportunity to engage in a challenging math activity each day for one week after their daily assignments were completed. Qualitative and quantitative data were collected through anecdotal notes of student conversation and recorded calculations of minutes that each student was observed spending on a mathematically challenging task. Compared to baseline data collected the week prior to implementation, results revealed that students spent an average of 14.74 more minutes working on a mathematically challenging task each day. Qualitative results also revealed that students were more engaged in cooperative learning and meaningful conversation with their peers.

[Social Sciences: General]

Sponsors: Janet Arndt, Joyce Meeuwsen, & Priscilla Nelson

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## **Comprehension of Foreign Accents Through Various Forms of Communication**

Natalie Carvalho\*, Jenna Meisenhelder, Brooke Whalen, & Joel Habrial, Gordon College

Do you ever have a hard time understanding people with accents? Do you think it would be easier to understand them if you were previously exposed to it or engaged in the conversation? Our study seeks to find if there is a relationship between engagement and comprehension where there is communication, using the same language, but where the listeners encounter an accent with which they are not familiar. We are looking to see the effectiveness of face-to-face communication even with difficulty understanding exactly what the person is saying. We expect to find that the people who engage in conversation with the accented person have a higher score on our comprehension test in comparison to the other two groups. We also hypothesize that those who watch the video of the accented person before completing the comprehension task have a better score than those who were not exposed to the accent beforehand. The results are pending as the research is still in progress.

[Social Sciences: General]

Sponsor: Bert Hodges

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## **A Study of Gender and Recognition of Children's Faces**

Allison Faber\* & Kayla Pacheco, Gordon College

Previous research shows that, when presented with a facial recognition task, women remember more faces than men and display an own gender bias, that is, they are more accurate at recalling women's faces. This study specifically explored recognition of children's faces and tested the prediction that women are more accurate than men in recognizing children's faces. We hypothesizes that women would not show an own gender bias. Fifty Gordon College students (25 females, 25 males) were exposed to children's faces and given a recognition test to see if they could correctly distinguish the target children's faces. Results indicated that women were no better at recalling faces in this type of task. No significant different between the number of faces that were remembered by females and males was observed. Results also indicated that there was no evident own gender bias displayed by males or female participants. Findings from a qualitative questionnaire revealed that female faces were the most distinctive (i.e., most clearly remembered) to both women and men.

[Social Sciences: General]

Sponsor: Christina Riggs Romaine

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## **Cognitive Multitasking Abilities Among Athletes and Non-athletes**

Amanda Powers\* & Hannah Lawrence, Gordon College

Past studies show that athletes perform better than non-athletes at cognitive multitasking. This study extends research on the relationship between multitasking and athletic ability by focusing on college-relevant tasks and exploring the experience of multitasking. Are student athletes better at performing relevant cognitive tasks while multitasking than non-athletes? 48 students participated in a mixed methods study, completing four tasks: mathematics, reading comprehension, sentence coping, and sorting shapes. After the task, participants filled out a survey exploring their experience when multitasking. Overall, the results showed no significant difference in the scores of athletes and non-athletes in any of the four cognitive tasks. The findings suggest that student athletes do not actually perform better at cognitive multitasking in a naturalistic setting. For the qualitative data, it was evident that athletes notice a difference when multitasking during physical activities and during cognitive tasks. Many athletes found multitasking during physical activities to be easier. Overall, the majority of people felt stress when performing the tasks and prefer to work and focus on one task at a time.

