



# St. Albert's Day Student Research Forum

April 14, 2015

9:30 a.m.—3:30 p.m.

Ahmanson Ballroom

Harper Center

## **HISTORY OF ST. ALBERT'S DAY AT CREIGHTON UNIVERSITY**

In 1997, faculty from the health science schools, as well as from the College of Arts and Sciences, expressed an interest in promoting the interaction between faculty scientists and students at Creighton University at both the undergraduate and graduate level. A series of discussions resulted in the first St. Albert's Day celebration, which was held on November 24, 1997. Since 1997, the St. Albert's Day poster session has been an annual event at Creighton University. In 2008, the event was expanded to include oral presentations as well as posters. Awards will be presented for the 'best poster' in three categories, as well as for the 'best presentation.'

St. Albert the Great was born in 1205 or 1206, and as a youth was sent to pursue his studies at the University of Padua. He joined the Order of St. Dominic in 1223. He completed a Doctor's degree at the university in Paris, which was celebrated as a school of theology. In 1254 Albert was elected Provincial of his Order in Germany. He resigned this office in 1257 in order to devote himself to study and to teaching. He was canonized in 1931. He is the patron saint of scientists and was the mentor of St. Thomas Aquinas. He was called the "Doctor Universalis" (Universal Doctor), in recognition of his extraordinary genius and extensive knowledge. He composed a veritable encyclopedia that contained scientific treatises on almost every subject. He was proficient in every branch of learning cultivated in his day, including physics, mathematics and metaphysics, and his writings did not distinguish between the sciences and philosophy.

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Wickramasekara, Rochelle	10:45 AM	3028A

## **SUMMER FACULTY FELLOWSHIP PARTICIPANTS**

Bucher, Gregory  
Khanna, Maya  
Shibata, Annemarie  
Taylor, McKenzie  
ZunigaUlloa, Jorge

## **HADDIX RESEARCH SCHOLAR PARTICIPANTS**

Averett, Erin  
Baruty, Andrew  
Chauhan, Harsh  
Lambert, G. Patrick  
Roedlach, Alexander  
Soukup, Juliane  
Hermsen, Kenneth

## **COLLEGE OF ARTS AND SCIENCES DEAN'S SUMMER RESEARCH PARTICIPANTS**

Aloziem, Ozioma  
Baronovic, Joseph\*  
Benevento, Maria  
Copeland, Sarah\*  
Dowdle, Emily  
Ewers, Caitlyn  
McGuie, Mara  
Rainwater, Conan  
Weed, Ashley\*

\*co-authors listed under Weed, Ashley in the program

## **HONOR'S PROGRAM SUMMER RESEARCH PARTICIPANTS**

Crawford, Cole  
Poston, Daniel

## **FERLIC SUMMER SCHOLARSHIP PARTICIPANTS**

Budney, Sarah  
Desa, Danielle  
Fischer, Kaitlyn  
Gnabasik, Ryan  
Miller, Christina  
Schaffer, Leah  
Schmachtenberger, Benjamin

# STUDENT POSTER ABSTRACTS

## 1. LOW COST 3D PRINTED PROSTHETIC DEVICES\*

Petrykowski, Marc, Department of Exercise Science, Creighton University, Omaha, NE.

