

# Celebration of **SCHOLARSHIP**



**THURSDAY, APRIL 21, 2022**

**Poster Presentation Program**

**IWU'S ANNUAL UNDERGRADUATE RESEARCH CONFERENCE**

SPONSORED BY THE JOHN WESLEY HONORS COLLEGE

Throughout the day (8am to 4:30pm) on Thursday, student researchers will be available to present and take questions at their posters during the times indicated in the program and listed on the posters. Natural Sciences presenters will present, in addition, between 2:00 and 4:00pm.

## BARNES STUDENT – JONES/LEEDY BANQUET HALLS

Health & Human Performance

[Barnes Student Center Hallway]

Natural Sciences

Natural Sciences

Natural Sciences

Communication

Music

[Mallway]

### **Post-Traumatic Growth, Stress, and Impulsivity in Daily Life**

Cameron Sarin and Rachel Brown, *10:00-11:00am, 1:00-2:00pm*

There has been a growing interest in psychological science in what influences addiction and recovery. The past two decades have seen a considerable increase in literature regarding growth through, and after, difficult events. This process, called Posttraumatic Growth (PTG) has been linked to addiction recovery (Stump et al., 2008; Haroosh & Freedman, 2017; Edwards et al., 2021) as well as other variables including perceived social support (Schroevers et al., 2010; Yongju et al., 2013) and situational factors (Prati & Pietrantonio, 2009; Cadell, et al., 2003). Concurrently, research suggests other factors have been associated with addiction recovery, such as impulsivity (Thomsen et al., 2018; McMullin et al., 2020) and spiritual well-being (Temme & Kopak, 2016; Foster, et al., 2013). This study examined PTG, sense of social support, intellectual humility and impulsivity, in relation to recovery outcomes among individuals currently in a 12-step based recovery home. In particular, we examined these variables across various points in the recovery process using a mixed-method longitudinal design involving multiple electronic surveys and mobile-app based experience sampling method (ESM). This allowed for the observation of processes of change, and variability, across relatively short periods of time within daily life.

### **Re-Signing Harry Potter**

Maddie Bigham, *10:00-11:30am*

I will examine and analyze Harry Potter and the Deathly Hallows Part 2 as my communication artifact. I will demonstrate how the characters and storylines of the film reflect the battle between good and evil and the sacrificial love that is present in the Gospel. I will use the semiotic theory, structuralism, to highlight the different elements of the story that contribute to the meaning that the film is trying to convey.

### **Semiotic Ad Critique**

Lainey Nielsen, *10:00-11:30am*

I conducted a semiotic ad critique in which I identified, analyzed, and critiqued the various messages contained within the ad from a semiotics perspective. I selected an advertisement from a blood donation campaign that identified donors as "superheroes". Various elements of the ad including text, colors, layout, and images all had an impact in the message that viewers understood.

### **Semiotic Ad Critique on Ford**

Hannah Heilman, *10:00-11:30am*

This project was created for our in-class presentations in which we semiotically critiqued ads. Mine was over Ford's campaign to push their first urban activity vehicle. Within the presentation, I break down the visual elements, wording, the icon used within it, and pulled in communication theories from our textbook.

<sup>†</sup> Denotes a project also included on the oral presentation schedule

## **Wi-Fries Ad Critique**

Grace Lehman, *10:00-11:30am*

This poster was for a presentation in class where we had to critique an ad using the theory of semiotics. For the ad critique I looked at the overall design through the colors, positioning, and text. Additionally, I looked at the meaning of the ad and how they communicated that through the semiotic framework.

## **ReSigning in Little Women**

Hannah Heilman, *10:00-11:30am*

For our Symbols and Imaging course, we need to analyze a communication artifact and resign it as a Christian truth. I selected the 2019 version of the movie Little Women. The poster will discuss deconstructionist theories and basic sign theory related to the film and how the themes in the movie relate back to Jesus' teachings.

## **Re-Signing Project, The Bigger Picture**

Donovan Edwards, *10:00-11:30am*

This poster project will take a deeper dive into the song The Bigger Picture by lil Baby, and showing the understanding of the artifact and its semiotic theory.

## **Star Wars: A representation of our walk with Christ.**

Zackery Stephenson, *10:00-11:30am*

The presentation is a semiotic re-signing of Star Wars: The Original Trilogy. I am analyzing the films' use of story elements and imaging and adapting them to Christian truths. Luke Skywalker's journey through the films can be described in terms of the Christian journey with Christ. Star Wars IV: A New Hope, introduces Luke to the force, jedi, light and dark sides. These are synonymous with new believers' learning of God, Christians, righteous behavior and sin. The Empire Strikes Back is representative of doubt, giving into temptation and the consequences of it. Return of the Jedi represents maturity, conquering over our sin nature, and redemption.

## **ReSigning: Biblical Truth in Popular Music**

Lainey Nielsen, *10:00-11:30am*

I will analyze the song "Where You Lead" by Carole King (Gilmore Girls theme song), and identify how it reveals biblical truth in the lyrics.

<sup>†</sup> Denotes a project also included on the oral presentation schedule

## **Beauty in the Mundane: An Analysis of Monet's Haybales**

Josiah Wollan, *10:00-11:30am*

Beauty can be found anywhere that God is. Through the eyes of Monet, we can see divine Beauty in the mundane. The artist carefully weaves together color, shadows, and technique to depict this Beauty everywhere.

## **Loved and Gracious**

Shae Gillespie, *10:00-11:30am*

"Loved and Gracious" is a short story that is meant to reinforce a Christian Truth in the world: the closeness we have with each other. Based off of the relationship between King David and Jonathon, Saul's son, the creative piece seeks to bring a heartwarming understanding to those who feel conflicted with the relationships they have with others and how God loves them no matter the circumstances. That He will embrace others with open arms, in death and in life, to a grieving relationship between two Biblical figures.

## **The Evolution of Diversity and Inclusion in Print Advertisement**

Hayleigh Turner

This research takes a look into the evolution of diversity and inclusion in print advertisement. Analyzing the most popular clothing brand from 2000 to 2021, 44 print advertisements were collected and analyzed using a qualitative coding system developed through research. The ads were then individually analyzed and given a total score that was then plotted on a graph. The final graph tracked trends of inclusivity and diversity in popular brand advertisements since the start of the new millennium.

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Health and Human Performance

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## **<sup>†</sup>Comparison of Co-contraction Ratios of College Athletes After Knee Injury During a Lateral Step-up**

Leah Maher; Lizzy Leggett; Ben Vongunten, *Presentation Times TBD*

The knee is the most commonly injured joint in the body. After serious knee injuries like a torn ACL or MCL, there is evidence to suggest that permanent muscular imbalances exist in the hamstring and quadriceps. **PURPOSE:** To determine differences in the lower extremity muscle activation following a major knee injury, specifically in the simultaneous contraction of the quadriceps and hamstrings during a lateral step-up. **METHODS:** Seventeen knee injured individuals ( 9 Female, 8 Male,  $20 \pm 1.23$  years) and nineteen healthy control individuals ( 9 Female, 10 Male,  $20 \pm .98$  years). Subjects had two 4-slot sensor adhesive interface electrodes attached to their previously injured or dominant leg. The electrodes were placed on the semitendinosus and vastus lateralis muscles. Subjects then performed three lateral step-ups on this leg. Electromyographic activity of the two muscles were measured during each rep and maximum amplitude of the semitendinosus and vastus lateralis were taken. The maximum amplitudes were then averaged and inserted into the co-contraction ratio equation, which represented indication of muscular imbalances. **RESULTS:** There was not a statistically significant difference in the co-contraction ratio between the injured

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and non-injured control group ( $p = .869$ , injured mean ratio = 1.238 mV, non-injured mean ratio = 1.206 mV); however, the injured group had a higher average contraction of their quadriceps (injured group = .5402 mV, non-injured group = .4244 mV). CONCLUSION: There is not concrete evidence to support that significant knee injuries cause muscular imbalances in the quadriceps and hamstrings. Further research and testing is required to determine the scope and significance that knee injuries have on long term lower extremity health.

