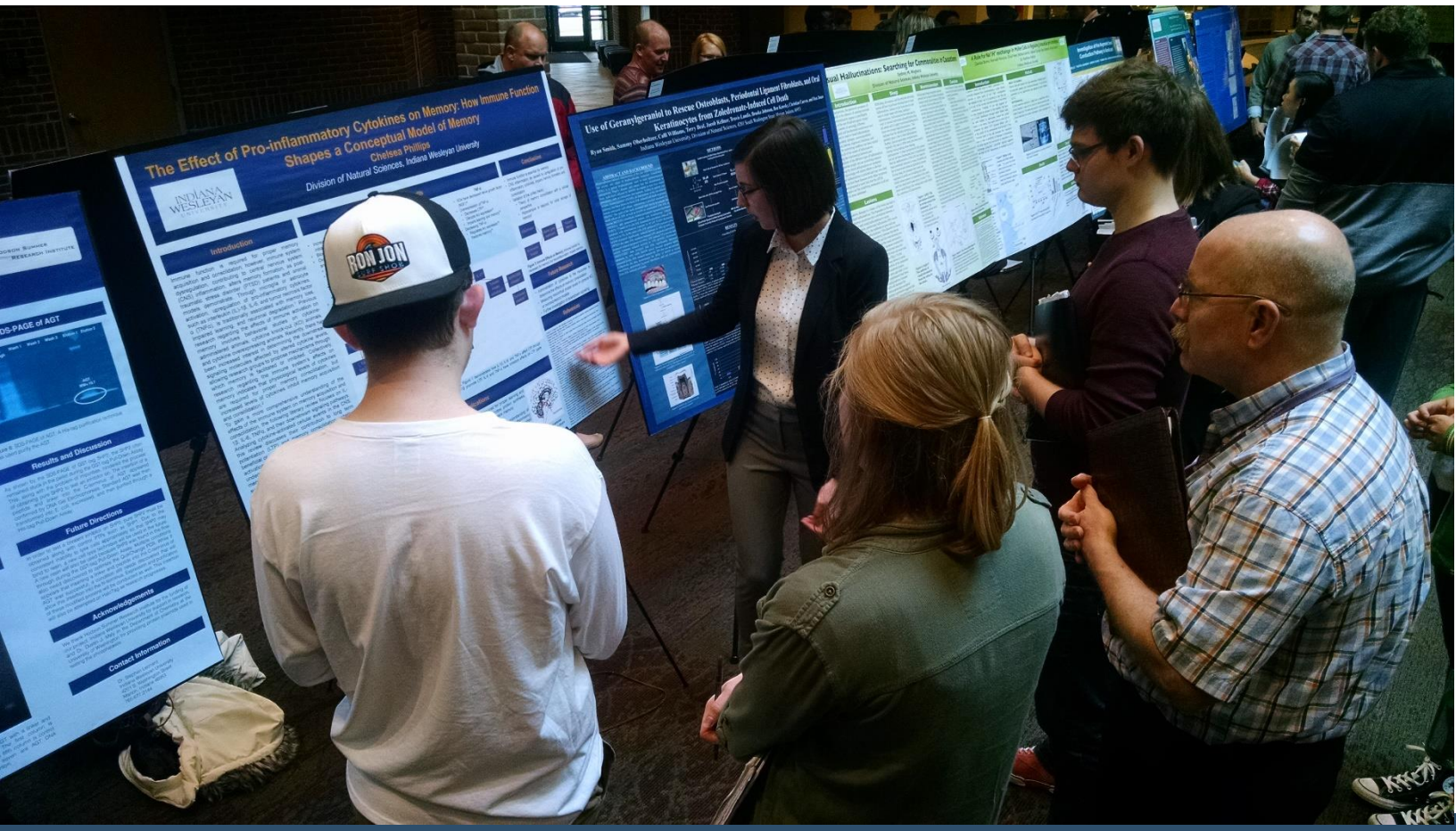
Celebration of SCHOLARSHIP



THURSDAY, APRIL 19, 2018

Poster Presentation Program

IWU'S ANNUAL UNDERGRADUATE RESEARCH CONFERENCE

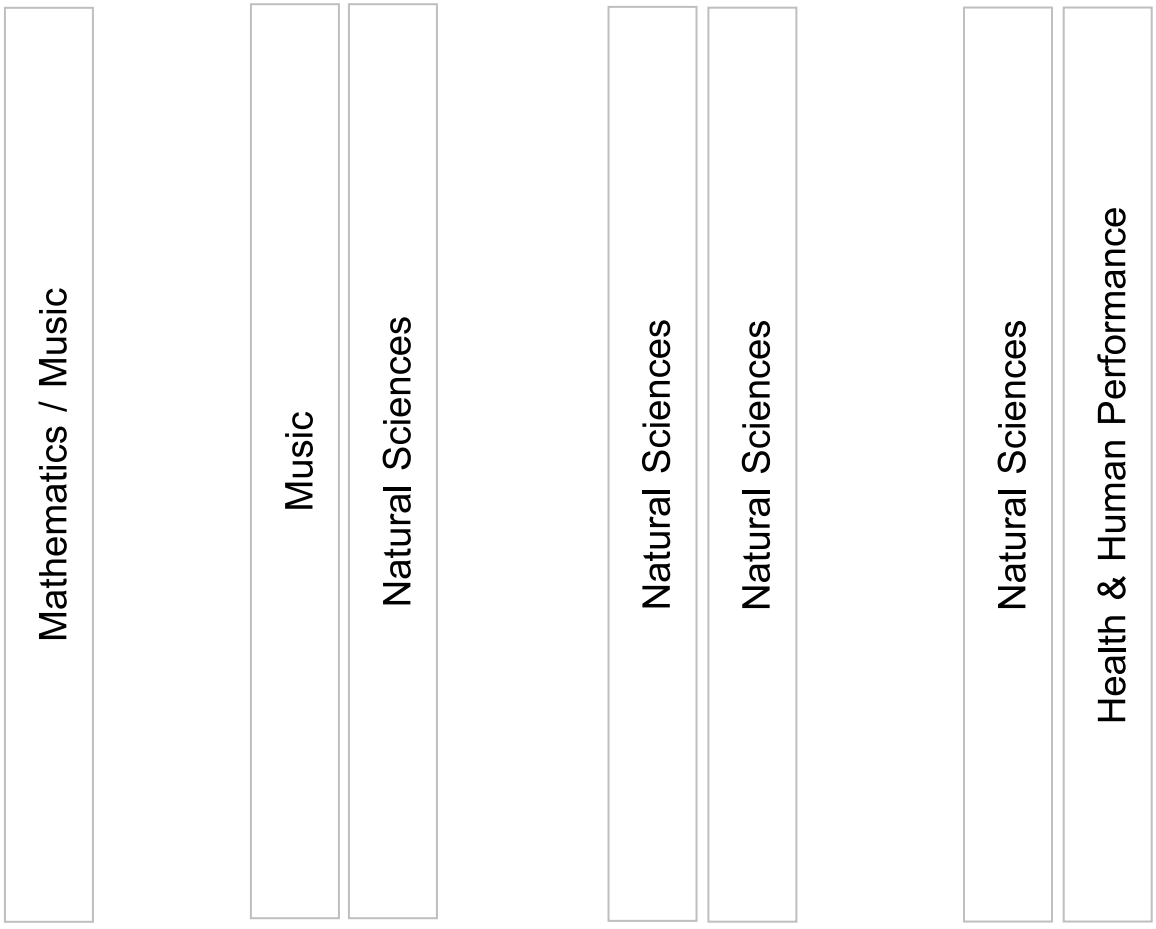
SPONSORED BY THE JOHN WESLEY HONORS COLLEGE

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 3:00 and 4:00pm.

BARNES STUDENT CENTER COMMONS

[Stage]

Behavioral & Social Sciences



[Baldwin Windows]

One Year Outcomes for a Mobile Social Belonging and Growth Mindset Intervention

Brittany Washington, *10:00am-12:00pm*

College is a challenging experience for most students. However, for some, the challenges are too great and they don't graduate. A 2012 University of Texas report showed that only 39% of first-generation students graduated in four years vs. 60% of those whose parents both graduated from college (Tough, 2014). Achievement and graduation rate gaps have also been observed for minority students (Schwartz, Kanchewa, Rhodes, Cutler, & Cunningham, 2016; Walton & Cohen, 2011). Growth Mindset (GMS) and Social Belonging (SB) interventions have shown promise in improving the academic outcomes and retention rates of first-generation and minority students (Yeager et al., 2016). Walton and Yeager (2014) define growth mindset as the recognition that "intelligence is not fixed but grows with hard work, effective strategies, and help from others" (p. 1). Social-belonging, on the other hand, involves the realization that "everyone worries at first about whether they belong in college, but these worries dissipate with time" (Walton & Yeager, 2014, p.1). Most GMS and SB interventions have been delivered online, before the semester begins. Smartphones provide a means of extending the reach and potential scalability of these interventions. Therefore, we tested the effects of a GMS and SB mobile intervention delivered in real-time during the first two weeks of the semester. This is the time period when students may be the most receptive to such mindset interventions. In this intervention, students received daily prompts about growth mindset and social belonging, in addition to diverse peer stories designed to promote social belonging.