One to two percent of newborns are born with congenital defects, and 10% of them have congenital differences of the upper extremity. Amniotic Band Syndrome is the term applied to a wide range of congenital anomalies, most typically limb and digital amputations and constriction rings that occur intrauterine in association with fibrous bands. It is estimated that in the USA, more than 32,500 children suffer from major pediatric amputation. Children's prosthetic needs are complex due to their small size, as well as their physical and psychosocial development. The family's financial resources play a crucial role in the prescription of prosthetics for their children, especially when private insurance and public funding are insufficient. The current cost for a myoelectric prosthetic hand ranges from \$30,000 to \$100,000. The cost of a body powered prosthetic hand, however, ranges from \$5,000 to \$11,000. Due to the complexity and high cost of these prosthetic hands they are not accessible for children of low income or uninsured families. Three-dimensional (3D) printing is a process of making a 3D solid object of virtually any shape from a digital 3D model. Advancements in 3D printing technology offer the possibility of designing and printing plastic mechanical hands at a very low cost. Body-powered voluntary closing prostheses, such as the present mechanical hand require significant wrist strength for best performance. Individuals with unilateral upper limb reductions suffer from a significant amount of muscle atrophy in the affected limb. It is unknown if the use of body-powered voluntary closing prostheses, such as our low-cost 3D printed mechanical hand improves muscle atrophy, muscle function, and overall functionality. Thus, the purpose of the current study is to examine strength, muscle morphology, and functionality of a low-cost 3D printed mechanical hand for children and adults with upper limb differences.

## 2. THE VALIDITY AND RELIABILITY OF BIOELECTRICAL IMPEDANCE ANALYSIS AND CIRCUMFERENCE MEASURES FOR ESTIMATING PERCENT FAT IN MEN

Wankum, Nicholas Jacob A. Miller, Allison E. Lieb, and Joan M. Eckerson, Department of Exercise Science, Creighton University, Omaha, NE.

**Background:** The BOD POD® (BP) is a valid and reliable technique for estimating percent fat (PF); however, it is expensive and not well-suited for field evaluations. Bioelectrical impedance analysis (BIA) and circumference measures (CM) offer more affordable and practical methods of estimating PF, but may not be as valid and reliable as BP.

**Purpose:** Determine the reliability and validity of BIA and CM to estimate PF compared to a criterion method of body composition (BP).

**Methods:** Fourteen college-aged men ( $X \pm SD$  age =  $21 \pm 1$  yr, weight =  $82.93 \pm 22.34$  kg, height =  $176.98 \pm 9.08$ cm, PF =  $19.7 \pm 12.8\%$ ) visited the laboratory on two occasions separated by 1 wk at approximately the same time of day for body composition assessment using the BP, BIA, and CM. CM were taken three times at the neck and waist and the average values were used to estimate PF. Reliability was determined by calculating intraclass correlation coefficients (ICC) and the validity of the PF estimates was based upon an evaluation of predicted values (BIA, CM) vs. the actual value from BP by calculating the constant error (CE = estimated PF – actual PF), r value, and standard error of the estimate (SEE). The significance of the CE values was determined using dependent t-tests with Bonferroni correction (\*p < 0.025).

CE	R	Intercept	Slope	SEE	
BIA	4.98*	0.89	-4.64	0.99	4.37
CM	-1.74	0.87	-3.56	1.29	4.77

**Results:** Test-retest reliability was high for both BIA (0.99, SEE 2.0%) and CM (0.98, SEE = 1.4%). However, neither technique provided valid results, since the SEE values (4.37% and 4.77%, respectively), were too large to be of practical value.

**Conclusions:** Although the BIA and CM techniques appear to be highly reliable, they are not recommended for estimating PF in men with average to moderately high body fatness.

### 3. **THE EFFECT OF THREE DIFFERENT BREAKFAST MEALS ON SATIETY AND DIETARY INTAKE IN NORMAL WEIGHT COLLEGE-AGED WOMEN**

Lieb, Allison Katie A. Mullen, Nina O. Allen, Joan M. Eckerson, Department of Exercise Science, Creighton University, Omaha, NE.

**Background:** Egg-based breakfasts (BF) have positive effects on satiety and energy intake compared to high carbohydrate (CHO) BF. Egg whites (EW) provide more volume and protein per kcal compared to eggs; however, their effect on dietary intake is not well-studied.