[Social Sciences: General]

Sponsor: Jonathan P. Gerber

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## **Beyond A Silhouette: Body Image Perception in College Females**

Julia Langford\* & Alicia MacDonald, Gordon College

Body image pathologies among college females have primarily been based on the ratings one attributes to herself on the traditional Figure Rating Scale (Thompson & Altabe, 1991), a scale comprised of 9 pen and ink drawings that progress left to right from smallest to largest copyrighted by Albert J. Stunkard. Studies of body image perception using this scale have shown that women have a tendency to choose an ideal body size (IBS) that is smaller than their current body size (Fallon & Rozin, 1985) and smaller than the figure they believe is most attractive. In the current study, a new Figure Rating Scale for females was constructed using nine photographs of women of average height (5'4") ranging from 100 to 180lbs. Female college students (n=33) were asked to mark the figures they believed corresponded with their current figure, ideal figure, and the figure they believed was most attractive to men. Using ratings made on the photo scale, results followed a similar pattern to prior research. The rating that women attributed to their current figure was significantly different than their ideal figure and the figure they believe to be most attractive to men. Contrary to previous research findings, the rating that women attributed to their ideal figure was significantly different than the figure they believe to be most attractive to men. Possible reasons for this difference are discussed, as well as women's self-reported experience of using a photo-based scale.

[Social Sciences: General]

Sponsor: Christina Riggs Romaine

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## **Friend Zone: Land of No Escape?**

Elizabeth Benton\* & Mark Spooner, Gordon College

The purpose of this study is to document statistical research on the recently coined social phenomenon of being in "the friend zone". The friend zone, closely related to unrequited love, is when a person's romantic interest is sidelined but friendship remains. The goal of our study was to determine whether

there is any statistically significant difference between the number of times men put women in the friend zone and the number of times women put men into the friend zone. Additionally, we hoped to gather qualitative data on the experience of being “friend-zoned”. Our mixed methods approach consisted of a short quantitative survey followed by a short qualitative interview for those who volunteered. Once our data had been collected and analyzed, we concluded contrary to our original hypotheses that there is no statistically significant difference between the number of times men and women “friend zone” another individual. Our qualitative data showed consistencies in the experience. There seems to be a possibility of more to unveil in this particular subject if future extensive research is applied.

[Social Sciences: General]

Sponsor: Jonathan Gerber

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### **Electrophysiology of Error-Processing in College Students with Combined and Inattentive Attention Deficit Hyperactivity Disorder (ADHD)**

Elizabeth Loy\* & Katie Hakanson-Stacy, Gordon College

Background: Impaired cognitive control is often one of the symptoms of ADHD. Previous studies have shown that children with combined-type ADHD exhibit have different brain functioning when completing tasks measuring error processing, one of the primary areas of cognitive control. However, previous research has not investigated if people with inattentive-type ADHD, who may not exhibit the same levels of hyperactivity and impulsivity, exhibit similar brainwave patterns to those with combined-type ADHD. Methods: College students ages 18 to 24 from the following groups completed a visual go/no-go task: students with ADHD combined subtype (n=6), students with ADHD inattentive subtype (n=6), and typically-developing students as a control (n=6). Electro-encephalography (EEG) data were recorded and analyzed to calculate two event-related potentials, the error-related negativity (ERN) and error positivity (Pe). Results: We anticipate that our findings will show that college students with ADHD combined-type exhibit a normal ERN amplitude and a lower Pe amplitude when compared to the control group, and that college students with ADHD inattentive-type exhibit a normal ERN amplitude and a Pe amplitude closer to that of the control group. Conclusions: These results would suggest that, although students with ADHD combined-type exhibit abnormalities in error-processing, students with ADHD inattentive-type process errors in a way more similar to that of their typically-developing peers.

[Social Sciences: General]

Sponsor: Jonathan Gerber

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### **Mathematical Problem-Solving Tasks and the Engagement and Enrichment of Academically Advanced Learners**

Rebecca Sindel\*, Gordon College

This study explores the use of problem-solving tasks requiring higher level thinking to increase engagement of elementary academically advanced learners. The mandate to “leave no child behind” also implies that advanced students are not “left behind” at levels they already attained. Articles on forms and methods of differentiation for advanced learners were examined for their discussion of the need for authentic tasks the include student input and provide open-ended and high-level questions. Third grade academically advanced learners were presented with authentic problems requiring higher level thinking in 15-minute center periods with the goal of increasing engagement level as measured by time on task and task completion. Student engagement was found to be affected by the type of task



chosen for the time allotted. Recommendations are made for the further study of effectively challenging layered problem-solving tasks.