Compassion, Culpability, and Heart Rate Measures: A Pilot

Lindsay Wood and Kara Slusser, *Presentation Times TBD*

It has been well documented that perceived culpability can moderate compassionate responding (Batson et al., 2007). Additionally, compassionate responding has been associated with both increases and decreases in heart rate and heart rate variability (HRV; Eisenberg et al., 1988, 1989, 1991, 1996; Kirby et al., 2017). In this pilot study, we examine the use of audio vignettes and a widely accessible commercial heart rate monitor for studying compassionate responding in relation to culpability, and associated changes in heart rate. Participants (n=32) came into the lab for two different sessions within a single week. They were fitted with Fitbit Charge HR's to measure heart rate. These devices were selected because of their accessibility and reasonable levels of error during nonaerobic activities (Stahl et al. 2016; Powierza et al. 2017; Dooley et al. 2017). Participants were then instructed to engage in other-oriented perspective-taking while listening to an audio vignette adapted from Batson et al. (2002) and (2007). A different vignette was used across the two sessions: one in which the person had no personal responsibility for the difficulties they were facing (Batson et al. 2007); and in the other, the person had some degree of personal responsibility for their difficulties (Batson et al. 2002). After listening, participants completed the Questionnaire of Cognitive and Affective Empathy (Reniers et al. 2011), Cameron and Payne's (2011) Compassion Scale, and Diener et al.'s (2010) Flourishing Scale. While no significant differences were observed in flourishing ($p=.709$) or empathy ($p=.806$), there was a significantly lower reported level of compassion in response to the vignette in which the person had some measure of culpability ($t62=3.299$, $p<.01$). No significant difference in heart rate mean ($p=.352$), or HRV ($p=.444$), was observed. Our findings suggest that another's culpability can influence compassionate responding. However, we did not detect any associated differences in heart rate. Nevertheless, this method may provide a feasible and accessible way to examine compassionate responding in the face of varying degrees of culpability, and any related heart rate differences. Of particular note, it provides a way of

examining individual differences among those who respond with high levels of compassion in spite of culpability.

The Theology of Animal-Assisted Therapy

Kristin Moore, *Presentation Times TBD*

The relationship between humans and animals has existed since the beginning of time when God created both creatures and man in the Garden of Eden. Made in God's image, mankind is responsible for stewarding creation, both biotic and abiotic elements. Humans have taken it upon themselves to domesticate animals, but the outcome has resulted in benefits for both the human and the animal and lead to a co-dependent relationship between the two beings. Within humans, human-animal relationships improve developmental growth, psychological well-being, and physical health. Noticing these beneficial results, the field of animal-assisted therapy has grown and been seen in a variety of settings accompanied by a diverse range of animal species. The way human-animal relationships are viewed through both theology and psychology influences the way animal-assisted therapy is approached and carried out, and the way it might be improved for more effective treatment in the future.

Neurologic Music Therapy and its Uses with Stroke Patients: A Literature Review

Nicole Weidner, *9:30-11:30am*

Throughout the past several decades, there has been a vast amount of research conducted to find the best methods of intervention to benefit stroke patients' recovery. Many medications, therapies, and surgeries are often needed by these patients to continue living and growing stronger in mind, brain, and body. With music therapy becoming more established in the therapeutic field, Neurologic Music Therapy (NMT) has become an emerging modality in treating a multitude of brain injuries, speech disorders, and gross motor and coordination issues—all of these which are normally present in stroke patients. In this literature review, a brief overview of these NMT techniques and discoveries, which are creating a more rapid, efficient, and rewarding recovery in stroke patients, will be discussed.

Investigating the Relationship Between Feminism and Perceived Pressure to Marry in Undergraduate College Students

Katura Rowe, *Presentation Times TBD*

The purpose of this study is to better understand the impact of feminist views on pressure that young (18-24 year-old) women feel to get married during or soon after their college years. A phenomenon that seems to be particularly strong in small Christian colleges is known as the "ring by spring" phenomenon. This can best be described as the goal or expectation to get engaged by the spring semester of senior year, or shortly thereafter. This concept appears to be less common in larger public universities where feminist views are more widespread.

Health and Human Performance

Effect of Preferred Music Genre on Exercise

Ben Lex, Ashley Etherton, Karaline Hallett, and Jordan Stemple, *Presentation Times TBD*

The aim of this study was to determine the impact of music on performance, rate of perceived exertion (RPE), and heart rate (HR) during moderate exercise. Running has been found to be a common mode of

exercise during which students listen to music (Barney, Gust, & Liguori, 2012). Prior research suggests that listening to preferred music during physical activity affects HR, RPE, and performance. Thirty healthy male and female university students (18-24 years old) participated in this study. Participants completed the 12-minute Cooper Run Test on three separate occasions, listening to most preferred genre, least preferred genre, and no music. Distance traveled, HR, and RPE were recorded during each test. After performing a Repeated-Measures ANOVA, it was determined that HR and RPE responses did not display any statistically significant differences ($p > 0.05$) among the three trials. While listening to most preferred genre, however, participants traveled a significantly greater distance than when they ran to their least preferred genre ($p < 0.05$). Because there is a linear relationship between exercise intensity and HR, it would be expected that HR would increase significantly as distance traveled increased, however, this was not the case, suggesting there is a physiological effect of listening to preferred music genre. The findings from this study enhanced our knowledge of music's impact on physiological responses. These discoveries impact a large portion of the exercising population, due to the popularity of listening to music during physical activity and the effect on performance.

Efficacy of Dry Needling on the Reduction of Trigger Points and Musculoskeletal Pain: A Critically Appraised Topic

Brooke Boyer, Alyssa Hampton, and Sarah Hawkins, *10:00-11:30am, 12:30-2:00pm*

Accuracy of Fitness Trackers in Predicting Caloric Expenditure during Stationary Biking

Caroline Moore, Corbin Coffman, Andrew Wick, and Elaine Shimmons, *Presentation Times TBD*

With the increasing prevalence of wearable activity trackers, it is important to investigate how reliable they are. The measurement of caloric expenditure of three different fitness trackers was assessed during a stationary bike test through the use of a six minute biking protocol. Each reading on the fitness trackers were compared to the metabolic cart, the gold standard in assessing caloric expenditure. Forty college-aged individuals voluntarily agreed to participate in the study. Following the data collection process, two of the fitness trackers were found to have a positive correlation in relation to the metabolic cart. However, activity tracker 1 was found to overestimate caloric expenditure, and activity tracker 2 was found to underestimate caloric expenditure. The results of activity tracker 3 were unable to be statistically analyzed due to the variation and inaccuracy between measurements found during the study. Since both activity trackers were found to be inaccurate when compared to the metabolic cart, this could lead to individuals having misconceptions about the number of calories they burn during an exercise session. As a result, those who use activity tracker 1 will be led to believe that they burn more calories than they actually do, while those who use activity tracker 2 will have a perception that they are burning less calories for the same exercise program.

Efficacy of the Myokinesthetic System SM on Reducing Low Back Pain: A Critically Appraised Topic

Joshua Sommers, Joe Wikel, and Kyle Zuber, *Presentation Times TBD*

The Accuracy of Activity Trackers Measuring Energy Expenditure Compared to the Metabolic Cart

Josiah Planck, Douglas Oliveira, Christi Wolgemuth, and Whitney Yoder, *Presentation Times TBD*

Fitness trackers are becoming increasingly popular worldwide. There are several different brands that produce fitness trackers that come in a variety of colors with various functions and abilities. It is essential that consumers who purchase these watches be able to rely on the functions that are advertised, especially when cost, exercise, and life-style choices wane in the balance. The purpose of this study is to assess the accuracy of the energy expenditure function of three different fitness trackers: Garmin Vivosmart HR, Fitbit Charge 2, and the Huawei Band 2. There were a total of 35 participants whose ages ranged from 18-23. The participants were college and graduate students at Indiana Wesleyan University. Each participant wore all three devices and walked on a treadmill for 10 minute at 3.0 mph with no incline. The energy expenditure from each device was compared to the results of indirect calorimetry, which is the gold standard. The average on the total energy expenditure was off by 37 calories on the Fitbit, 22 calories on the Garmin, and 4 calories on the Huawei when compared to the metabolic cart, which utilizes indirect calorimetry. The main finding was that all devices overestimated energy expenditure and they all had a moderate correlation to the metabolic cart. Consumers need to be aware of the product they are buying, its functions, and accuracy. Purchasing fitness trackers can be expensive so doing proper research on which one is the most accurate is essential.

Recurrent Delayed Onset Focal Seizure Disorder with Bilingual Manifestations in a Baseball Athlete: A Case Study

Kayleigh Hollywood and Madison Stadt, *12:00-2:00pm*

To present the case of a 19-year-old male baseball athlete who was diagnosed with partial symptomatic epilepsy with uncontrolled complex partial seizure disorders with status epilepticus.

Bilateral Athletic Pubalgia in Collegiate Male Soccer Athlete: A Case Study

Rebecca Spiegel and Madison DePolo, *Presentation Times TBD*

Bilateral athletic pubalgia is a rare condition caused by pelvic floor weakness. This typically affects male, Caucasian athletes. Mechanism for this condition is participation in athletics which require forceful, twisting motions with quick change in direction. This case describes a twenty-three year old male collegiate athlete with bilateral athletic pubalgia. Diagnosis found using magnetic resonance imaging (MRI). The standard treatment for athletic pubalgia was performed, bilateral surgical repair.

Correlation Analysis of the Skulpt and BodPod

Victoria Haller, Annabell Kennell, Alexandra Seabeck, and Alexandrea Springer, *Presentation Times TBD*

The BodPod is known as the golden standard for measuring body composition. A new body composition measurement tool called the Skulpt© was created recently. There is little to no research on the Skulpt©, because it is so new. For this reason, our study sought to determine the accuracy of the Skulpt© compared to the BodPod. This research is beneficial because if the Skulpt© is determined to be accurate, the low cost and convenience of the Skulpt© would make measuring body composition more accessible and available to the general population. This will increase the public's knowledge on the importance of a healthy body composition. The purpose of our study is to test how accurately the Skulpt© measures body fat percentage when compared to the BodPod. Participants completed an informed consent and demographics form prior

to the study. The participant's body composition measurements were recorded, using the BodPod first then Skulpt©. Results were analyzed using the Spearman's R Correlation on SPSS software and concluded there was a statistical significance of 0.000 between the BodPod and Skulpt©. A 4.8582% difference was found between the measurements. There was a direct relationship correlation of 0.845 found between the BodPod and Skulpt©. The Skulpt© was statistically higher when measuring body composition in comparison to the BodPod. The primary recommendation is to avoid using the Skulpt© in research settings. The Skulpt© is acceptable to measure body composition in the general population if prior knowledge is given that it will provide a consistently higher measurement than the BodPod.