**Purpose:** Compare an EW BF to an isocaloric toaster pastry (TP) and normal (NL) BF on energy and protein intake in college-age women. **Methods:** Using a randomized, crossover design, 31 women (X age  $\pm$  SD = 20  $\pm$  1 yr; BMI, 22.9  $\pm$  2.1 kg/m<sup>2</sup>; weight = 62.1  $\pm$  7.4 kg) who regularly ate BF ( $\geq$ 5 x/wk) consumed one of three test BF for 5d: EW (Egg Beaters® Original;) and two pieces of toast with spread (350 kcal), 2 low-fat TP (360 kcal) or NL BF. Visual analog scales (VAS) were completed before and 30 min, 1hr, 2hr, and 3hr post-BF to assess satiety and satisfaction. Dietary intake was assessed via three 24hr dietary recalls. Differences ( $p < 0.05$ ) in dietary protein and energy intake were identified using repeated measures ANOVA and VAS scores were analyzed using mixed effects factorial ANOVA.

**Results:** Subjects consumed less kcal ( $p=0.035$ ) and more protein ( $p=0.001$ ) during EW BF (X  $\pm$  SE = 1572  $\pm$  63 kcal; 72  $\pm$  3 g) compared to TP (1751  $\pm$  63 kcal; 57  $\pm$  3 g). There were no differences for the NL BF compared to EW or TP (1742  $\pm$  68 kcal; 64  $\pm$  3 g). The EW BF resulted in greater ( $p < 0.001$ ) feelings of fullness and satisfaction at all times post-BF compared to TP and NL BF.

**Conclusion:** A protein-rich EW BF led to reduced daily energy intake, increased protein consumption and greater satiety and satisfaction compared to an isocaloric TP. These findings support replacing CHO with EW at BF for enhanced PRO intake and energy reduction.

**Acknowledgement:** Funded by ConAgra® Foods

### 4. **THE EFFECT OF TWO DIFFERENT BREAKFAST MEALS ON ENERGY INTAKE AND NUTRITIONAL STATUS IN NORMAL WEIGHT COLLEGE-AGED WOMEN**

Mullen, Katie Allison E. Lieb , Nina O. Allen, Joan M. Eckerson, Department of Exercise Science, Creighton University, Omaha, NE.

**Background:** Breakfast is associated with lower body weight and a more favorable nutrient intake profile. However, many young adults choose convenience over nutrition at breakfast, which may have negative effects on energy consumption and nutrient intake.

**Purpose:** Compare the effect of a toaster pastry (TP) breakfast to an isocaloric protein-rich egg white (EW) breakfast on daily energy intake and nutritional status in young women.

**Methods:** Using a randomized, crossover design, 31 women (X age  $\pm$  SD = 20  $\pm$  1 yr; BMI, 22.9  $\pm$  2.1 kg/m<sup>2</sup>; weight = 62.1  $\pm$  7.4 kg) who regularly ate BF ( $\geq$ 5 x/wk) consumed two test breakfasts for 5 days (Tues-Sat): EW (Egg Beaters® Original) and two pieces of toast with spread (350 kcal) or 2 low-fat TP (360 kcal). Nutrient and energy intake was assessed via three 24hr dietary recalls (two weekdays and one weekend) and compared to the 2010 Dietary Guidelines for Americans (DGA). Differences ( $p < 0.05$ ) in energy and nutrient intakes (X  $\pm$  SE) were identified using two-tailed dependent t-tests.

**Results:** For each breakfast condition, subjects did not meet dietary recommendations for fiber, calcium, iron, potassium, and vitamin D. The t-tests showed that subjects consumed significantly greater amounts of protein, potassium, and calcium during the EW breakfast and consumed fewer Calories (1572  $\pm$  63 kcal) vs. TP (1751  $\pm$  63 kcal). During TP breakfast, subjects consumed higher amounts of carbohydrates, sugar, and vitamin A vs. EW.

**Conclusion:** Key recommendations of the DGA are to control Calorie intake and reduce sugar consumption to manage weight, and to increase consumption of nutrients of concern including calcium, potassium, vitamin D, fiber, and iron. The EW breakfast resulted in reduced energy intake, less sugar, and higher amounts of calcium and potassium and, therefore, is recommended over a TP breakfast high in sugar to meet DGA guidelines and manage weight.