### **†The Impact of Plated Running Shoes on Physiological and Psychological Variables**

August Hubbard, Emily Tripp, and Lindsey Schroeder, *Presentation Times TBD*

The aim of this research was to determine if midsole materials of plated shoes (PS) and traditional shoes (TS) impact physiological and psychological components of energy expenditure when running. Each of the variables examined are strong indicators of fatigue. The researchers hypothesized there would be a significant decrease in energy expenditure in plated shoes compared to traditional shoes. METHODS: The subjects were 11 cross country and track athletes from Indiana Wesleyan University and 10 recreational runners. Each participant completed 2 running tests for 5 minutes each, one with PS and the other with TS. Each participant ran at an individualized calculated speed. The variables examined with a metabolic cart were volume of oxygen consumed ( $VO_2$ ), volume of carbon dioxide produced ( $VCO_2$ ), and calories (kcal), along with rating of perceived exertion (RPE), and heart rate. A post-test survey was administered to record the subjects' opinions of how each shoe felt. RESULTS: A Wilcoxon test examined the results in terms of RPE in PS and TS. A significant difference was found in the results ( $Z = 1.96$ ,  $p = .04$ ). A paired t-test examined the results in terms of  $VO_2$ ,  $VCO_2$ , kcal, and heart rate in PS and TS. Significant differences were found for  $VCO_2$  ( $p = .05$ ) and kcal ( $p = .04$ ). CONCLUSION: Plated shoes have significant physiological and psychological effects on energy expenditure. The insignificant findings in this study trend in the direction of significance. Research with additional subjects is needed to further support these conclusions for the significant and insignificant variables.

### **†The Relationship Between Y-Balance Test Performance and Hip Extensor Strength**

Liz Richards, Ethan Stump, Kori Stump, *Presentation Times TBD*

Risk of injury is an important factor to assess for all individuals, regardless of athletic status. Lower limb injuries occur in both athletic and general populations. These injuries emphasize the need to assess all participants' potential risks. Therefore, studying the general population's risk for injury fills the gap, benefitting clinicians and exercise participants. This study compared hip extensor strength values to anterior reach scores on the Y-Balance Test (YBT) to explore a correlation for lower extremity injury in a general population. Thirty-six students (9 males and 27 females) at Indiana Wesleyan University participated in this epidemiological surveillance. The hip extensor strength test protocol was borrowed from Wilson et al (2018). The dynamic reachability procedure was based on the testing standards provided by Fusco et al (2020). In one session, the participants performed the hip extensor strength and Y-Balance tests. There was no statistically significant correlation between right leg YBT scores and isometric strength values. However, a relationship in the left leg YBT score was moderately correlated with isometric strength value. A paired t-test determined there were no statistically significant differences in YBT scores in right and left legs. The authors of this research found varying results on the relationship between the Y-Balance Test and hip extensor strength. These results suggest that hip extensor strength cannot replace the Y-Balance Test for injury prevention in a general college population.

Keywords: Y-Balance, general population, hip extensor strength, risk for injury

† Denotes a project also included on the oral presentation schedule

## <sup>†</sup>The Effect of Attentional Focus in Dynamic Stability in Individuals with Knee

### Ligament Injuries

Anna Stevens and Christine Martin, *10:00-11:00am, 2:00-3:00pm*

Knee ligament injuries are common in sports that require cutting and rapid agility movements. With the utilization of balance tests in post-injury rehabilitation, along with attentional focus of instruction, one can decrease the chances of a secondary injury. **PURPOSE:** To identify the impact of attentional focus cues during dynamic balance tests in individuals with knee ligament injuries. **METHODS:** Twenty collegiate athletes (10 male and 10 female) volunteered for this study. All participants were at least one year post surgery and had a previous knee ligament injury. Each day, two dynamic stability tests were conducted: star excursion balance test (SEBT) and vertical drop jump (VDJ). The difference between each day was the instruction given: internal focus or external focus. For the SEBT, the internal instruction given was “focus on keeping the stationary knee from bowing in” and the external instruction was “hold the bar with one hand and focus on keeping it horizontal the entire time throughout the movement”. For the VDJ, the internal instruction was “land with 2 feet on the platform. Focus on your knees not going over your toes. This instruction asked them to focus on their body movements. Then, the external instruction was “land in line with the cones in front of you. This instruction asked them to focus outside of their body movements. Testing occurred on two days, with at least 24 hours between testing days. **RESULTS:** There is no significant difference between either attentional focus in dynamic stability tests performed by those with a knee ligament injury,  $t(19) = -.818, p > .424$  (VDJ),  $t(19) = 1.26, p > .223$  (ESE), and  $t(19) = .678, p > .506$  (ISE). While there was no significant difference between the two types of instruction amongst the participants, additional analyses were run to compare between the two genders. This revealed that certain trials of the SEBT had better outcomes in males than females with external focus. **CONCLUSION:** There was not an attentional focus (external or internal) of instruction that exhibited better outcomes in either dynamic stability tests, despite prior research that has shown an external focus produced better results.

## <sup>†</sup>The Effect of Mindfulness Meditation on Pressure Pain Threshold among College

### Students

Seth Honeycutt, Alex Lampman, Matt Lavin, Kloe Muntz, and Samara Schlabach, *10:00-11:00am, 2:00-3:00pm*

A survey from the National Institutes of Health (NIH) revealed that the number of Americans who suffer from any type of daily pain (acute or chronic) is around 25.3 million. To help combat this immense problem of pain, non-medicinal methods like mindfulness meditation have become a popular practice. Previous research shows a connection between mindfulness meditation and pain reduction. **PURPOSE:** The purpose of this research study was to confirm the correlation between mindfulness meditation and increased pressure pain thresholds in college students. **METHODS:** 20 subjects (14 females; 6 males) volunteered for this study. The subjects were randomly assigned to a 20-minute mindfulness meditation (MM) or resting group. Pressure pain threshold (PPT) was assessed for each subject using a 30-kilogram (kg) capacity dolorimeter before and after their assigned session. The average of three trials was used as the final PPT score and recorded in kg of pressure. Paired samples t-tests were used to assess the difference in PPT within groups while an independent t-test determined the difference in PPT between the MM and resting group. **RESULTS:** Neither

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the resting session ( $t(9) = -0.154$ ,  $p = 0.881$ ) nor the meditation session ( $t(9) = 0.361$ ,  $p = 0.726$ ) elicited a statistically significant increase of pressure pain threshold. The mindfulness meditation ( $M = 0.102$ ,  $SD = \pm 0.875$ ) did not produce a statistically significant difference in PPT from the control group ( $M = -0.052$ ,  $SD = \pm 1.070$ ),  $t(18) = -0.348$ ,  $p = 0.732$ . CONCLUSION: Subjects in the MM group did not exhibit a significant increase in PPT compared to the resting group, despite showing an increase in mean PPT from the pretest scores. Because mean scores increased for the meditation group, but decreased for the control group, it appears that there is a relationship between a state of mindfulness and PPT. Further, Cohen's  $d$  effect size within the MM group ( $d = 0.762$ ) suggested a greater effect than the resting group ( $d = 0.573$ ).