Accuracy of Fitness Trackers in Measuring Caloric Expenditure and Heart Rate

Zane Hayden, Michael Olson, Kennedy Jones, and Ally Thines, *Presentation Times TBD*

As people continue to try to be healthier, the popularity of fitness trackers increases. The purpose of this study was to test the reliability and accuracy of the heart rate and caloric expenditure of two of these wearable devices, the Fitbit Charge 2 and the Garmin VivoSmart. The articles researched for this review showed that the Fitbit Charge 2 can accurately measure heart rate at rest. This was also shown with the Garmin VivoSmart. For exercise, however, the Garmin VivoSmart would underestimate the heart rate. This was also true for the Fitbit Charge 2. For caloric expenditure, both devices were shown to be inaccurate, either measuring too high or measuring too low. However, each study used different ways to measure the accuracy of both of the variables. Therefore, the design of the study could be a significant factor in determining this accuracy. The study conducted, composed of 21 participants (age range 18-62), showed the Garmin VivoSmart to overestimate the heart rate while resting and the Fitbit Charge 2 to underestimate the heart rate at rest. Both devices underestimated heart rate while performing the study (i.e. while exercising). As far as caloric expenditure, the Garmin VivoSmart underestimated the calories burned; the Fitbit Charge 2 overestimated the number of calories burned. As reliance upon these technologies continue to rise, it is imperative that the companies strive to improve in the accuracy of these variables.

Mathematics and CIS

Predicting Cycles in the Diagraphics of Commutative Rings

Morgan Bounds, *Presentation Times TBD*

The digraphs of commutative rings under modular arithmetic create intriguing patterns. Most contain cycles of varying lengths, while a select few contain none at all. It was conjectured in 2015 that the cycle structures of composite moduli can be predicted based on the digraphs of their prime subrings. This presentation offers a proof of the conjecture, as well as a surefire method of anticipating vertex coordinates in arbitrary moduli.

Music

The Impact of the Therapeutic Relationship on the Outcome of the Results of Therapy

Abi Dawson, *Presentation Times TBD*

This research will look through the history of both music therapy and clinical therapies and discuss the importance of the therapeutic relationship between the therapist and the client and the influence that it has on the outcome of the therapy. The research will cover different stances on the topic, as well as evidence

towards the importance of the relationship. Along with the meta-analysis of previous studies and writings, ideas and evidence of current impacts and statistics will be given as to why it is so important.

Music Therapy and Hospice Care

Alli Greear, *Presentation Times TBD*

The goal of this project is to discover if relaxation techniques done by a Music Therapist do effect hospice patients positively.

The Effect of Music Therapy on Students with Developmental Disabilities

Austin Todd, *Presentation Times TBD*

The purpose of this study is to educate people on the use if music therapy in a specific field (students with developmental disabilities). It will show how music therapy can be used with the population and help advocate for its future use.

The Effect of Film Music on Emotions – Implications for Music Therapy

Becca Bryan, *Presentation Times TBD*

Music can be used to evoke emotions, change perceptions, and influence opinions. Film music is a good example of this power of music. This presentation will break down research showing that music can make you feel certain emotions, theories on why music makes you feel this way, and how music therapists can use this information in their field.

The Use of Music Therapy to Improve Social Skills of Children with Autism

Bekah Woeste, *Presentation Times TBD*

The presentation will cover the effect of music therapy on improvement of social skills in children diagnosed with autism spectrum disorder. The research involved is a meta analysis of scholarly studies which cover a variety of therapeutic methods and social skills targeted for individuals with ASD.

Music Therapy and Post-Traumatic Stress Disorder

Emily Berger, *Presentation Times TBD*

The purpose of this research was to analyze the available research on music therapy and it's effectiveness with adults with post-traumatic stress disorder. A literature review was used to gather the data presented. The results found indicate that sufficient data is not currently available to reach a conclusion, but data suggests that music therapy has the potential to produce positive effects. More research with larger sample sizes and improved treatment protocols is needed.

The Effects of Music Therapy on Communication Skills in Children with ASD

Emily Mouser, *Presentation Times TBD*

This research project will look at how music therapy can be effective in Children with Autism Spectrum Disorder (ASD), specifically regarding their communication skills. It will review a number of articles on the subject, one of which explores how music therapy can be used within certain approaches, and how successful automatic reinforcement can be established by combining target verbal behavior with music. Another article, based on video submissions from three therapists, looks into how expressive music can act as a nonverbal language, and another studies the neural mechanisms behind speech and music perception

in ASD, finding that there can be persevered fronto-temporal connectivity during sung-word listening. The next article presents a review of literature as well as a case study. It talks specifically about the details of nonverbal communication, its importance in therapy, how it can be achieved through music, and how all that related to autism directly. It also looks at why music can be a means of communication and even notes how the nonverbal can sometimes translate to the verbal. The last article talks about the putative human mirror neuron system (MNS), which may be abnormal in people diagnosed with autism, and proposes an intervention involving music that might engage parts of the brain that intersect with it.

Does Music Affect Heart Rate and Blood Pressure?

Erin Daly, *Presentation Times TBD*

Music therapy in children's hospitals has grown so rapidly in the past few years, more than it ever has. It is used to work on a variety of goals and needs, a few of them being to regulate heart rate and blood pressure. Some studies and tests have been done proving that music does affect heart rate and blood pressure in a positive way; other studies have been contradictory. The objective of this research is to accumulate information from several different research articles to see if music truly does regulate one's own heart rate and blood pressure.

The Effects of Music on Pain and Anxiety in Children

Evan George, *Presentation Times TBD*

This project sought to find the effect of music as it relates to pain and anxiety in children. Several of the studies focused on children who were hospitalized, or about to undergo some sort of medical procedure. The results of the studies examined showed reduction in pain and anxiety in children when music is utilized.

Music Therapy and Social Problem-Solving Skills in Preschoolers

Lauren Meeks, *Presentation Times TBD*

This presentation will explore what are social problem-solving skills, also known as executive functioning. It will examine a body of research articles and sources to see what effect music has on the development of executive functioning skills in preschoolers and how it can work to compensate for deficits in that area.

What are the Psychological Responses of Music Therapy on Neonates in the NICU?

Mary Pierce, *Presentation Times TBD*

Music therapy has an effect on almost every population. In this research projection, I am going to focus on the physiological response of neonates in the NICU (neonatal intensive care unknit) to music therapy. Each article tests to see how each group of infants reacts to certain types of music: parent-selected songs, well-known folk song, and even the effect of a male sung lullaby.

The Effect of Music Therapy on Speech in Children

Megan Bauserman, *12:00-2:00pm*

This poster presentation is a meta-analysis of the current research pertaining to the effect of music therapy on speech in children. It covers the different populations of children that have received music therapy speech treatment, and examines the different treatment styles that have been utilized in research, as well as the results of these different treatment styles.

Music and Mental Health

Noriah Matanick, *Presentation Times TBD*

The effects of music on the interpersonal skills of those who struggle with mental health/mental illness.

The Benefits of Music Therapy for Clients that have Depression

Priscilla Chen, *9:00-10:00am, 2:00-3:00pm*

Depression is a very common mental illness in America. Music therapy interventions can help clients learn how to cope with sadness and anxiety. Clients can learn how to respond to their emotions in a more positive and beneficial manner to improve their overall well-being.

Music Therapy with Child Abuse

Sara Drown, *Presentation Times TBD*

This is a meta-analysis study of how music therapy can benefit children who have suffered from abuse, whether it was emotional, physical or verbal abuse. This study discusses the statistics of abuse in our culture and signs of abuse in children. It talks about different kinds of interventions that have been used to help both children and adults with a history of abuse over come their past and move on better in their lives, cope with the memories, manage the anxiety the abuse has caused, and more. This study also discusses the effects that childhood abuse/trauma can have on a person and how it effects the persons interpersonal relationships, with music therapy interventions to combat the effects that were caused by the abuse. Child abuse is a problem in our society but in this study, I briefly will talk about how music therapy has been helping children and adults who have suffered abuse battle the memories and the past.

Natural Sciences

Daily Student Engagement with Text Messages in General Chemistry

Abigail Johnson, *3:00-3:30pm*

Students often report using ineffective study techniques (Gurung, 2005; Gurung, Weidert, & Jeske, 2010). Using text messaging (Qualtrics), this project encouraged practice testing, distributed practice, and interleaved practice (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013). All students enrolled in general chemistry (N = 82) at a small Midwestern private university participated in this project. Starting the second week of class, students started receiving a daily text message with four quiz questions (students received course points for answering the questions daily). After answering each question (practice testing), students received feedback explaining the correct answer. As each week progressed, a subset of the 20 weekly questions came from previously learned material (distributed practice); additionally, the ordering of the content mixed the four main content areas (naming, stoichiometry, dimensional analysis, and balancing equations) of the course material (interleaved practice). For exam one, participants' total score on practice questions and the total number of days they completed questions was a significant predictor of their exam score ($F(1,81) = 17.90$, $p < .001$, $R2 = .18$; $F(1,81) = 12.60$, $p = .001$, $R2 = .13$). This pattern was the same for exams two, three, four, and the final exam. For participants' final grade in the course, participants' total score on practice questions was a significant predictor of their final grade ($F(1,75) = 46.34$, $p < .001$, $R2 = .39$). This suggests that the use of practice testing, distributed practice, and interleaved practice using smartphones may increase exam scores.