**Acknowledgement:** Funded by ConAgra® Foods

## 5. **CHANGES IN RUNNING MECHANICS DURING INCREMENTAL RUNS PRE AND POST FATIGUE**

Giordano, Kevin David Nishiki, Takashi Sado, Brittney Mikkelsen, Jorge Zuniga and Dimitrios Katsavelis, Department of Exercise Science, Creighton University, Omaha, NE.

**Background:** Runners compensate for fatigue by altering running mechanics. These compensations include increase in tibial acceleration, stride length, and stride number among others and can be associated with high risk of injuries, such as tibial stress fracture and other related musculoskeletal pathologies.

**Purpose:** To investigate the changes in running mechanics as a compensation for increased speed before and after fatigue.

**Methods:** Five male college students (age = 20.8 $\pm$ 1yr; weight =76.7 $\pm$ 4kg; height = 181.2 $\pm$ 4cm) visited the Creighton University Biomechanics laboratory on two occasions. During the first visit, subjects underwent an incremental test of 3-min stages to determine their lactate threshold speed (LTS) by collecting blood samples (LTS=7.6 $\pm$ 1mph). During the second visit, subjects were asked to complete an incremental run of seven 30-second stages at speeds that ranged from 20% below to 40% above the LTS. Subsequently, they performed a 5k run at their LTS followed by another incremental run. A wireless accelerometer that was placed at each subject's dominant tibial plateau recorded acceleration before and after the 5k run. Primary outcome measures were total tibial acceleration (TTA) during the 30-second intervals, stride number and stride length.

**Results:** A two way repeated ANOVA (2 states x 7 speeds) indicated that there was a main effect of speed and a main effect of fatigue in TTA ( $p < 0.05$ ). Post hoc analysis revealed that TTA was significantly greater at speeds larger than 10% above LTS. Regarding the stride parameters, statistical analysis showed that there was a more significant effect of stride length than stride number to account for an increase in speed.

**Conclusion:** The findings showed that TTA – a previously identified risk factor for impact-related injuries – is affected by fatigue and speed. However, runners tend to account for an increase in speed the same way after fatigue, independently of the increase in TTA that can lead to increase risk of injuries.



6. **PERSISTENCE OF MOTOR UNIT FIRING IN PEOPLE WITH PARKINSON'S DISEASE-RELATED FATIGUE IS INDEPENDENT OF ANTI-PARKINSON MEDICATION**

Katsavelis, Dimitrios Justin Haney, Lauren Nun and A. Joseph Threlkeld, Department of Exercise Science, Creighton University, Omaha, NE.

**Background:** Parkinson's disease (PD) is a progressive neurodegenerative disorder with wide prevalence and increasing incidence. A cardinal symptom of PD is bradykinesia: diminished amplitude of voluntary and reflexive movements associated with decreased muscle activation. Bradykinetic movements reflect altered motor unit discharge patterns and persistent motor unit firing. This persistence can be quantified by measuring the resting residual torque (RRT); the amount of joint torque present when a subject with PD is not voluntarily activating muscles.

**Purposes:** To quantify the amount of knee extension RRT between sequential maximal quadriceps contractions in people with PD-related fatigue in comparison to controls. To compare RRT when subjects were ON vs OFF anti-Parkinson's medication.

**Methods:** The present project was part of a larger NIH study of people with PD-related fatigue. Seventeen people with PD-related fatigue (age = 65.8±6yr; weight =85.0±19kg; height = 171.3±10cm) were assessed in the Creighton University Rehabilitation Research laboratory on two occasions, once ON and once OFF anti-Parkinson's (dopaminergic) medication. Sixteen healthy older controls (age = 65.6±7yr; weight =84.6±11kg; height = 173.6±9cm) underwent the same testing. Subjects generated repetitive maximal isometric knee extensions lasting seven seconds followed by three seconds of rest (7/3) until the extension torque output fell to 65% of MVIC for three consecutive contractions. The primary outcome measure was mean RRT during the rest period.