### **†Assessing Leg Muscle Disparities Between ACL-Reconstructed College Athletes and Healthy College Athletes Using Isokinetic Dynamometer**

Emily Carter, Lauren Turner, Aaron Harris, *10:00-11:00am, 2:00-3:00pm*

70 percent of ACL injuries occur in non-contact settings, opening up the endless possibilities of the sports or activities that this injury may occur in. Particular muscle imbalances in the lower extremities may be correlated to susceptibility of injury. PURPOSE: To compare muscle strength patterns in the hamstrings and quadriceps between Anterior Cruciate Ligament Reconstruction (ACLR) and healthy control groups. METHODS: A total of thirty-two participants, 16 ACLR and 16 healthy matched controls (HMC), participated in this study (14 Male, 18 Female). Flexion/Extension ratios and individual leg deficit were recorded using the HUMAC isokinetic dynamometer. To compare differences in the flexion/extension muscular strength ratio between ACLR and HMC group, the ACLR leg was matched with the HMC leg according to dominance. Independent T-tests were run to identify a difference in the ratio of hamstrings (flexors) to quadriceps (extensors) in addition to muscular deficit between the ACLR group and the HMC group. A paired-sample T-test was conducted to determine the muscular differences between the injured and uninjured sides in the ACLR group. RESULTS: There were no significant differences in the hamstring to quadriceps ratio or the muscular deficits between the ACL and HMC group ( $p > .05$ ). The paired T-test demonstrated nearly significant differences ( $p = 0.054$ ) between the right and left flexors at a speed of 180deg/sec. CONCLUSION: The results reveal that there were no significant findings when comparing the ACLR group to the HMC group. Nearly significant data was found between the differences of flexor strength in the injured and non-injured limb of the ACLR group, showing slightly weaker average peak torque values in the ACLR limb. Limitations included small sample size, possible exercise or practice prior to testing, and type of reconstructive surgery. Further research is still needed to determine the best methods for finding trends related to muscle deficits in ACLR athletes in order to best prehab and rehab an ACL reconstruction.

### **The Effect of a Chlorophyll Placebo on Psychological and Physical Outcomes in Treadmill Exercise**

Abigail Collins, Ariana Glass, Emily Neese, Melissa Cook, *Presentation Times TBD*

Lack of adherence to exercise is an increasing problem that leads to cardiovascular disease, diabetes, cancer, depression, anxiety, etc. Exercise is a combination of mental and physical components manipulated through external factors. While the use of a placebo can complement the physical health benefits of exercise, it is unknown whether a chlorophyll placebo can directly affect performance outcomes during physical activity. PURPOSE: To evaluate the difference between potential effects of a chlorophyll placebo and a chlorophyll supplement on perceived exertion during untrained treadmill exercise. METHODS: Two groups of 15 male and female non-treadmill experienced runners (18-23 yrs) completed two trials. Each trial was 10 minutes long, the speed of the participant was self-regulated, and researchers recorded heart rate (HR), RPE, and speed (S) for each minute using a K5 metabolic backpack and heart rate monitor. Energy expenditure (EE)

† Denotes a project also included on the oral presentation schedule



and total distance (TD) traveled were recorded after 10 minutes. After the first trial, participants from group one received a 3-day supply of a chlorophyll supplement, and group two received a chlorophyll placebo. Participants were blind to their group placement, speed, distance, and all other recorded data. RESULTS: HR, RPE, S, TD, and EE increased during the second trial; however, the data did not show a significant increase (HR = .194, RPE = .644, S = .464, TD = .772, EE = .572). CONCLUSION: Yielding a result of no significant difference between the two trials or groups, further research is needed to establish whether a chlorophyll placebo affects the physical and psychological outcomes of treadmill exercise.

### **Cartilaginous Defect Repaired Using an Up-and-Coming Cartilage Allograft Matrix Technique; A Case Study on Cartilage Defects Using CartiMax**

Elizabeth Williams, Emily Mize, *Presentation Times TBD*

Cartilage is an extremely complex arrangement of several biomaterials. The intricate nature and design of cartilage tissue is directly connected to the numerous cases previously presented with post-surgical complications. However, newer techniques are emerging to address such pathologies as well as promote quicker recovery outcomes. One such surgical intervention is accomplished through the usage of a cartilage allograft matrix called Cartimax. This procedure utilizes a viable chondrocyte and chondrogenic mixture along with growth factors that adapt to the size and shape of the defect and lesion in the cartilage. When using the gold standard micro-fracture surgery, a patient could possibly be out of play for 4-7 months, whereas with this treatment option, athletes may be closer to 3-6 months with a decreased chance of failure of the surgery. We present the case of a 20-year-old collegiate women's soccer athlete presenting with left knee pain following the last game of her spring season. With an injury of no defined mechanism and inability to bear full weight following 90 minutes of play, she sought out care. After failed conservative rehabilitation, diagnostic testing revealed a 4 mm cartilage defect on the medial condyle surface of the patella. Surgical options were pursued and CartiMax was chosen to repair the defect. Approximately 3 months after surgery, she was cleared to full soccer-related activity with no problems. This is a unique case as CartiMax has scarce research published due to it being a newer technique. No studies regarding long-term efficacy using the human body have been published. Prospective research and studies should evaluate the method further to understand its full capabilities regarding condylar defect repairs in the future.

### **Efficacy of Yoga on Chronic Low Back Pain and Mental Health Deficients: A Critically Appraisal Topic**

Anna Fuller & Cameron Lilly, *Presentation Times TBD*

Low Back Pain (LBP) is a global pandemic that affects 60-70% of those in the European and US countries within the general population. Prevalence of LBP has been documented in 50-70% of those who participate in light to heavy activity daily and is the primary reason that individuals quit activities around the age of 35-55 years of age. LBP also has been found to have deep relationships with mental health pathologies such as depression, anxiety, and sleep disturbances. Growing evidence has been found in the literature that suggest that the symptomatology of LBP can be exacerbated by psychological factors, such as depression, anxiety, and pain. In 2016 alone Americans spent an estimated \$380 billion on low back and neck pain. As there are many causes of LBP, one treatment that has been found to be effective in treating both LBP and the associated mental health pathologies is therapeutic yoga. Yoga is an ascetic discipline, which includes breath control, simple meditation, and the adoption of specific bodily postures, and is practiced for health and relaxation. It is possible that LBP and the associated mental health pathologies can be alleviated through the use of Yoga and education.