The Effects of Caffeine and Ethanol on Telomere Homeostasis in Tetrahymena

Alexander Breytenbach and Rebecca Evey, *Presentation Times TBD*

Tetrahymena has long been a model organism for the study of many eukaryotic proteins and enzymes. Most notably, it has served as one example of homologous regulation at the telomere to humans. This is the organism where telomerase was first discovered and characterized. Although not perfect, an understanding of tetrahymena telomeric proteins and pathways give a lens into predicting outcomes for similar complications in humans. This was the premise of our research into the nature of the effects of caffeine and ethanol on the telomere. Both are contained in beverages consumed by the average human, and therefore insight given by a single celled ciliate could point to potential investigations worth exploring more carefully. Both caffeine and ethanol altered the homeostasis of the telomere as judged by the difference in telomere length vs a control group of tetrahymena. This indicates potential stimulus adaptation and response that could provide chronic affects to the cell over a long-term exposure. The amount of time proved to also increase the impacts seen on the cellular DNA. The full extent of this affect could be the focus and interest of further exploration.

Investigation of an outer nerve ring-like structure in *Aurelia aurita* using immunofluorescence confocal microscopy

Amelia Georgas, *3:00-3:30pm*

Jellyfish are considered by many to have the simplest nervous systems of the animal kingdom. Like other members of the phylum Cnidaria, *Aurelia aurita* ("moon jellies") lack a central nervous system (brain and spinal cord) but contain two types of nerve networks: a conduction system for regulating striated muscle contraction (pulsing) and a nerve net for controlling non-pulsing-related behavior (feeding etc). However, *Aurelia aurita* is believed to lack a specialized component of the conduction system found in other cnidarians called an outer nerve ring (ONR). The ONR links adjacent "arms" and speeds nerve conduction around the outer periphery of the animal. Our recent investigation of nerve conduction in moon jellies indicate they have a functional ONR at least during the ephyra stage of development. In this current study, we used immunofluorescence confocal microscopy in an attempt to visualize and further define the ONR in *Aurelia aurita* ephyrae.

A History of Visualization of the Cell

Andrea Lacy, *11:00am-12:00pm, 3:30-4:00pm*

Although the history of cell biology is complex and extensive, it can be simplified into four eras by looking at the visual image of the cell. Beginning in the 19th century, the visual capacity of the light microscope largely influenced cell biology. Because of the invention of the electron microscope in the 1950's, detailed structural knowledge of the cell was available and informed its visual image. With the development of biochemistry, cell biology underwent a molecular revolution which dominated during the 1980's. Cellular images aimed to illustrate the cell through symbolic means to describe molecular interactions that are beyond what is visible by the microscope. And finally, in the 21st century, three-dimensional modelling and animation currently aims to combine structural and molecular data to form a comprehensive visualization of the cell.

Neutron Scattering in MoNA detector bars for Comparison with Simulation

Andrew Wantz, *10:00-11:00am, 3:30-4:30pm*

A. Wantz, J.E. Boone, W.F. Rogers (Indiana Wesleyan University), N. Frank (Augustana College), A.N. Kuchera (Davidson College), S. Mosby (Los Alamos National Lab), M. Thoennessen (FRIB, NSCL, Michigan State University), and the MoNA Collaboration – In order to test the effectiveness and accuracy of Monte Carlo simulation (GEANT4 with Menate R), used by the MoNA collaboration for interpreting neutron-

scattering data from the MoNA (Modular Neutron Array) and LISA (Large multi-Institution Scintillator Arrays) at NSCL, MSU, an experiment was conducted at Los Alamos LANSCE center in which 16 MoNA detector bars were exposed to a well characterized neutron beam. Each MoNA bar consists of BC408 organic scintillator measuring 200x10x10 cm^3 with PMTs attached to each end. In order to properly characterize important neutron scattering signatures over a wide range of incoming neutron energy, such as scattering angle, mean distance between scatters, multiplicity, and dark-scatter, it is important that background be fully understood and corrected for. Background sources include neutrons scattered from the collimator on entrance to the room, decay of neutron activation within the bars, neutrons scattering in the room, and cosmic muons. Several methods for accounting for and removing background contributions to data were developed so that data can be compared directly with simulation (which does not contain these background features). Results, including scattering data comparisons with simulation will be presented.

The Impact of Plastic Pollution of Aquatic Environments

Benjamin Evenson, *Presentation Times TBD*

Plastic Debris has been increasing and shows no signs of stopping. In 2012 alone, the production and consumption of plastics increased by four percent. To begin to make a change we first have to understand the problem. Studies have found that the aquatic plastic pollution stems from terrestrial environments. This plastic pollution in ingested by seabirds and aquatic organisms. The chemicals used in plastic are unhealthy for these organisms and can even cause fatality. This is a conglomeration of multiple studies to help understand the problem of plastic pollution. The method for measuring the plastic pollution was net tow sampling. The study measured for both plastic size and weight and their concentrations over the oceans. The sizes measured ranged from .33mm to >200mm. This range in measurement allowed for the inclusion of plastics from microplastics (<5mm) to mega-debris (>100mm). The effect on seabirds and aquatic organisms was measured by dissecting 362 seabirds aging from juveniles to adults. The studies found that the majority of debris stemmed from societal use in the domestic, industrial, and agricultural worlds. These plastics degrade into microplastics and end up in the rivers and oceans. The most abundant plastic size was 1.01mm-4.75mm range. It was also found that the highest concentrations of plastic debris were found in the northern Pacific and Atlantic oceans spreading between the US and both Asia and Europe. The studies also found that 66% of the birds sampled had ingested plastic. Some of the species even showed 100% prevalence. Plastic debris is invading our oceans and the local organisms. We need to find solutions to reducing our plastic waste and keep its levels from rising before we can ever hope to clean up what we have already caused. By knowing the basis of the problem we can more easily find a solution.

The Use of Sensory Integration Therapy For Children With Disabilities In A Healthcare Setting: A Systematic Review

Brie Oetman, *9:30-11:30am, 3:00-3:30pm*

Sensory Integration Therapy (SIT) is a commonly practiced yet controversial intervention used for individuals with disabilities. It is mainly used in home, educational, and clinical settings by occupational therapists or child life specialists. The objective of this review was to systematically analyze the literature on SIT to assess its effectiveness on children with various disabilities, and to secondarily evaluate it in healthcare settings. Beginning with reviewing the history of SIT, the outcomes of over eighty studies since SIT's beginning were examined. The quality of the methodology and design, the disabilities present in the chosen subjects, and the collection and outcomes of the results were compared. Based on a diverse spectrum of disabilities, dissimilar progress tracking, and each individual subject's unique preferences toward SIT, these studies did not provide enough convincing evidence for the overall efficacy of SIT as of today.

Effectiveness of Treatment Techniques on Age-Related Macular Degeneration

Cailey Willhardt, *Presentation Times TBD*

Age-Related Macular Degeneration is an incurable eye disease caused by the buildup of cellular waste or leaky blood vessels. It is currently the leading cause of vision loss and has affected more than 10 million Americans. It is also expected to continually affect more individuals in the upcoming years. Individuals affected by this disease can lose their central vision along with their ability to view fine details. Both researchers and physicians suspect that vitamins and other supplements may help prevent further progression of the disease; however, several studies find these preventative measures to be controversial. Age-related macular degeneration has become a significant problem not only in the United States, but throughout the world. As individuals continue to perform research on ARMD, they are continually expanding their knowledge and working towards a solution.

Visualizing Antigens Related to Steroidogenesis Through IHC of Mouse Testes

Carissa Van Cise, *1:30-3:00pm, 3:00-3:30pm*

Mice deficient in VIP (3) or one of its associated protein receptors VPAC2R (1) or PACAP (2) have disrupted circadian rhythm. VPAC2R-KO (hereafter called KO) male mice exhibit loss of fecundity around thirty days after reaching sexual maturity. Since VPAC2R is normally expressed in the testis, this loss of fecundity may be directly related to the lack of VPAC2R expression in the KO testis, or it could be due to loss of normal circadian control through the hypothalamic-pituitary-testis axis. To determine whether the VPAC2R deficiency has a direct or indirect impact on the testis, expression of VPAC2R, StAR, transferrin, and 3β-HSD was measured using immunohistochemistry (IHC). These are downstream targets regulated by the circadian rhythm clock genes. The protein 3β-HSD helps convert progesterone to testosterone while steroidogenic acute regulatory protein (StAR) transports cholesterol across the mitochondrial membranes in cells, the rate-limiting step in production of steroid hormones such as testosterone. Transferrin is a protein that is expressed only in the Sertoli cells of the testis' seminiferous tubules. IHC analysis of testis sections has indicated that 3β-HSD is expressed less in the KO mouse testis compared to wildtype. This lack of 3β-HSD would limit conversion of precursors to testosterone, causing or contributing to the early loss of fecundity observed in the KO male mice. At this point, further testing is needed to determine whether the lack of VPAC2R in KO mice directly or indirectly impacts mouse testis.