**Results:** Independent t-tests indicated a significant difference ( $p<0.02$ ) in PD RRT in both ON [4.96 % body weight (%BW)] and OFF (5.25 %BW) conditions when compared to older controls (1.36 %BW). However, there was no significant difference in RRT between ON and OFF states ( $p=0.34$ ).

**Conclusion:** Current findings support persistence of motor unit firing in people with PD, which was independent of dopaminergic medication. RRT may provide a method to explore PD bradykinesia and persistent motor unit firing.

7. **THE EFFECT OF FATIGUE ON TIBIAL ACCELERATION DURING AN INCREMENTAL RUN**

Knight, Eric Ryan Smith, Nicholas Than, Lauren Nun, Alex Sikora, Joan Eckerson and Dimitrios Katsavelis, Department of Exercise Science, Creighton University, Omaha, NE.

**Background:** Tibial acceleration is one of the most important mechanical factors that are associated with high risk of injuries, such as tibial stress fracture and other related musculoskeletal pathologies. Increased tibial acceleration is linked to increased bone-to-bone stress that if combined with prolonged runs may exceed the repair and remodeling process of the bone structure over time. Running through fatigue is a condition that exacerbates this phenomenon.

**Purpose:** To investigate the effect of a high-intensity fatiguing exercise bout on tibial acceleration while running at various speeds in an attempt to identify a change in speed-acceleration relationship.

**Methods:** Five male college students (age = 20.8±1yr; weight =76.7±4kg; height = 181.2±4cm) visited the Creighton University Biomechanics laboratory on two occasions. During the first visit, subjects underwent an incremental test of 3-min stages to determine their lactate threshold speed (LTS) by collecting blood samples (LTS=7.6±1mph). During the second visit, subjects were asked to complete an incremental run of seven 30-second stages at speeds that ranged from 20% below to 40% above the LTS. Subsequently, they performed a 5k run at their LTS followed by another incremental run. A wireless accelerometer that was placed at each subject's dominant tibial plateau recorded acceleration before and after the 5k run.

**Results:** A two way repeated ANOVA (2 states x 7 speeds) showed that there was a main effect of speed and a main effect of fatigue (p<0.05). Post hoc analysis revealed that tibial acceleration was significantly greater at speeds larger than 10% above LTS.

**Conclusion:** The findings showed that tibial acceleration – a previously identified risk factor for impact-related injuries – is affected by fatigue and speed. Therefore, it is of paramount importance that individuals that run through fatigue should not run at speeds much faster than their LTS to avoid increasing their risk of injury due to reduced tolerance for impact.

## 8. **Nanpwen Maladi Ki Pa Gen Remèd” (There is No Illness that Does Not Have a Cure): How Biomedical Intervention Fits into the Local Haitian Context**

Herman, Augusta , Department of Sociology, Anthropology and Social Work, Creighton University, Omaha, NE.

**Purpose/Rationale:** Haiti is home to some of the poorest and most vulnerable populations, making it a hotspot for non-governmental organizations (NGOs) and foreign-aid supported health clinics. Haitians welcome both biomedicine and traditional healing in their culture. Yet, health-focused NGOs tend to offer biomedicine while ignoring important aspects of traditional voodoo-influenced medicine. My research highlights Haitian perspectives on foreign biomedical treatment.

**Methods:** In anthropological fashion, I utilized qualitative research methods for this study. I immersed myself into Haitian culture by living in a suburb of Port-au-Prince over the summer of 2014. I interviewed patients waiting at a local hospital in Fermathe using a Kreyol-English translator. I also conducted observations and participated in local culture to get a better understanding of the Haitian context. Interviews were then transcribed and translated, and then analyzed for themes.