<sup>†</sup> Denotes a project also included on the oral presentation schedule

## **Efficacy of Reflexive Performance Reset**

Sarah Buresh, Jaxson Savieo, Logan Fritz, *Presentation Times TBD*

**Purpose:** This study was designed to put Reflexive Performance Reset's (RPR) impact on athletic performance to the test. Due to how new this phenomenon is, there is little evidence supporting these claims. It is said to have a positive impact on strength, agility and power. RPR is being utilized on multiple platforms across the globe. Coaches, trainers and athletes alike are implementing this technique into their training regime. Coaches like Mike Clark (3x NFL Strength Coach of the Year) and Brandon Aiken (AD/Head Strength Coach at University of South Carolina-Aiken) tout reflexive performance reset's (RPR) efficacy in this area, and while the literature is sparse, effectively activating the nervous system may positively impact athletic success. **Methods:** Thirty-one participants (12 males & 19 females; 16 athletes & 15 nonathletes) were selected from the Indiana Wesleyan University student body to conduct a series of three tests — broad jump, handgrip dynamometer, and cone agility drill — all of which are commonly used to measure athletic performance. The participants performed a series of two trials. In the first trial, the participants performed each of the aforementioned drills and their scores were recorded. After at least forty-eight hours, the participants conducted their second trial. In the second trial (intervention), the participants self-administered RPR and then underwent the same tests as the first trial. The data was analyzed using a paired T-test to find statistical significance. **Results:** There were statistically significant increases in broad jump ( $p < 0.000$ ), right hand grip strength ( $p < 0.013$ ), and cone agility ( $p < 0.001$ ) second trial (intervention) but not left hand grip strength ( $p = 1.000$ ). **Conclusion:** The data suggests that RPR trends towards being able to significantly increase athletic performance as measured by broad jump, handgrip strength, and cone agility. Although there are many factors to consider, it seems clear that RPR did positively impact athletic performance

## **Anterior Cruciate Ligament Reconstruction Using a Hybrid Graft: A Case Study**

Meghan Clairday & Sarah Walker *Presentation Times TBD*

Injury that occurs to the anterior cruciate ligament (ACL) is a season-ending injury that may involve surgical repair following months of rehabilitation. Research is conflicting as to which is the most appropriate type of reconstruction in regards to graft choice. This case study follows a male college basketball athlete's progression through an ACL surgical repair using a hybrid graft, a combination of an allo-and-autograft. Measurements were based around the athlete's progression through his rehabilitation protocol, which looked at strength, flexibility, and range of motion. Findings concluded that the hybrid graft proved to be no more effective than the standard autograft commonly used in ACL repair.

<sup>†</sup> Denotes a project also included on the oral presentation schedule

### **Nonlinear Lotka-Volterra Competition Models**

Mara Smith *10:00-11:30am*

The classical Lotka-Volterra equations that model the interactions between two species competing for a limited resource have many potential modifications to improve biological accuracy; this research explores exponential modifications to the competition term. After an introduction to the behavior of the classical Lotka-Volterra equations is given, a nonlinear modification to the model by Taylor and Crizer is discussed. An extension of this modification is proposed, in which the population variable of the competition term is raised first to the power of small integers and, next, positive real numbers. A proof is offered that isocurves for any positive exponent values can intersect a maximum of 3 times, and additional proofs limit the number of intersection points in relation to exponent and parameter values. Finally, we prove that, in such models, the stability of the equilibria alternates between stable and unstable when considered in a northwest to southeast configuration.

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Music

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### **Music Therapy Education and Interventions for the LGBTQ+ Community**

Alexandra Smith

The purpose of this research is to help bring awareness to Music Therapy and the LGBTQ+ community. Through this research, the author's hope is to remind students, professors, and professionals in the LGBTQ+ community that they are not alone in the music therapy profession, and that there is a bright future for LGBTQ+ affirming music therapy. This research was concluded in three sections. First, the author highlights the LGBTQ+ community, their history and struggles they face. Following, the author discusses the progression of LGBTQ+ affirming music therapy. The author ends her research with clinical practices that can be applied for music therapists, but also clinical counselors, therapists, etc.

### **The Effects of Music Therapy on the Symptoms of Psychological Disorders**

Meira Wooldridge

This presentation will display a review of the existing literature on treating the symptoms of psychological disorders with music therapy. Researchers on this topic have found that music therapy is a promising treatment for disorders like Generalized Anxiety Disorder (GAD), Post Traumatic Stress Disorder (PTSD), Obsessive Compulsive Disorder (OCD), schizophrenia, forms of depression, and forms of eating disorders. This literature review focuses on the symptom areas of anxiety, depressive symptoms, and emotion regulation while also addressing other symptoms of note.

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## **The effects of improvisational music therapy on the communication skills of children with autism**

Rachel Lowe

This presentation is a literature review founded in the previous research concerning the topic of improvisational music therapy and its effects on the communication skills of children with autism. This presentation looks specifically at the different uses and methods of improvisation used within music therapy that can affect the communication skills of those with autism while defining what these improvisational interventions look like and how they might be implemented. This presentation looks at several studies on this topic and their results to see if improvisational music therapy does in fact effect the communication skills of those with autism or not and if there is an effect if it is a positive or negative effect on these skills. This presentation also includes how the previous research on this topic is affecting current research on this topic in the present day, including research pilots and studies that have also recently come forward.

## **The Effects of Music Therapy on premature infants in the NICU**

Alisa Giammarco

For my research poster, I am looking at the current research on the effects of Music Therapy on premature infants in the Neonatal Intensive Care Unit (NICU). This poster will address the specific areas in which music can benefit the recovery, comfortability, and over all wellbeing of the babies struggling in the NICU. It will also touch on certain music therapy techniques that are seen to be affective in treatment, what instruments have the most impact, and how the music therapist can help facilitate bonding between the infant and their parents or caregivers. Music is a powerful tool that can promote healing in many aspects of life, and I would love to shed a little light on how it has been seen to work in the NICU.

## **Music therapy and it's effect in the prison setting**

Emelia Grate

Music therapy is a fairly new profession, and it's integration into the world is a progressing job. The life of an inmate is one that is continuing to be ignored, especially in terms of mental health. I will be presenting on the benefits of music therapy in the life of an inmate, or more generally, in a prison.

## **Music Therapy and Suicide Prevention Research**

Melissa Daniels

Suicide awareness and prevention is an ever-increasing and urgent matter that strides should be taken towards. Mental health is a continually growing topic of conversation, although in some settings it is not always productive or even beneficial. As someone preparing to enter the newer yet developing field of Music Therapy, I wanted to investigate what connections have already been made. Music is a universal language that affects everyone in some way, and different genres can be applied differently to accomplish unique functions. While occasionally stereotyped or frowned upon, music of a sad nature does in fact offer a different

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perspective and unique advantageous qualities to the therapeutic process. As a board-certified music therapist utilizes music within the iso principle, there can be consequent impacts on the emotional regulation and coping mechanisms of the recipient. This systematic research review will be centered around the following question of investigation: what are the effects of utilizing music of a sad nature within the iso principle on healthy coping mechanisms and emotional regulation in adolescents with suicidal ideation?

### **The Effectiveness of Clientele Preferences in Music Therapy**

Madeline Sinders

This presentation provides information regarding the benefits of using clientele's preferences in music therapy sessions. Reasons may include motivation, triggers in memory and/or other functioning in skills such as gross or fine motor skills, growth in the client's progress, and more. Preferences may include musical genres, songs, instruments, and even using past memories or present moments they feel comfortable sharing. From the perspective of a music therapy practicum student, clientele should have the opportunity to embrace themselves without question, and letting clientele have a say in their sessions regarding what they like will allow them to do that.