Development of Selective and Potent Bivalent Inhibitors of the Phosphatase SHP2

Chad Hawkins, *10:30-11:30am, 3:00-4:00pm*

Protein tyrosine phosphatases (PTP) are responsible for regulating cellular signaling pathways within the human body. PTPs regulate these pathways by catalyzing the removal of a phosphate group from the protein tyrosine. When mutated or misregulated, PTPs have been linked to many diseases. For example, malfunctions of the protein tyrosine phosphatase SHP2 (PTPN11) have been linked to diseases such as LEOPARD Syndrome, Noonan Syndrome, Diabetes, and Metachondromatosis. Mutations of SHP2 can also be found as a factor in cancers including juvenile myelomonocytic leukemias, neuroblastoma, melanoma, acute myeloid leukemia, breast cancer, lung cancer, and colorectal cancer. By making a specific inhibitor for SHP2, the PTP can be selectively prevented from incorrectly regulating cellular signaling pathways. Creating a specific inhibitor for SHP2 is challenging due to the highly conserved active site structures of the enzymes. Creating this specific inhibitor will allow for the further study of pathways SHP2 regulates. The method by which this inhibitor is created should also be applicable to other enzymes in the PTP family.

Analysis of volatile compounds and their potential importance in Moringa oleifera

Clare Bennett, *Presentation Times TBD*

Moringa, also known as “The Miracle Tree”, is highly nutritious and used throughout the world for medicinal purposes. Some known properties of Moringa include anti-inflammatory, anti-bacterial, antioxidant, and anti-cancer. The aim of this study was to analyze volatile compounds within *Moringa oleifera* plant tissue, as well as investigate potential functions of these compounds. The volatile compound profile of Moringa was explored using gas chromatography - mass spectrometry in a collaboration with Purdue University, as well as through literature review. Potential connections between the known compounds and known uses of Moringa were investigated through literature review.

Environmental Sustainability of Organic Agriculture

Elise Diefenbacher, *Presentation Times TBD*

The purpose of this research is to determine the sustainability of organic agriculture in both crops and livestock by discussing the requirements and processes of the organic food industry. Organic food has experienced a significant increase in recent years and continues to rise, but little information is commonly known about the farming techniques and requirements that farmers must undergo to sell certified organic foods. Organic foods are commonly perceived as healthier and deriving from environmentally-friendly practices. This research will reiterate the requirements of becoming USDA Certified Organic, provide statistics of the organic food industry, and bring to light some issues within the organic food industry that should be addressed by the USDA.

Development of biochemical tools for analysis of HIV-1 Nef-dependent Hck activation and viral packaging

Hannah Hartzler, Malorie Weldy, and Rebekah Drew, *Presentation Times TBD*

Nef is an accessory protein of HIV which assists the virus to increase infectivity and pathogenesis. Nef does this by binding with the Hck’s – a Src family tyrosine kinase – SH3 domain. This complex then gives a promising target for anti-HIV therapies. Little is known, however, about the mechanism by which the Nef-dependant Hck activation assists in HIV infectivity. In order to assess the requirements for Hck packaging in virion, a series of Hck expressing mutants were created from a 293 cell line, an in vitro assay was explored, and a immunoprecipitation for Nef-Hck binding was attempted. There were two mutants created; one was a cloning of a K296M negative control and the other was a recloning of the novel Rte Mutation created the year before. The assay development showed that p-73, a known Hck target, is expressed in the 293 cell line however the attempt to develop a p-73 antibody was unsuccessful. Finally, the immunoprecipitation attempted to pull out Hck from the 293 Hck-Wt cell line via the V5 tag placed on the mechanism so that there would be pure Hck available for further testing. Both the p-73 assay and the V5 immunoprecipitation were unable to be finished due to an unknown problem with the Western Blot experimentation process.

The Role of Mirror Neurons in Empathic Concern

Hannah Parsons, *Presentation Times TBD*

Mirror neurons are an interesting class of neurons found throughout the ventral premotor cortex and inferior parietal lobe and other regions of the brain, connected by the cortical MNS network. These neurons are crucial for action understanding and imitation. Empathy is a process involving the affective sharing of self and other’s perspectives. Empathy can be broken down into different categories and empathic concern or compassion is only one. Compassion training should theoretically produce plasticity changes in regions of the MNS and other regions of brain involved in empathic response. This poster will examine the neural

plasticity in fMRIs taken after compassion training and explore how this change in plasticity might connect the MNS to empathic concern.

ATP-Induced Extracellular Acidification from Retinal Muller Gila is Sensitive to Extracellular Concentration of Sodium and Potassium

Hannah Parsons, Brock Goelein, Thomas Leuschner, Michael Gongwer, Lexi Shepherd, and Hannah Caringal, *Presentation Times TBD*

In recent years, significant interest has developed in the role glia play in actively regulating neuronal signaling in the central nervous system. This study characterizes a molecular pathway by which a type of glial cell in the retina, known as a Müller cell, causes a robust extracellular acidification when exposed to ATP, which is likely to be co-released with glutamate at neuronal synaptic terminals. Alterations in extracellular pH have been shown to regulate synaptic transmission in the retina, and we hypothesize that the pH modulation by Müller cells is a key regulator of visual signals in the retina. Prior studies of this regulatory pathway implicated activation of a P2Y pathway relying on elevation of intracellular calcium to induce the glial cell mediated extracellular acidification. This study, which utilizes a novel H+-selective self-referencing technique to measure proton fluxes from isolated tiger salamander Müller cells, analyzes the dependency of this ATP-induced pathway on the presence of the extracellular ions Na+ and K+. Self-referencing studies involving the removal of extracellular Na+ demonstrated a significant decrease in the ATP-induced acidification. In addition, the sodium transport blocker amiloride and the sodium-hydrogen exchanger blocker cariporide each reduced the effect in an analogous manner to the removal of extracellular Na+. Together, these results strongly imply a role of sodium-dependent mechanisms, and the sodium-hydrogen exchanger, as a proton carrier in the ATP-evoked pathway. The ATP-induced acidification was also sensitive to extracellular K+ concentrations. The reintroduction of extracellular K+ from a nominally 0mM K+ Ringer's solution resulted in a large potentiation of the ATP-induced acidification. This K+ sensitivity points toward a positive feedback mechanism through which increased extracellular K+ levels, likely correlated with increased neuronal activity, could further enhance the glial cell mediated ATP-evoked proton efflux and act to attenuate overactivity of retinal neurons. Collectively, our results indicate that the proton efflux activated by ATP likely involves multiple carriers with Na+ and K+ dependencies. This characterization of ionic dependencies of the ATP-evoked extracellular acidification sheds further light on an important mechanism through which glia shape visual signals in the retina.

Analysis of the biochemical requirements for Nef-dependent packaging of Hck into HIV virions

Hannah VanDusen, *Presentation Times TBD*

Nef is an accessory protein of HIV which works in multiple ways to increase virus infectivity and contribute to pathogenesis. In addition to downmodulating MHC-1, CD4, and other glycoproteins, Nef activates the Src family tyrosine kinase Hck by binding with its SH3 domain, resulting in increased HIV infectivity. This complex, inhibited by a unique diphenylfuropyrimidine, is a promising target for anti-HIV therapies. However, very little is known about the mechanism by which the Nef-dependent Hck activation benefits HIV. It is known that Hck is packaged into the virion during virus production. To begin to investigate the biochemical requirements for Hck packaging, we have produced stable 293 cell lines which express several mutant Hck proteins. These are wild type Hck, Hck Y416F (structurally normal but kinase dead), Hck P2A Y527A(constitutively active), and Hck PP (closed inactive conformation). By expressing HIV in these cell lines and analyzing the virions produced, we will determine whether the protein-protein interaction of Hck and Nef, the kinase activity of Hck, or both are important in the packaging of Hck into virions.

Test of Monte Carlo Simulation for MoMA Neutron Detectors

James Boone, *10:00-11:00am, 3:30-4:30pm*

The J.E. Boone, A. Wantz, W.F. Rogers (Indiana Wesleyan University), N. Frank (Augustana College), A.N. Kuchera (Davidson College), S. Mosby (Los Alamos National Lab), M. Thoennessen (FRIB, NSCL, Michigan State University), and the MoNA Collaboration – The MoNA (Modular Neutron Array) and LISA (Large multi-Institutional Scintillator Array) detector systems at NSCL are used to determine the energy and trajectory of neutrons decaying from particle-unbound states in exotic neutron-rich nuclei. In order to test the accuracy of simulation (GEANT4 with Menate R), important for interpreting scattering data from the arrays, an experiment was recently conducted at Los Alamos LANSCE center using 16 MoNA detectors (each consisting of BC408 organic scintillator plastic measuring 200x10x10 cm3) exposed to a thin, well-characterized neutron beam over a wide energy range in order to observe neutron scattering directly. Neutrons scatter elastically from H and C nuclei and inelastically from C nuclei. Elastic scattering from C (including some inelastic channels) produce light below detector threshold, and therefore constitute “dark scattering,” redirecting neutron trajectories without detection, and some inelastic C channels produce additional neutrons in the array. Several features of scattering, including scattering angle, mean distance between scatters, multiplicity, and dark-scatter redirection are analyzed and compared with simulation over a wide range of incoming neutron energy. Results will be presented. Work supported by NSF Grant PHY-1744043

Improving Bone Health Knowledge in Selected Age 9-12 Indiana Students

Jaylin Miller, *Presentation Times TBD*

Studies by Winzenberg et al. regarding bone mass and osteoporosis indicated that a 10% increase in bone mass during childhood potentially delays the onset of osteoporosis by 13 years. Further, Golden et al. reported that between the ages of 9 and 12, peak bone mass lags behind peak height by 6-12 months, making children susceptible to bone fractures. Taking this data into consideration, our laboratory investigated bone health knowledge in students at Fairfield Community of Elkhart county and Lakeview Christian of Grant county. The purpose of the study was to see if an educational presentation would help students understand how to build healthier bones. After institutional review board approval and informed consent from the students and their guardians, our laboratory tested 273 students ages 9-12 in 4th, 5th, and 6th grades. We gave each student a 12-question survey. The first questions identified variables in the students. The second tier of questions probed their knowledge of foods containing calcium and vitamin D, two important nutrients for healthy bones. Then students were asked if they could define osteoporosis. Lastly, students were asked if they knew why exercise was important. The 12-question survey results established their baseline understanding of bone health. Students had an awareness that consuming calcium and vitamin D was important (95.3%), but did not correctly identify which foods contain these nutrients (only 14.7%). Only 7% knew the definition of osteoporosis. The students were aware of the importance of exercise (97.4%) and participated in daily exercise (96.3%). The second part of the research involved a live presentation that gave students information about appropriate nutrition and exercise for good bone health. For the last part of the research, the same survey will be given to the students and results will be analyzed to assess the effectiveness of our educational efforts.