**Results:** Findings suggest that patients harbor complicated feelings about biomedicine and traditional healing. They do not readily separate the two, but rather incorporate them within a larger pluralistic worldview. Haitian patients incorporate Christian and voodoo religion into their perceptions of medicine and also practice both traditional healing and biomedicine in their homes. I suspect that the geographical proximity to Port-au-Prince was influential to these results, and perhaps more rural communities would be more reluctant to trust biomedicine.

**Conclusion/Significance:** In conclusion, it is clear that Haitians have a different view of medicine than do Westerners, who are often the people providing medical aid to Haiti. Haitian perspectives are very complicated and include aspects of their culture that Americans are unfamiliar with, especially the Afro-Latin religion voodoo. By better understanding Haitian ways of thinking about medicine, NGOs and other aid organizations can provide more effective and culturally appropriate care.

9. **Energy Consumption in Creighton University Residence Halls: Comparing Attitudes and Behaviors**

Kelly, Sarah, Department of Sociology, Anthropology and Social Work, Creighton University, Omaha, NE.

**Purpose:** The purpose of this research is to evaluate whether or not students residing in Creighton University Residence Halls attitudes about energy consumption reflect their behaviors.

**Methods:** To complete this research, I utilized a survey through the BlueQ survey system which was randomly distributed to students living in the residence halls in Creighton University. I also viewed the kWh per student per day in each of the residence halls. Data was collected during the month of December. I compared the survey information to the data about energy consumption in the residence halls with the Stata program in order to determine whether or not student attitudes reflected their behavior in regards to energy consumption.

**Results:** The results of this research reveal that Creighton University students living in the residence hall do have a concern for the environment, but they do not want to be held responsible for engaging in more sustainable consumptive practices. Also, the results reveal that the physical composition of the residence halls has more of an impact on the energy consumption than the residents of the building.

**Conclusion/Significance:** The findings of this research will allow Creighton University officials to understand student energy consumption habits and interest allowing for better energy consumption practices in the future.

10. **Exploring Connections Between Language and Quality of Care in Refugee Health**

Desai, Chaitri, Department of Sociology, Anthropology and Social Work, Creighton University, Omaha, NE.

Proper communication and understanding is a critical aspect of health care. It has been proven that barriers to communication in a health care setting can have an adverse effect on the quality of care received. Language in and of itself is a challenging issue in a health setting, and it is further complicated with issues such as cultural differences and unfamiliarity with the health care system in the United States. These are some of the obstacles that refugees face when accessing health care after resettlement. This project aims to understand how the complexities to language and culture inter-mingle in the health clinic and their effects on the care that refugees receive. This research will be conducted through various interviews and observation of patient-doctor interactions in refugee clinics located in Omaha. The main objectives of this research project are to give insight into how the language used by health care providers affects the patient physician relationship, to identify if simple, jargon-free language or in-depth language and explanations are needed for proper patient understanding, and to further propose practical solutions in improving the quality of care resettled refugees receive.

11. **THE POLLEN TUBE PATHWAY IN VICTORIA: IMPLICATIONS FOR FLOWER EVOLUTION IN WATER LILIES (NYMPHAEACEAE)**

McGlynn, Mary, Erik F. Manke, Diane Cooley, Kyosuke Oda, Erika L. Fennen, Sarah Garro and Dr. Mackenzie L. Taylor, Department of Biology, Creighton University, Omaha, NE.

**Purpose:** The giant water lily, Victoria, exhibits flowers that are much larger than those of other members of the water lily family Nymphaeaceae. One primary function of the flower is to facilitate the growth of a pollen tube from the stigma to the ovule, where it delivers the sperm to the egg. Changes in flower morphology, therefore, have consequences for the reproductive events critical

for successful fertilization. In order to understand the evolutionary consequences of increased flower size in *Victoria*, we characterized the pollen tube pathway and pollen tube development in both species of *Victoria* (*V. amazonica*, *V. Cruziana*). We then compared *Victoria* to other Nymphaeaceae, particularly, *Nymphaea* and *Nuphar*. These comparisons will provide insight into how flower evolution in Nymphaeaceae has affected reproductive development.