### **Music Therapy in Stroke Rehabilitation**

Hallie Hunt

This presentation is on how music therapy benefits patients who are recovering from a stroke, or a similar traumatic brain injury in general. I am diving into the research and evidence that shows the effectiveness of various music therapy treatment methods. Specifically, some of the main targets for recovery that I am researching include motor and cognitive goals, and increasing mood and social support through music therapy.

### **The Effect of Music Therapy on Mental Health in clients with Alzheimer's Disease and Dementia**

Katherine Wolter

This presentation is a review of the existing literature in music therapy that shows the effect of music therapy on the mental health of clients with Alzheimer's disease and dementia. It covers how music therapy effects specifically depression and anxiety levels in clients. It also addresses how music therapy can effect quality of life and overall well-being, which in turn can effect mental health. Included also are some intervention ideas that were used in the literature to show the effect that music therapy has on mental health in clients with Alzheimer's disease and dementia.

<sup>†</sup> Denotes a project also included on the oral presentation schedule

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### **†Isolation of Novel Salt-Tolerant Bacteria from Don Juan Pond, Antarctica**

Sophia Sanguedolce, 2:00-4:00pm

Two bacterial strains (designated DJP-L and DJP-S) were isolated from Don Juan Pond, which is located in the south fork of Upper Wright Valley, Antarctica and represents the saltiest and coldest body of water on Earth. Its waters contain approximately 40% salt, which exists mostly as CaCl<sub>2</sub>. In the winter, this shallow pond reaches -50°C. From this pond, two bacterial isolates were obtained by primary enrichment culturing on agar plates. Sequencing and phylogenetic analysis of the 16S ribosomal RNA (rRNA) gene was performed and revealed that strain DJP-L belongs to the genus *Virgibacillus*, and that strain DJP-S resides within the Bacillaceae family, most closely related to the genus *Paraliobacillus*. Strain DJP-L is an endospore former, as confirmed by microscopic observation, and although no endospores have been observed for strain DJP-S, it is also suspected to form endospores based on its taxonomic affiliation. Both species are halotolerant, showing growth from 0% to up to 25% salinity and growing optimally between 5-10% salinity. Preliminary temperature tests indicate psychrotolerance for both isolates, with growth of both strains occurring from 0°C to 25°C. These strains represent the first microorganisms isolated from this hypersaline and permanently cold aquatic system.

### **†Role of Fusion Protein Endocytosis in Cedar Virus Particle Assembly**

Ashley Rice, 2:00-4:00pm

Hendra Virus (HeV) and Nipah Virus (NiV) are deadly henipaviruses that currently lack treatments and vaccines for humans. This warrants investigation into their mechanism of virus particle assembly. Recently, Cedar Virus (CedV) was discovered as a non-pathogenic henipavirus, thus serving as a great model to study henipavirus particle assembly. Henipavirus fusion relies on a tetrameric attachment protein (glycoprotein, G) to bind to the host receptor and a trimeric fusion protein, F, to fuse the host and viral membranes. F reaches the surface of an infected cell as an inactive precursor (F<sub>0</sub>) where it must undergo endocytosis and proteolytic cleavage in an endocytic compartment in order to reach maturation before being recycled to the plasma membrane. A YxxΦ motif present in the cytoplasmic tail of CedV F is one of the signals for endocytosis. To better understand the role of F-trafficking and processing on the mechanisms of CedV particle assembly, a recombinant CedV containing the mutation Y524A at this YxxΦ motif in the cytoplasmic tail was rescued. The goal of this project is to evaluate differences in viral protein incorporation between CedV-Wt and CedV-Y524A particles. Furthermore, differences in localization of G between CedV-Wt and CedV-Y524A will be explored. Together, these aims will help to elucidate henipavirus particle assembly, thus facilitating the development of vaccines and treatments.

### **Analysis of Rescue From Zoledronate-Induced Death in Human Gingival Fibroblasts**

Danielle Dadisman and Colten Mowat, 2:00-4:00pm

Medication-related osteonecrosis of the jaw (MRONJ) is a disease that is characterized by painful lesions of exposed necrotic bone. These lesions develop as a result of an invasive dental procedure in patients that are taking osteoclast-inhibiting drugs such as zoledronate (ZOL) and denosumab. Patients often take these drugs if they are undergoing treatment for bone cancer, osteoporosis, or other types of cancers that have metastasized to bone. ZOL is scrutinized the most since it is a potent nitrogen-containing bisphosphonate. Bisphosphonates (BPs) are a group of drugs that are used for treating many bone-resorptive diseases since

† Denotes a project also included on the oral presentation schedule

they inhibit osteoclast function; however, they also localize to soft tissue and bone in the oral cavity. One approach investigated for reducing the local effects of BPs in the oral cavity was use of geranylgeraniol (GGOH) that showed promise by reducing ZOL-induced human gingival fibroblast (HGF) apoptosis in vitro. ZOL inhibits the mevalonate pathway leading to apoptosis, and GGOH is an intermediate within the mevalonate pathway that allows partial rescue of cells from this inhibition. However, some evidence suggests a potential tumorigenicity of GGOH. Phosphonoformic acid (PFA) which is not tumorigenic, was an alternative rescue agent investigated. PFA is an inhibitor of sodium-dependent phosphate transporters. These transporters were thought to be important for BP entry. Quantitative real time RT-PCR was performed to determine their expression in HGFs. HGFs did not contain significant amounts of the transporters compared to the controls, likely contributing to PFA's insignificant rescue of HGFs from ZOL-induced viability loss. BPs have a high affinity for calcium in bones and soft tissue. Therefore citrate, a calcium chelator, was also investigated as a possible rescue agent but did not significantly rescue. Dynasore (Dyn), a dynamin inhibitor, was another compound that was investigated for preventing ZOL entry. Dyn inhibits fluid-phase endocytosis, another cell entry mechanism used by BPs. Dyn prevented ZOL-induced viability loss in HGFs. Fluorescently labeled ZOL (AF647-ZOL) colocalized with FITC-dextran, a molecule known to enter the cell via fluid-phase endocytosis. This colocalization occurred in the presence of Dyn indicating that Dyn does not inhibit ZOL from entering HGFs.

### **Inhibition of Endosomal Acidification Prevents Zoledronate-Induced Viability Loss in Human Gingival Fibroblasts**

Evan Brown, 2:00-4:00pm

Medication-related osteonecrosis of the jaw (MRONJ) is a serious intraoral side effect of bisphosphonate, antiangiogenic, and denosumab treatments. Individuals affected with MRONJ are unable to heal from dental procedures, leading to painful oral lesions that involve exposed bone and unhealed soft tissue. Previous findings from our lab demonstrated the ability of 10 microM Dynasore, a dynamin inhibitor, to completely prevent viability loss in human gingival fibroblasts (HGFs) treated with 50 microM zoledronate (ZOL, a potent bisphosphonate). Among its various dynamin-dependent and dynamin-independent activities, Dynasore reduces membrane ruffling, a necessary step for macropinocytosis, and inhibits the vesicular H<sup>+</sup>-ATPase needed for endosome acidification. Earlier results from our lab showed through confocal fluorescence microscopy that Dynasore failed to prevent entry of ZOL into HGFs. Consequently, the study presented here addressed the ability of Dynasore to prevent endosomal acidification in HGFs as cytosolic entry of bisphosphonates requires acidification and maturation of endosomes. HGFs were treated with either 30 microM Dynasore or with vehicle, followed by incubation in the presence of 1 microM LysoSensor Green DND-189, a pH-sensitive probe specific for endosomes. Subsequent live capture of HGFs via confocal fluorescence microscopy was followed by a blinded, unbiased measurement of corrected LysoSensor Green total cell fluorescence (CTCF). Results indicated that Dynasore decreased CTCF by 2.4-fold compared to vehicle control (p<0.005). These results suggest that inhibition of endosome acidification may be of importance in preventing the adverse tissue effects observed in MRONJ lesions. Additional studies are warranted to investigate whether fluorescently-labeled ZOL fails to localize to mature endosomes in the presence of Dynasore. This work was partially funded by an Indiana Academy of Science Senior Research grant and a University Scholar Award from Indiana Wesleyan University.