Rescue of Human Oral Keratinocytes from a Bone Cancer Drug Side Effect: Zoledronate-Induced Apoptosis Rescue

Jesse Maguire, *Presentation Times TBD*

Zoledronate (ZOL) is a nitrogen-containing bisphosphonate, commonly used as an osteoclast inhibitor in diseases such as bone cancer and osteoporosis. It also binds to hydroxyapatite, decreasing calcium release,

and thereby increases bone density. ZOL has a side effect in cancer patients—osteonecrosis localized to the actively remodeling bone and to the soft tissue of the jaw. ZOL blocks completion of the mevalonate pathway, leading to cell death. Geranylgeraniol (GGOH) is a naturally occurring intermediate of this pathway, acting downstream of the ZOL block to potentially rescue cells. Other potential rescue agents include 100 μM citrate (naturally occurring salivary calcium chelator), 10 μM melatonin (antioxidant), and 2 mM Etidronate (non nitrogen-containing bisphosphonate thought to block cell uptake of nitrogen-containing bisphosphonates). The purpose of this study was to compare the four agents in terms of rescue from ZOL-induced apoptosis (programmed cell death) in oral epithelium. Apoptosis was measured by two methods: 1) determination of caspase 3 (apoptosis executioner) levels in treated cells and 2) determination of the number of treated cells displaying phosphatidyl serine (a cell marker for apoptosis) on their surfaces through the flow cytometry-based Nexin assay. These experiments revealed that normal human oral keratinocytes show a mild but significant increase (1.8-fold) in apoptosis when treated with 50 μM ZOL for 72 hours. However, the immortalized OKF6/TERT2 oral keratinocytes showed no significant increase in apoptosis with ZOL treatment, and no rescue when paired with 10 μM GGOH or any of the other agents.

Visualization of Striated Muscle in Moon Jellies Via Fluorescence Confocal Microscopy

Jesse Tom-Rad Fornah, *Presentation Times TBD*

The jellyfish nervous system is considered to be the simplest within the animal kingdom. Like other members of the phylum Cnidaria, Aurelia aurita jellyfish ("moon jellies") lack a central nervous system (brain and spinal cord) but contain two types of nerve networks: a conduction system for regulating striated muscle contraction (pulsing) and a nerve net for controlling nonpulsing-related behavior (feeding etc). In this study, we optimized a method for visualizing striated muscle in Aurelia aurita ephyrae using immunofluorescence confocal microscopy. This is the first step toward understanding the physical and functional coupling between striated muscle and the moon jelly conduction system.

Construct Assembly using Gibson Cloning to create a Gene Knockout in Tetrahymena thermophila

Julianna Korns, *2:00-4:00pm*

The study of gene function in organisms is an important topic in research, and the method of a gene knockout is one way to do this. A limited number of methods to create a gene knockout in Tetrahymena thermophila exist. One option is to use lox-P recombinase to cut out a sequence between two inserted lox-P sites in a gene construct. These lox-P sites can be inserted into a gene construct using polymerase chain reaction (PCR) and Gibson Cloning methods. Gibson cloning is an efficient, one-tube reaction that allows for the combination of multiple pieces of DNA into a circular plasmid using only three main reagents. Using PCR, six separate segments of DNA have been made for a full construct, and Gibson Cloning has allowed for the combination of two of these pieces. Once the entire Gibson construct is successfully assembled, a gene knockout can be produced in Tetrahymena thermophila to observe the effects a knockout of the Pot1 gene will have on telomeres. A Pat1 gene knockout will also be produced to confirm the results and success seen in the Pot1 knockout.

The Effects of CART and Bay 55-9837 on In Vivo Glucose-Stimulated Insulin Secretion in Wild-Type and VIP/PACAP Receptor 2 Deficient Mice

Kaitlyn McEnaney, *Presentation Times TBD*

Type 2 Diabetes Mellitus, triggered by insufficient insulin secretion, causes the inhibition of the cellular uptake of glucose, inducing hyperglycemia. Two peptides, Bay 55-9837 and cocaine- and amphetamine-regulated transcript (CART), and their effects on glucose stimulated insulin secretion (GSIS) are currently being studied

as a novel treatment for type 2 diabetes. BAY, a selective VIP/PACAP receptor 2 (VPAC2R) agonist, is a 31-amino acid peptide. Binding of an incretin, such as Bay, to VPAC2R in situations of high glucose facilitates the increase of intracellular Ca2+ and cAMP levels, stimulating insulin secretion. GSIS properties of BAY have been previously confirmed through intra-peritoneal glucose tolerance tests (IPGTTs) on wild-type (WT) mice. CART, an anorexigenic peptide highly expressed in the brain, is up-regulated in type 2 diabetic rats. CART-deficient mice are shown to have obstructed insulin secretion and glucose elimination as well as increased body weight. In the presence of augmented cAMP via a glucagon-like peptide 1 (GLP-1), CART has potentiated GSIS; however, CART has diminished insulin secretion in situations of low cAMP levels as seen in vivo previously. Recently during IPGTTs, BAY and CART have been tested on WT and VPAC2 knock-out (VPAC2KO) mice. Contrasting from previous results, CART was shown to increase insulin secretion in both WT and KO. BAY stimulated GSIS in the KO while insulin secretion was significantly lower in WT. WT and KO were also treated with glucose and a vehicle along with a saline-saline dose to yield a glucose excursion standard and a stress-related glucose response reading, respectively.

Mapping the locations of Bluebird nest boxes using ARCview GIS software

Katie Larson, *Presentation Times TBD*

This semester in our research lab we spent most of our time preparing for this summer when the data collection begins in earnest. I was assigned the computer software ARCview GIS to map and secure the locations of our bluebird nest boxes that we will be monitoring for nesting success and other pertinent data. All of us worked to refurbish, place and prepare the nest-boxes for the four trails that will be monitored. These trails include: Sweetser Switch, Matter Park, Cardinal Greenway, and Blackford Trails. The geographic data was mapped using the ARCview GIS software and the data collection sheet that will standardize the information we amass will assure quality control of the overall project.

Community Involvement in the Monitoring of Bluebird Nestbox Activity

Kayandra Orwig, *8:00-9:30am, 3:00-3:30pm*

Due to interspecific competition with House Sparrows and habitat loss, the population of bluebirds declined in the early 1900s in North America. However, the placement of nestboxes and bluebird trails allowed for the bluebirds to increase in numbers in the 1960s and 70s. In order to sustain the bluebird species, people have been involved with conservatory methods. In this study, four sites where marked with bluebird nest boxes in Grant and Blackford County, Indiana. Their placements were as follows: 20 nest boxes in Sweetser Switch trails, 20 in Blackford trails, 20 in Cardinal Greenway, and 12 in Matter Park. With the construction of these nest boxes, the purpose of this study is to observe and record the nestbox activity. An important part of this research involves Grant and Blackford County citizens. With the making of a website, the community will have the opportunity to help monitor nestbox activity. Comments will be available if the public wants to add any information and pictures. Reason being, the general public can join an effort to ecological causes.

Microwave-Assisted Tissue Processing: A Tool to Assess Murine Tissue Morphology

Koby Buth, *Presentation Times TBD*

In order to process tissue samples to visualize in light microscopy, the samples must first be dehydrated and infiltrated with paraffin wax. Conventional processing methods can take anywhere from 18-24 hours to complete this, so, in order to expedite and streamline the procedure, we developed a processing method that utilizes a domestic microwave. By microwaving the samples in methanol, isopropanol, and paraffin wax, we are able to prepare tissues for slicing on a microtome within one hour.

We developed this procedure to assist us in assessing the function of the vasoactive intestinal polypeptide receptor 2 (VPAC2R). Previous research shows that male VPAC2R knockout (KO) mice have increased testicular degeneration compared to wildtype (WT) mice, leading to premature infertility. Utilizing the microwave tissue processing, however, we saw no difference between age-matched WT and KO testes morphology. 3 -HSD levels were tested through immunohistochemistry and found to be higher in WT than KO mice. We also noticed that KO livers are saved from steatosis that was seen in age-matched WT mice. Further research will need to be completed in order to elucidate the mechanism by which KO livers undergo less steatosis.

The Effect of Humidity, Purity, and Particle Size on Vitamin Degradation Kinetics

Leah Potts, *9:00-10:00am, 2:00-4:00pm*

Research supports a clear relationship between temperature and the reaction rate of a compound; however, the relationship between humidity and reaction rate is observable but largely debated. The rate of degradation varies depending on the compound's purity, crystallinity, hygroscopicity, as well as the humidity and temperature in which the compound is contained. Beyond this primary layer of focus lies variables that are not only more challenging to control for, but that also form a complex web of relationships that alter degradation. Such a large number of variables makes it difficult to study individual alterations to a compound but makes the importance of this research clear. Our research is working toward solidifying our knowledge of the relationship between humidity and reaction rate by testing the discussed variables on pharmaceuticals, namely niacinamide (Vitamin B3) and ascorbic acid (Vitamin C). This project is striving for a more thorough understanding of degradation kinetics and a more accurate prediction of medicinal shelf-life incorporating humid environments.