**Methods:** Flowers of *Victoria* were hand-pollinated and collected various hours after pollination (hap). Samples were stained and viewed under fluorescent light.

**Results:** In *Victoria*, pollen germinated across the entire stigmatic surface. Pollen germination was slow compared to other Nymphaeaceae, reaching 40% germination at 8 hours after pollination compared to 90% at 1 hour after pollination in *Nymphaea*. Following germination, *Victoria* pollen tubes grew laterally until they reached the zone of postgenital fusion, where they penetrated the stigmatic tissue and grew down through the substigmatic transmitting tissue. The average shortest distance to the first ovule was 4.9 mm in *Victoria*, compared to 2.0 mm in *Nymphaea* and 5.5 mm in *Nuphar*.

**Conclusions/Significance:** Differences in time of ovule entry between *Nymphaea* and *Victoria* can be attributed to both slower pollen tube growth and a longer pollen tube pathway. The difference in time of ovule entry between *Nuphar* and *Victoria* can be attributed to a slower germination rate, slower pollen tube growth, and a further distance of lateral growth on the stigmatic surface.

## 12. POST-POLLINATION DEVELOPMENT IN *RUPPIA MARITIMA*\*

Altrichter, Kristine Luke Aeilts, and Mackenzie L. Taylor, Department of Biology, Creighton University, Omaha, NE.

**Purpose:** *Ruppia maritima* is an aquatic plant found in shallow lakes and coastal areas throughout the world. *R. maritima* exhibits hydrophily, a rare pollination mechanism in which pollen is transported via the water surface. The transition to hydrophily is known to be accompanied by modifications in pollen morphology, but the consequences of this evolutionary transition for reproductive development are not well-understood. In this study, we characterized post-pollination pollen development in *R. maritima*. This is the first study to investigate pollen development in *R. maritima* and will yield valuable data for producing a comprehensive picture of reproductive development in water-pollinated plants.

**Methods:** Mature pollen characters were documented using light, scanning electron, and transmission electron microscopy. In order to investigate post-pollination pollen development, field collections were carried out and hand-pollinations were completed. Specimens were examined with light microscopy to determine the timing of developmental events, as well as rates of pollen germination and tube growth.

**Results:** We confirmed that mature grains exhibit a heteropolar exine with a reticulate proximal wall and smooth distal wall. Pollen is only deposited on stigmas in inflorescences with elongated peduncles. Pollen tubes emerge from apertures at the tips of the reniform grain, but only a small percentage of pollen successfully germinates. Germination occurred within five minutes after pollination and pollen tubes reached the ovule within one hour after pollination.

**Conclusion:** Rapid pollen germination and a short time to fertilization are likely adaptive for water-pollination. Understanding reproductive development in hydrophilous plants is key to answering questions regarding the evolution of flowering plant reproduction.

**Acknowledgement:** This project was funded by a 2014 Faculty Summer Research Fellowship to MLT, a Ferlic Summer Scholarship to LA, and the Clare Boothe Luce Program for Women in Science.

13. **BONE AND MINERALIZED MATRIX EFFECTS CORRELATE WITH ECTOPIC miRNA EXPRESSION**

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**Background and Objective:** MicroRNAs (miRNAs) are the small RNA component of the RNA induced silencing complex (RISC) used to target protein coding messenger RNAs (mRNAs) for post-transcriptional repression. Genome-wide studies have demonstrated a broad range of miRNA induced effects on mRNA levels ranging from fine-tuning to complete absence. Transgenic FVB/NCrl-Tg(GFAP-Mir183,Mir96,Mir182)Mdw mice were developed as a model system to identify, in vivo, target genes and biologic processes regulated by a trio of evolutionary conserved miRNAs known as the miR-183 cluster. MicroCT scanning demonstrated a bone phenotype which provides direct support that Tg-Mdw mice have developmental and/or remodeling defects of bone tissue. The hypothesis is that ectopic miR-183 cluster misexpression negatively influences, through posttranscriptional repression of miR-183 cluster target genes, one or more biologic signaling networks involved in bone formation/remodeling.