<sup>†</sup> Denotes a project also included on the oral presentation schedule

## **Monocarboxylate Transport Mediates ATP-Induced Extracellular Acidification of Mammalian Astrocytes**

Benjamin Merillat and Rachel Leininger, *2:00-4:00pm*

There has been recent heightened interest in understanding the role of glial cells in shaping synaptic transmission. Previous research regarding retinal Tiger Salamander Müller cells, a type of glia, revealed how ATP-dependent extracellular acidification can inhibit synaptic transmission through a cellular pathway involving intracellular calcium, purinergic receptors, and altered regulation of sodium-hydrogen exchange (NHE). This study demonstrates the common function that the NHE shares with ATP-mediated acidification in cultured rat cortical or hippocampal astrocytes. Isolated cells were examined through self-referencing, a method of measuring extracellular pH using an electrode containing a proton permeable ionophore. The study also reveals the role of a monocarboxylate transporter (MCT) in glial cell signaling pathways, suggesting that lactate transport contributes to the ATP-induced extracellular acidification. These findings reveal the importance of MCT along with NHE in mediating astrocyte cell signaling. The cross-species conservation of this mechanism observed in both tiger salamanders and rats suggests that this form of regulation using pH is fundamental to brain function. These methods of measuring extracellular pH through self-referencing can be used in determining the remaining portions of the cell signaling pathway.

## **Florescent Imaging Shows Proton Concentration Variation in Muller Cells**

Jared Kilmer, *2:00-4:00pm*

Glia cells make up nearly half the nervous system yet their role in the nervous system function is poorly understood when compared to neuron signaling. Our lab has specifically looked at the role glia play in shaping neuronal communication across synapses. We have observed that Muller cells, glia found in the retina, will release protons to acidify the extracellular environment around the synapses in the retina. ATP, acting as an extracellular signaling molecule, seemingly starts a cascade of events that leads to the efflux of protons. The protons were thought to be released from the mitochondria before being transported out of the cell. To test this, the lab collected Muller cells by dissociating tiger salamander retinas to isolate the Muller cells. An inverted microscope along with fluorescent imaging with the pH-sensitive dye, BCECF – AM, were used to measure the internal pH levels of Muller cells. NH<sub>4</sub>Cl and nigericin were used as controls to produce an expected change in internal pH levels. ATP was then added to induce the theorized pathway and cause proton release from the mitochondria. Furthermore, a sodium-hydrogen exchanger inhibitor, amiloride, was externally added to the cells to help aid any buildup of protons by restricting proton efflux. Ultimately, the results indicate that the internal proton concentration does increase upon ATP application to Muller cells and supports intracellular acidification as a source of H<sup>+</sup> efflux increase. Furthermore, the experiments showed that our equipment is capable of measuring internal changes and despite the difficulties, it is exciting that we were able to observe internal pH conditions for the first time.

## **Impact of VPAC<sub>2</sub>R Deficiency on the Lipid Metabolic Pathways**

Madeline Burghaze, *2:00-4:00pm*

Vasoactive Intestinal Peptide Receptor Types 1&2 (VPAC<sub>1</sub>R and VPAC<sub>2</sub>R) are two G protein-coupled receptors that equally bind ligands vasoactive intestinal polypeptide (VIP) and pituitary adenylate cyclase activating peptide (PACAP). VPAC<sub>2</sub>R-deficient mice were created to study the role of the VPAC<sub>2</sub>R gene, and previous studies with these mice (mutant, MUT) have revealed those lacking the VPAC<sub>2</sub>R gene

<sup>†</sup> Denotes a project also included on the oral presentation schedule



preferentially burn fat and have much less fat deposition in the liver compared to the wild type (WT) mice. Previous and current studies have shown that MUTs have higher fasting glucose and lower fasting insulin levels, suggesting an insufficient release of insulin in response to glucose. Additionally, they have been found to have lower fasting free fatty acid (FFA) levels in the bloodstream than WT mice, supporting the idea that the mice lacking VPAC2R are preferentially burning fats rather than storing them. Given this data, an investigation of metabolic pathways in the liver and brown adipose tissue (BAT) of the mice was performed via measurement of the relative expression of the following proteins in MUT mice compared to WT mice: peroxisome proliferator-activated receptor alpha (PPAR $\alpha$ ), Acetyl-CoA carboxylase (ACC), AMP-activated protein kinase (AMPk), and Protein kinase B (Akt1). Results showed a trend in MUT mice toward lower expression of PPAR $\alpha$  in the liver compared to that of WT mice, but the difference was not significant. A significant difference in AMPk expression in brown adipose tissue was detected by Western Blot analysis, revealing that AMPk is expressed at higher levels in the brown adipose tissue of MUT mice compared to that of WT mice. No significant difference was found in the levels of expression of AMPk, p-AMPk, ACC, p-ACC, Akt, or p-Akt in the liver, or PPAR $\alpha$ , p-AMPk, ACC, p-ACC, Akt, or p-Akt in the brown adipose tissue. This data suggests that more frequent fatty acid breakdown signaled by AMPk is the cause of lower FFA levels and body weights in MUT mice.

### **Cultivation of Extremophilic Heterotrophic Bacteria Isolated from a Haloalkaline Soda Lake in Washington State**

Emily Simmons, *2:00-4:00pm*

Soap Lake, found in Washington State, is a soda lake that contains high levels of sodium carbonate and sulfate which gives it its high alkalinity and pH. This lake has two distinct layers, one aerobic and one anaerobic. Samples were taken from every meter (1m-23m) and from the sediment and surface waters. Bacteria from these water samples were then inoculated and streaked for isolation. The bacteria have been further isolated and purified with the intention to test for salinity, pH, carbon sources, temperature, and aerobic and anaerobic conditions. The expected outcome is to be able to sequence the 16s ribosomal RNA genome and identify the bacteria found in Soap Lake.

### **A New Method of Bird Call Identification**

Jacob Kydd, *2:00-4:00pm*

Have you ever been walking outside, hearing bird calls, and wondering what kind of bird it is? Now you can seamlessly find this information with your smartphone. There are several methods for recording bird calls in nature. SongSleuth makes it easy to record a bird sound, and within seconds you will have a great idea of what kind of bird it is. The most effective way to use the application is to stand directly below the tree with minimal surrounding noise. It will tell you the top three choices, and you can determine your final selection by looking at the bird!.