Antimicrobial Use and Extraction of Essential Oils

Leyla Solis, *Presentation Times TBD*

The use of essential oils as an alternative method to Western Medicine has become increasingly popular for use in treating various ailments from infections and illness to depression and anxiety. Essential oils are derived from plant matter through distillation or by pressing. In this study, essential oils from cinnamon bark (Cinnamomum verum), clove bud (Syzygium aromaticum), peppermint leaf (Mentha piperita), palmarosa grass (Cymbopogon martinii), ylang ylang flowers (Cananga odorata), moringa seeds (Moringa oleifera), and neem seeds (Azadirachta indica) were evaluated for their antibacterial properties by determining the Minimum Inhibitory Concentration (MIC) of each oil against 16 different bacteria in addition to performing disk-diffusion assays. Finally, the constituents of these essential oils were identified and quantified through Gas Chromatography and Mass Spectrophotometry (GM-MS) to identify any component(s) contributing to antimicrobial activity.

Antimicrobial Use and Extraction of Essential Oils

Logan Morris, *Presentation Times TBD*

Our study aimed to investigate the viability of essential oils as antimicrobial agents. We achieved this by isolating various essential oils and testing them using Kirby-Bauer Disk Diffusion, Minimum Inhibitory Concentration (MIC), and growth assays against twenty pathogenic and nonpathogenic microorganisms found in the mouth and gastrointestinal tract. We also analyzed the physical compositions of the essential oils and determined which compounds were present at the highest concentrations using GC-MS.

Cultivation and characterization of icebound microorganisms from the south pole

Lynn Stokes, Austin Huntington, Brad Burchell, Emma Dewey, and Katie Shaffer, *Presentation Times TBD*

We received three South Pole ice samples from our collaborator, Dr. Michael Madigan (Southern Illinois University Carbondale), with the purpose of culturing cold-adapted microorganisms associated with polar ice. Little is known about microbial ecosystems of inland Antarctica, if indeed such ecosystems even exist. Although considerable research has been carried out on microorganisms indigenous to the warmer coastal regions of Antarctica, only one species, a strain of the bacterial genus Pseudomonas, has ever emerged from culture-based studies of South Pole ice. Molecular studies have revealed that a diversity of bacteria exists in polar ice samples, but whether these organisms compose an active ecosystem or are simply a random assortment of microbes imported by air currents is unknown. To begin to answer this question, we are in the process of cultivating microorganisms from South Pole ice. We inoculated a variety of liquid enrichment culture media with thawed ice samples and incubated the cultures at temperatures ranging from -5°C to 4°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 icebound microbes.

Development of Selective and Potent Bivalent Inhibitors of SHP2

Marissa O'Hair, Emily Gathercoal, Brandon Estrem, *8:00-9:00am, 3:00-3:30pm*

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 a SHP2-targeting peptide for selectivity. These pieces are assembled in situ by the self-labeling enzyme SNAP-tag. Alternatively a traditional medicinal chemistry route can be utilized by developing a small molecule library of inhibitors to test for SHP2 selectivity. In order to test the efficacy and selectivity of each approach, all inhibitors will be tested in an activity assay against SHP2 and SHP1 phosphatase.

Evidence for a Functional Outer Nerve Ring in Moon Jellies

Megan Ferris, *11:00am-12:00pm, 3:30-4:00pm*

Jellyfish are considered to have the simplest nervous systems of the animal kingdom. Like other members of the phylum Cnidaria, Aurelia aurita jellyfish (“moon jellies”) lack a central nervous system (brain and spinal cord) but contain two types of nerve networks: a conduction system for regulating striated muscle contraction (pulsing) and a nerve net for controlling nonpulsing-related behavior (feeding etc). However, Aurelia aurita is believed to lack a specialized component of the conduction system found in other cnidarians called an outer nerve ring (ONR). The ONR links adjacent “arms” and speeds nerve conduction around the outer periphery of the animal. In this study, we investigated the nerve conduction pathway in moon jellies and observed a functional ONR during the ephyrea stage of development.

ATP (P2Y1) Receptor Drives Glial Cell-Mediated Acidification of Retina

Michael Gongwer, Lexi Shepherd, and Hannah Caringal, *3:00-3:30pm*

There has been rapid increase in interest for and understanding of the active role glial cells play in regulation of brain signaling. Glial cells in the retina have been shown to be important regulators of visual signals and are promising candidates to target blinding diseases. A recent study in our lab characterized a novel pathway by which retinal (Müller) glia regulate extracellular levels of H+, an especially potent and underappreciated mechanism of modulating synaptic transmission and cellular excitability. This study utilized calcium imaging along with a self-referencing technique to measure H+ fluxes from tiger salamander Müller to characterize a novel pathway through which ATP induces a pronounced extracellular acidification. ATPγS, a non-hydrolyzable form of ATP, along with ADP and MRS236, P2Y1 receptor agonists, resulted in an intracellular calcium rise and acidification. Collectively, this strongly points toward ATP acting on P2Y1 receptors. The findings reported here shed further light on an important regulatory mechanism by which glia in the retina shape extracellular pH, and suggest that proton flux mediated by ATP-activation of Müller cells and of other glia as well may be a key mechanism modulating neuronal signaling in the vertebrate retina and throughout the brain.

Extracellular pH Changes Mediated by Retinal Muller Glia are Shaped by Two Distinct Pathways

Michael Gongwer, Lexi Shepherd, and Hannah Caringal, *Presentation Times TBD*

Extracellular H+ dynamics are correlated with significant changes in the release of neurotransmitter in the retina. This has led to a number of recent studies examining the role extracellular H+ dynamics play in shaping visual signals. However, few studies have directly measured H+ fluxes from individual identified cells. Self-referencing H+ selective microelectrodes have proven to be ideally suited for sensing extracellular pH changes from isolated cells. Two recent studies utilized self-referencing to measure H+ fluxes from retinal Müller glia from tiger salamander retina and characterized two pathways by which Müller cells regulate extracellular pH. In the first pathway application of high KCl produces a large HCO3- dependent extracellular acidification at the endfoot. In the second pathway extracellular ATP induces a large HCO3- independent acidification. The present study directly examines overlap of the two previously reported pathways by measuring extracellular H+ fluxes and intracellular calcium levels. The pathways could be distinguished by their calcium dependency and the involvement of anion transport in the extracellular acidification, and collectively, these findings point toward a multifaceted ability of Müller cells to regulate pH, and by extension, shape synaptic transmission in the retina.

A Study on the Opioid Epidemic and Various Methods of Bringing About It's End

Michael Muczynski, *Presentation Times TBD*

The opioid epidemic in America is continuing to take lives and destroy communities. This study took a look into various ways to stem the flow of opioids into the possession of the general public. This report looked specifically into patient-doctor interactions and the ability of support staff to maintain healthier dosages of opioids and negate the risk of opioid dependency. This report also looked into identification of alternatives to opioids such as medical marijuana. This report also identified into common risk factors and ways to identify individuals who are more likely to become dependent upon opioids.

Rescue of Zoledronate-Induced Necrosis in Human Oral Keratinocytes

Morgan Smith and Ethan Blake, *Presentation Times TBD*

Zoledronate (ZOL) is a nitrogen-containing bisphosphonate used in the treatment of bone resorptive diseases, including osteoporosis and cancer metastasis to bone. ZOL is linked to bisphosphonate-related osteonecrosis of the jaw (BRONJ), a disease in which oral lesions occur, particularly after oral surgery. Geranylgeraniol (GGOH) rescues some cell types negatively affected by ZOL, likely by providing an alternate route in the mevalonate pathway, a pathway blocked by ZOL and necessary for cell viability. This study aimed to examine ZOL-induced human oral keratinocyte necrosis, as well as the rescue effect of 10 microM GGOH on ZOL-induced necrosis. In addition, we investigated possible ZOL-induced necrosis rescue effects from 10 microM melatonin (known reactive oxygen species scavenger), 2 milliM Etidronate (non-nitrogen bisphosphonate thought to block nitrogen-containing bisphosphonate entry into cells), and 100 microM citrate (endogenous calcium chelator in saliva). Two human oral keratinocyte lines were used: normal human oral keratinocytes (NHOKs) and immortalized human oral keratinocytes (OKF6/TERT2s). Necrosis measurements via lactate dehydrogenase (LDH) release assays indicated a mild but significant increase in NHOK necrosis due to 72 hour treatment with 50 microM ZOL (6.4%), along with a significant but modest rescue by 10 microM GGOH (6.7% decrease to untreated levels). OKF6/TERT2 cells demonstrated a greater increase in necrosis (13.3%, $p<0.05$) but no rescue in the presence of 10 microM GGOH. Data describing comparative rescues from melatonin, citrate, and Etidronate in OKF6/TERT2 cells suggests that each of these agents do not rescue these cells from ZOL-induced necrotic effects at the doses tested.

Parameterizing Docking Candidates to Evaluate Binding Affinity for SHP2 *in silico*

Nate Kitzmiller, *Presentation Times TBD*

We report on CHARMM General Force Field parameterization of small organic inhibitors for the SHP-2 active site with a view to performing molecular dynamics docking studies. The inhibitors come from two classes of competitive general phosphatase inhibitors, isothiazolidinone (IZD) phosphate mimetics and oxindole scaffolds. We use the VMD Force Field Tool Kit (ffTK) plugin to implement the CHARMM workflow. The geometry and size of the molecules present difficulties in determining the CHARMM parameters, but treating molecular subunits separately reduces computation load and complexity and is extensible to other molecules.