[Social Sciences: General]

Sponsors: Janet Arndt, Joyce Meeuwsen, & Priscilla Nelson

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## **Home Literacy, Parental Involvement, and Reading Achievement**

Carson Tucker\*, Gordon College

This research study examines the efficacy of providing reading materials to students and literacy development information and strategies to parents in an effort to encourage parental involvement and increase reading achievement. Literacy development strategies and home reading materials were provided to the parents of 21 kindergarten students from an urban school district for a period of two weeks. Strategies were sent home weekly and books were sent home nightly. Parents were also invited to attend a Literacy Day at the school where they had the opportunity to learn ways to encourage reading at home. Data was collected through observations made by the researcher, parent surveys, and changes in students' DIBELS scores from before implementation to after. Results revealed that the amount of time parents spent reading with their children did increase, but it did not have a great effect on reading achievement in students.

[Social Sciences: General]

Sponsors: Janet Arndt, Joyce Meeuwsen, & Priscilla Nelson

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## **The Effects of Writing Fluency Practice and Explicit Teacher Feedback**

Cindy Sherman\*, Gordon College

Every year, as part of the Lynn district schools, fourth-grade students are expected to develop several five-paragraph essays in preparation for the Massachusetts Comprehensive Assessment System (MCAS). In preparation for this high-stakes test, this study explores the effects of incorporating consistent writing fluency prompts that are met with specific teacher feedback in a fourth grade classroom setting. In a class of nineteen students, seven English language learners and two native English speakers were deemed eligible for intentional writing fluency practice, based on consistent errors in verb tense and sentence structure. Errors in structure and verb tense were quantified in these students' initial five-paragraph essays that were written in November 2011. Over a span of eight weeks, these students were then given between eight and twelve creative writing prompts that required at least three sentences, beginning with a topic sentence supported by details. Following each rough draft, students met with the teacher to edit and revise their responses. Following current research on the benefits of positive and explicit teacher feedback, students' final drafts were given qualitative comments and returned to the student. Following this procedure, similar errors were quantified, analyzed and compared to students' final five-paragraph essays written in February 2012. This study concludes that incorporating closely monitored writing fluency practice is equally beneficial for native speakers and learners of English. Both native English speakers and three of the five English language learners showed a decrease in errors in both structure and tense between November and February. However, the variability of students benefitting from this intervention relies more on students' range of current abilities in manipulating the English language, rather than overall English proficiency.

[Social Sciences: General]

Sponsors: Janet Arndt, Joyce Meeuwsen, & Priscilla Nelson

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## Undergraduate Research Symposium 2012

We want to thank everyone who made this event possible.

We recognize the contributions of our judges who so generously agree to take the time to talk with the students and evaluate their research.

Dr. Charles VanKirk, Lantheus Medical Imaging  
Dr. Karen Mason, Gordon Conwell Theological Seminary  
Dr. Bryan Auday, Gordon College

Our appreciation also goes to:

- Dan Russ and the Office of the Academic Dean, for generous contributions that make refreshments possible (and Dining Services, for providing delicious food).
- Keith Krass, for his support in addressing the many details of this event.
- Gordon College Physical Plant, for setting up and organizing the poster presentation space.
- Chemistry ACS Student Chapter, the Biology Club, and the Psychology Club, for helping in the setting up and taking down of the posters and general all-around assistance.
- The academic departments in the sciences.

Most of all, we are grateful for the many Gordon College students whose work we see today. This event celebrates those students who show the skill, the tenacity, the creativity, and the dedication to complete research projects, and then organize their findings in ways that effectively communicate to the College community. We also appreciate the faculty advisors who guide students through the process.

The 2012 Organizing Committee

Dwight Tshudy, Chemistry (chair)

Joel Boyd, Chemistry  
Jonathan Gerber, Psychology  
Suzanne Phillips, Psychology  
Justin Topp, Biology  
Jessica Ventura, Kinesiology