### **Soil Health Changes After Transitioning from Cropland to Perennial Pasture**

Aaron Schaaf, *2:00-4:00pm*

Grazing is an agricultural practice that has been carried on for thousands of years. Soil health is heavily interconnected and influenced by the effects of grazing practices and therefore the impacts of grazing, specifically management-intensive grazing, have been of interest for studies. Shawver et. al studied the impacts of grazing on soil health, which was measured by terms and data collectively known as soil health

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indices, in the attempt to study the hypothesized and negative potential impacts of grazing. Perennial irrigated cropland was converted to paddocks for the study and were used for the grazing of cattle in designed intervals. Soil cores were then sampled from the paddocks after the study and soil health indices were analyzed via lab. Results indicated that both positive and negative changes occurred to the soil that was tested in the study.

### **Cultivation and Characterization of Planktonic Microorganisms from a Hypersaline, Alkaline Lake**

Amanda Armstrong, 2:00-4:00pm

We obtained water samples from Soap Lake in Washington State with the purpose of culturing microorganisms associated with hypersaline and alkaline environments. Little is known about microbial ecosystems of Soap Lake. To better understand the environments present, we are in the process of cultivating microorganisms from the water samples. We inoculated a variety of liquid enrichment culture media with water samples and incubated the cultures at 10°C. Positive cultures were streaked on agar plate media, and isolated strains will be described based on their morphology, physiological traits, and ribosomal RNA gene sequences. We anticipate that this study will expand our understanding of the diversity, metabolic activities, and ecological contributions of Soap Lake microbes.

### **Development of Selective and Potent Bivalent Inhibitors of the Phosphatase SHP2.**

Andrew C Hodgson, 2:00-4:00pm

Protein tyrosine phosphatases (PTPs) are responsible for regulating cellular signaling pathways within the human body. PTPs regulate these pathways by catalyzing the removal of a phosphate group from a phosphorylated tyrosine. When mutated or misregulated, PTPs have been linked to many diseases including LEOPARD Syndrome, Noonan Syndrome, Diabetes and many cancers. By making a specific inhibitor for SHP2, the PTP can be selectively prevented from aberrantly regulating cellular signaling pathways. Creating a specific inhibitor for SHP2 is challenging due to the highly conserved active site structures of the 107 phosphatases found in human cells. One approach is to generate a bivalent inhibitor composed of a generic PTP inhibitor for potency coupled to one of two distinct SHP2 SH2-domain-targeting peptides for selectivity. These pieces are assembled in situ with the self-labeling enzyme HaloTag. These bivalent inhibitor combinations will be tested in activity assays against SHP1, SHP2, E76K (a SHP2 single amino acid mutant with uninhibited activity) to determine their respective potencies.

### **Deficiency of VPAC2R Affects Body Weight in Older Mice by Reducing Glucose Clearance and Increasing Fat Utilization.**

Eden Weghorst, 2:00-4:00pm

Vasoactive Intestinal Peptide Receptor Types 1&2 (VPAC1R and VPAC2R) are two G protein-coupled receptors that share the same two ligands, vasoactive intestinal polypeptide (VIP) and pituitary adenylate cyclase activating peptide (PACAP). To study the function of VPAC2R, VPAC2R-deficient mice were created. Previous studies of these VPAC2R-deficient mice (mutant mice, or MUT) have revealed that these mice have significantly lower body weight after about 18 weeks of age, and a different circadian rhythm compared to the wild type (WT) mouse, which includes an advance in the time in which they feed. Additionally, respiratory quotient analysis of these MUT mice show that they preferentially burn fat. To understand the impact that the VPAC2R deficiency imposes on mouse body weight in older mice, we used two study groups of mice that were 48 weeks of age. Each study group contained 5 male wild-type (WT) and 5 male MUT mice. We explored lipid metabolic pathways systemically and specifically in the liver and

<sup>†</sup> Denotes a project also included on the oral presentation schedule

brown adipose tissue, and 24-hour fasting plasma samples were collected to determine glucose, insulin, and circulating free fatty acid (FFA) levels. At 48 weeks, mean pre-fasting and post-fasting body weights were significantly different. Significantly lower concentrations of FFAs were found in the MUT mice compared to the WT mice following the 24-hour fasts. The insulin concentration was higher in WT compared to the MUT mice following the 24-hour fasts. The weights of the WT genotyped mice were consistently higher than the weights of the MUT genotyped mice.

### **Surveying Insect Pests in the Grant County Area**

Allison Tims, 2:00-4:00pm

In Grant County there are a multitude of insect pests to be found! What is the importance of these pests and their presence here? The type and general presence of pests can communicate a great amount of information about a particular ecosystem. This research is focused primarily on just how pest population data is gathered and what this data may mean for the broader ecosystem.

### **Investigating Purinergic Receptors in ATP-Induced Extracellular Acidification of Tiger Salamander Müller Cells**

Anna Phillips, 2:00-4:00pm

Previous study of glia show they regulate neuronal signaling by shaping extracellular conditions, such as pH, which could have widespread effects in both neuronal function and disease. Our lab has reported extracellular acidification around Müller cells isolated from tiger salamander retinas in response to ATP bath application, but the pathway by which this acidification occurs is not yet fully known. Prior work has shown that ATP and its metabolites (ADP and adenosine) all have potential to activate or influence glial activity through different receptors. Here we investigate the effects of suramin, a known purinergic P2 ATP receptor inhibitor, on the cellular acidification response to ATP. Collectively, we found that suramin had a partial, but not complete effect of decreasing the ATP response from Müller cells. This suggests the possibility of additional receptor activity during the response, such as the P1 receptor, or additional signaling from other molecules, such as ADP and adenosine.

### **Environment Conditions for Growth of Cultured Dead Sea Isolates**

Luke Hamachek, 2:00-4:00pm

The objective of this research was to investigate the diversity of cultivable bacteria in Dead Sea surficial waters and to characterize the indigenous bacteria obtained. To this end, a surface water sample taken from the Dead Sea, a hypersaline aquatic ecosystem, was inoculated into plates of medium SWYE (see methods), and colonies of four distinct morphologies developed after 14 days. Four strains of bacteria were then isolated from the four different colony types, and the isolated strains were characterized based on their growth response to a range of physical (e.g., pH, temperature, and salinity) and chemical (e.g., utilization of carbon sources) parameters, as measured spectrophotometrically. Determinations of the range and optimal growth patterns for each of these parameters are underway for each isolate and are based on turbidity-dependent absorbance measurements obtained following incubation of cultures. In addition, pure cultures of the four isolates will be submitted for 16S rRNA sequencing to determine their phylogenetic relatedness to previously characterized strains. Based on their physiological properties, the bacteria described in this study may play a significant role in nutrient cycling in the extremely harsh hypersaline waters of the Dead Sea.

† Denotes a project also included on the oral presentation schedule

## **Impact of the Implementation of Low-Cost Spectrophotometers on Student Learning in the Science Curriculum**

Brandon Tripp, 2:00-4:00pm

Analytical Instrumentation has taken on a significant role in chemistry throughout academia, government, and industrial laboratories. This has led to an increasing complexity of the instruments and a greater need for students to understand the instruments in their undergraduate curriculum. Due to the increasing complexity and automation, though, these instruments are typically operated by inserting a sample and receiving a digital response, which prohibits students from understanding the importance of the instrumental output. This “black box” effect is detrimental to student growth and understanding. The purpose of this project is to study the impact of developing and implementing a low-cost, manual instrument into chemistry curriculum. A photometer was chosen for implementation, as it is easy to produce, inexpensively constructed, and allows direct visual analysis to complement the instrumental data output. The photometers, created using a 3D printer and simple electronic circuits, were implemented in an introductory-level college course. Students were objectively surveyed for changes in understanding through pre- and post-instructional assessments and also subjectively observed throughout the process to better gauge their understanding of the instruments. The data suggests that the increased interaction has provided a positive impact on student understanding.