The Impact of Astrocytes on Sleep via Regulation of Adenosine and Glutamate Pathways

Olivia Moorlach, *Presentation Times TBD*

Despite their history of being known as passive support tissue, astrocytes are now recognized as being intimately involved with the formation, maturation, and elimination of synapses. Recent research indicates that these glia cells also have a role in cortical state regulation. How is not fully understood. However, they are known to impact glutamate and extracellular adenosine modulation, which is known to shift cortical states. They are also known to decrease the function of NMDA receptors, dampening excitatory activity. Recently, it has been found that astrocytes have an extensive network that connects different areas of the brain that allows it to function as a whole. Given this, astrocytes are well positioned to have a stronger impact on overall cortical states. By aiding in the synchronization of delta waves at <1Hz which is characteristic of slow-wave sleep, astrocytes have a profound impact on cortical states. In this review I will examine various lines of research that indicate how astrocytes might regulate cortical states, and discuss implications for treating neurological issues involving cortical state dysregulation.

Rescue of Zolendronate-Induced Senescence in Human Oral Keratinocytes

Preston Rippe, *Presentation Times TBD*

Bisphosphonates are used to treat osteoporosis, Paget's disease, cancer that metastasizes to bone, and other bone resorption diseases. An adverse side effect occurs within roughly 12% of bisphosphonate-treated oncology patients: bisphosphonate-related osteonecrosis of the jaw (BRONJ). Zolendronate (ZOL) is a nitrogen-based bisphosphonate that functions by blocking farnesyl pyrophosphate synthase in the mevalonate pathway. This pathway plays an important part in synthesizing sterol isoprenoids (cholesterol), promoting prenylation of CAAX proteins, and maintaining osteoclast function. Geranylgeraniol (GGOH) is a mevalonate pathway intermediate that is a potential rescue agent for the ZOL-induced death effects of BRONJ. In the oral mucosa, ZOL can cause excessive senescence characterized as the decline of DNA replication, resulting in lower cell density and delayed wound healing. In this study, we compared 10 microM GGOH to other agents in terms of their relative ability to rescue from 72 hour, 50 microM ZOL-induced keratinocyte senescence. Overall, ZOL induced senescence in normal human oral keratinocytes (NHOKs, 2.8-fold, $p<0.05$) and immortalized OKF6/TERT2 keratinocytes (5.6-fold, $p<0.05$). Significant senescence recovery occurred in both keratinocyte lines in response to 10 microM GGOH and an additional booster of 10 microM GGOH 24 hours after initial treatment. In OKF6/TERT2 cells, exposure to 2 milliM Etidronate, 100 microM citrate, and 10 microM melatonin each rescued ZOL-induced senescence to a level comparable to that of GGOH.

Osteomicrobiology: How the gut microbiota affect bone health

Rachel Block, *Presentation Times TBD*

Osteomicrobiology is a relatively new field of research that aims to bridge the gaps between the gut microbiota (GM) and the osteoclast activity that affects bone health. Osteoclasts are a type of cell found in the skeletal system that are responsible for bone resorption. They break down bone in order to release calcium into the blood. Under normal conditions, osteoclast activity is balanced by the bone remodeling activity of osteoblasts. When the bone resorption rates become much higher than the rate at which bone is formed, osteoporosis occurs. Osteoporosis is a common bone disease in older men and women characterized by weak and porous bones. The most common cause of this disease is due to a deficiency in sex steroid hormones. Women are much more likely to get osteoporosis because once they reach menopause, they produce lower levels of estrogen. Low levels of estrogen cause an increase in signaling molecules such as TNFa and RANKL, whose function is to stimulate osteoclastogenesis. Currently, there is no cure for this disease, but there are treatments that can help manage and prevent the onset of the disease. One promising therapy for increasing bone mass is the oral administration of probiotics. The microbes in the gut have effects on the immune system, specifically T cells, which then affects osteoclast activity. Osteoclasts are linked to the immune system due to common antigen receptors on both osteoclasts and macrophages. The interactions between these three systems (the GM and digestive system, the immune system, and the skeletal system) have provided evidence that taking probiotics may be a potential treatment for menopausal osteoporosis.

Callus Induction and Embryogenesis of Moringa oleifera From Leaves, Stems and Seeds

Rebecca Embalabala, *Presentation Times TBD*

Moringa oleifera is a plant native to parts of Asia and Africa and is known for its high nutritional qualities. The leaf and seed extracts are antimicrobial and the seeds of M. oleifera can be used for water purification. We are interested in the biochemical and molecular studies of this plant. Successful tissue culture of Moringa will provide cells for the mass production of biochemicals needed for the characterization of compounds and DNA transformation. We present successful callus formation through tissue culture of M. oleifera. Several

combinations of auxins and cytokinins were tested to induce callus formation of leaf, stem and embryo explants of M. oleifera. The study included three auxins (2,4-D, IAA and NAA) and two cytokinins (BA and kinetin). Callus formation was successful from all explants. Callus formed in a dark incubator set at 25°C within 2-4 weeks. Media without the presence of any plant growth regulators also produced callus within 2-6 weeks. Regeneration of M. oleifera callus is currently in progress.

Use of Geranylgeraniol to Rescue Osteoblasts, Periodontal Ligament Fibroblasts, and Oral Keratinocytes from Zoledronate-Induced Cell Death

Sammy Oberholtzer, *Presentation Times TBD*

Zolendronate (ZOL) is a nitrogen containing bisphosphonate that is used to treat osteoporosis or Paget's disease. However, a side effect from the treatment with zolendronate is bosphosphonate related osteonecrosis of the jaw (BRONJ). Through a research articles by Ziebart et al. (for the selection and dosage of ZOL) and correspondence with Nur Bashira from the University of Malaysia (for the acquisition of cell lines), this project analyzes senescence, apoptosis, and necrsosis through the cell lines of early passage normal human oral keratinocyes (NHOK), preliminary passage of human periodontal ligament fibroblasts (HPDLF's), and early passage (OKF6/TERT2). These cell lines are incubated for 72 hours and treated with 50 μm of ZOL. Then are quantitatively measured by the rescue of geranylgeraniol (GGOH) for these three conditions. Culmination of data was by beta-galactosidase staining; caspase-3 and LDH assay then analyzed with photomicrographs and the BioTek 96 well plate reader. Results yielded with 10 μm of GGOH significantly rescued the ZOL treated HPDLF's in necrosis by 13% ($p<0.01$), apoptosis by 0.96%, and senescence. OKF6/TERT2 only saw a significant rescue of treatment in apoptosis below untreated levels.

Method for Pancreatic Islet Isolation and Quantification of Secretagogue-Augmented Glucose-Stimulated Insulin Secretion

Sydney Weghorst, *Presentation Times TBD*

Islets of Langerhans (100μm-200μm in size) are located in the pancreas and are composed of 60-70% beta cells, 15-20% alpha cells, and 10-15% delta cells. The beta cells produce and store insulin. To maintain blood glucose levels, insulin is released in the presence of glucose, promoting its cellular uptake. Bay 55-98372, a VPAC2 selective agonist, is known to augment insulin release in response to glucose. During our exploration of the VPAC2R knockout (KO) mouse phenotype, in vivo results showed hyperglycemia and hyperinsulinemia in the VPAC2 KO mice. To determine if the hyperglycemia and the hyperinsulinemia were a direct result of islet dysfunction, we performed the following procedure. Islets isolated from C57Bl/6 (WT) and KO mice were exposed to various levels of glucose and Bay in a glucose stimulated insulin secretion assay. Normalization of insulin release data was accomplished using two methods. The normalized data indicates that islets isolated from VPAC2R-deficient mice have impaired insulin release during glucose challenge when compared to islets isolated from WT litter mates.

The Impact of Branched-Chain Amino Acids on Muscle Development, Athletic Performance, and Overall Health

Timothy Fox, *Presentation Times TBD*

The use of Branched-Chain Amino Acids (BCAA's) as supplements has grown increasingly popular in recent years among athletes seeking to improve their performance, along with fitness enthusiasts who wish to improve their overall body composition. However, there are many contradicting studies regarding BCAA's as to whether they are effective towards improved athletic performance, muscle development/body composition, and overall health. In a particular study, researchers actually found a correlation between the consumption of BCAA's and an increased risk for Type II diabetes. Due to their increasing popularity, in addition to the

potential health risks involved, consumption of BCAA's has become a subject of controversy. For this research project, several studies exploring the factors of BCAA consumption including: hormonal health, resistance to neurological fatigue, recovery in athletes, specific mechanisms pertaining to the synthesis and breakdown of muscle protein, and potential health risks have each been analyzed.

3D Printed Fluorescence Microscope for Studies of Tetrahymena Thermophila

Zechariah Pfaffenberger, *Presentation Times TBD*

Recently, smaller laboratories have been able to gain access to previously unattainable equipment through the wide availability of open source designs that drastically lower such equipment's cost. In this project, we followed one such open source design to adapt one of IWU's microscopes to do fluorescence microscopy. Fluorescence microscopes are an invaluable tool for studying the biochemistry of living organisms. Labeling structures with specific fluorescent dyes or visualizing the changes in levels of ATP are just two potential techniques that are possible with a fluorescence microscope. Commercially available fluorescent microscopes can cost anywhere from $2000 to $10,000. We built our device for around half of this cost and have demonstrated operational function of the microscope for our laboratory's model organism Tetrahymena thermophila. Work is on going to characterize the devices capabilities and to test it on other organisms.

Social Sciences

Fact and Fiction: The Validity of Homer as a Historic Source

Audra Beaujon, *9:00-10:00am, 1:00-2:00pm*

The Homeric epics are hailed as great literary achievements from the ancient world, but how truthful are their historic accounts? Based on my senior capstone paper, this presentation will analyze the history of the Greek Dark Ages, the stigma surrounding oral history, and the significant historical and cultural takeaways from the epics themselves.