## **Fabrication of H<sup>+</sup> Selective Microelectrodes for Self-Referencing Recordings from Müller Cells**

Mason Vredevelde, 2:00-4:00pm

Müller cells are cells that are located within the retina of the eye and recent research and studies have shown that they are key players in neuronal signaling. These cells are very sensitive to ATP, which is used not only as an energy source but also as a messenger molecule. When Müller cells are exposed to extracellular ATP, we have characterized a pathway within the cell that causes the extracellular environment to acidify. Research of the pH changes around these Müller cells, specifically the ATP-mediated effects, requires the ability to get an accurate measure of small changes of pH around isolated cells. In our lab, H<sup>+</sup> selective microelectrodes are produced to make these pH change measurements in a very close proximity of the Müller cell. Electrodes are made from hollow TW 150-4 glass borosilicate glass (WPI) tube and put into a Sutter P-97 Puller. Pulled Electrodes are then salinized or surrounded in a hydrophobic cover. Once salinized, the electrodes can be stored until ready for use. Before use, the electrodes are backfilled with a 100 mM KCL, 10 mM HEPES saline pHed to 7.0 and made H<sup>+</sup> selective by front-filling them with a H<sup>+</sup> ionophore. Calibration of the voltage sensitive H<sup>+</sup> selective microelectrodes then occurs with the help of the self-referencing system and a voltage change that is measured when the electrode is moved from one log unit of pH to another one (ie pH 7 to pH 8). If the Nernstian slope that is produced from the recordings from the electrode is ~50-60 mV between the two solutions of differing pH environment, the electrode is considered H<sup>+</sup> sensitive. The microelectrodes can now be used to measure small changes in H<sup>+</sup> flux from isolated cells that would mimic the response of retinal Müller glia when added to a bath of ATP.

<sup>†</sup> Denotes a project also included on the oral presentation schedule

## **The Preliminary genome analysis of the alkaliphilic and minimalistic phototrophic bacterium *Heliorestis convoluta***

Naomi Malachi, 2:00-4:00pm

Vasoactive Intestinal Peptide Receptor types 1 and 2, which are G-protein-coupled receptors. Additionally, Pituitary Adenylate Cyclase Activating Peptide (PACAP) is a peptide belonging to the VIP family. PACAP contains three receptor types, VPAC1, VAPC2, and PAC1. PACAP has an equal affinity for both VPAC1 and VPAC2 but has the greatest selectivity for PAC1. All three of receptor types are found within pancreatic islets. All three receptor expressions are found within pancreatic Islets of Langerhans (commonly known as Islets). Stimulation of glucagon secretion and augmented insulin secretion in response to the presence of glucose is a result of the VIP and PACAP expression within the pancreas. In order to determine the role of the VPAC2R gene within pancreatic islets, two groups of mice were studied. The first group of mice (MUT) were created with a non-functional VPAC2R gene, and the second group of mice (WT) were created with a functional VPAC2R gene. Research into the functional differences of islets within the two groups of mice focuses on three components. The first being, augmented insulin release in the presence of glucose when signaling occurs through the VPAC2R receptor. The second, the result of the loss of this receptor on glucose stimulation insulin secretion determined by isolating the islets of both WT and MUT mice. Following isolation, insulin release was analyzed through glucose-stimulated insulin secretion (GSIS) assays. Thirdly, the remaining insulin secreted from islets during the GSIS assay was then quantified by enzyme-linked immunosorbent assays (ELISA). In addition to this, differences between islet size were also studied. It appeared that, WT islets were physically larger than MUT islets for a period of time. In order to determine islet diameter and mean cell number per islet Image J software and flow cytometry were employed. The difference in islet size was explored first through the application of Image J software, captured via phase-contrast of the islets. Following this, size difference was also determined through the number of cells per islet. Flow cytometry was then used to utilize the enumeration of islet nuclei in groups of 160 lysed islets of MUT and WT mice. Image J analysis revealed that MUT islets were larger in diameter on average compared to WT. While enumeration of WT islets revealed that they have more cells per islet on average than MUT derived islets. 18-hour, 17 mMol concentrations of ELISA data also revealed similar results in MUT islets response to glucose stimulation compared to WT islets. The 24-hour study was unable to yield enough MUT islets for comparison of their WT counterparts. In place of this comparable ages of MUT were used. Even still, MUT did not show any significant response to glucose stimulation. In contrast, WT islets did respond with insulin secretion as increased glucose stimulation occurred.

## **Examining structural and biochemical features of metabolic enzymes from thermophile *H. modesticaldum***

Mary Bonanno, Simon Falconer, 2:00-4:00pm

Our research has centered around *Heliobacterium modesticaldum*, a thermophilic bacteria native to the hot springs of Iceland. These bacteria have an optimal growth temperature of 52°C and are likely to express proteins that maintain thermal stability at elevated temperatures. *H. modesticaldum* is closely related to *Heliorestis convoluta*, which is a mesophilic and alkaliphilic bacteria that expresses homologous proteins. The goal of this study is to compare the thermal stabilities of homologous proteins from these two bacteria and determine what aspects of protein structure could contribute to higher thermal stability. This is

<sup>†</sup> Denotes a project also included on the oral presentation schedule

accomplished through three major steps: cloning into *E. coli*, expression and purification of the target proteins, and stability analysis using custom FTIR and Fluorimeter setups.

## **Combatting Leishmaniasis**

Jacob Hulbert

Leishmaniasis is a disease that affects hundreds of thousands of people each year. The disease manifests itself in multiple ways, including cutaneous leishmaniasis (CL), mucosal leishmaniasis (ML), and visceral leishmaniasis (VL). Many methods to combat leishmaniasis have been developed. Some, such as diagnostic PCR, are very effective, but not practical in endemic areas. The purpose of this research is to shed light on ways to combat leishmaniasis that are useful in endemic areas.

## **Monocarboxylate Transport Mediates ATP Induced Extracellular Acidification of Mammalian Astrocytes<sup>†</sup>**

Hannah Miller *2:00-4:00pm*

There has been heightened interest in determining the role of glial cells in synaptic transmission. Culturing primary rat astrocytes provides an approachable model for understanding glia's role in the nervous system. Previous studies of retinal Tiger Salamander Müller cells revealed an ATP dependent extracellular acidification influenced by intracellular calcium, purinergic receptors, and altered regulation of sodium-hydrogen exchange (NHE) in the cell. This study shows how NHE plays a similar role in the ATP-mediated acidification of rat astrocytes cultured from the cortex or hippocampus. The study also reveals an additional contribution of a monocarboxylate transporter (MCT), which suggests how lactate transport activity promotes the ATP-induced extracellular acidification. These findings reveal the importance of MCT and NHE in astrocyte cell signaling (See central model). Similarities observed between organisms suggest that this mechanism is fundamental to brain function.

<sup>†</sup> Denotes a project also included on the oral presentation schedule