**Methods:** SEM, microCT analysis, histology and X-ray imaging are currently being pursued to assess morphologic and ultrastructural features of mineralized tissues (i.e. bone and teeth) in 2 lines of Tg(GFAP-Mir183,Mir96,Mir182)Mdw mice.

**Results:** Micro CT analysis shows a loss of cortical bone density and trabecular bone in femurs of Tg-Mdw homozygotes compared to Wt mice as early as P36. SEM imaging of the fracture faces of Tg-Mdw maxillary teeth demonstrate fewer and less defined rod/inter-rod enamel. Histologic assessments of the tissues and cells which secrete the mineralizing matrix of both bone and enamel are pending.

**Discussion and Conclusion:** These data support an effect of transgenic miR-183 cluster expression in tissues and cells which secrete and/or maintain mineralized matrix. From a health and wellness perspective, further morphologic and future molecular characterizations should add new knowledge applicable to the cellular signaling and gene regulatory circuits that control bone remodeling, bone loss and fracture repair.

14. **DICER KNOCKOUT MICE SUGGEST CRITICAL ROLE OF MICRORNA IN CEREBELLAR CELL PROLIFERATION, ORGANIZATION, AND MIGRATION**

Arneson, Erik Taylor Mighell, Megan Bosch, Garrett Soukup, Colby Bradfield, and Annemarie Shibata, Department of Biology, Creighton University, Omaha, NE.

Dicer is an RNAase III endonuclease responsible for cleaving short non-coding RNAs, in particular microRNAs. MicroRNAs (miRNAs) are short non-coding endogenous RNA of 19 to 22 nucleotides that form regulatory complexes to post-transcriptionally modulate gene expression. MicroRNAs are involved in a variety of essential cell mechanisms such as proliferation, differentiation, and apoptosis. Both in vitro and in vivo studies have shown that miRNAs are likely to be involved in essential neuronal processes controlling neural development. We hypothesize that miRNA expression is required for the proper development, migration, and survival of granule cells in the cerebellum. Conditional Dicer knock-out (CKO) mice using the expression of Cre recombinase under the control of the Atoh1 gene promoter were developed (Soukup et al., 2009) to establish a foundation for investigating miRNA function in cerebellar granule precursor cells (CGPCs). Atoh1, a bHLH gene, is specifically expressed in and is essential for the development of cerebellar granule cells. Characterization of the physical behaviors and morphological development of the cerebellum in Atoh-1 CRE conditional Dicer knockout mice, reveals a critical role for miRNAs in the migration and survival of CGPCs. Immunohistochemical studies show aberrant cellular morphology in granule and purkinje cells, malformed lobules, and decreased

localization of sonic hedgehog secretion in the CKO. Further analysis is focused on investigating several different miRNAs which have been shown by microarray assays to display differential expression in the CKO. These miRNAs will be investigated via knockout in CGPC culture. In addition, we plan to investigate the importance of Dicer and of miRNA function in Sonic Hedgehog receptor signaling and regulation of Gli1 transcription factor expression. Dysfunctional Sonic Hedgehog signaling and miRNA expression has been implicated in cerebellar medulloblastoma, the second most common childhood neuroectodermal tumor. These findings support critical role for miRNA expression in CGPCs and provides a model system for investigating the mechanisms of miRNA regulation of cerebellar development and function.

15. **CORTICAL NEURONAL DAMAGE STIMULATES A MICRORNA AND EPIGENETIC-ASSOCIATED TRANSITION IN ACTIVATED MICROGLIA THAT ENHANCES NEURONA\***

Mathy, Nicholas, Alex Johnson, and Annemarie Shibata, Ph.D., Department of Biology, Creighton University, Omaha, NE.

Activated microglia, the resident immune phagocytic and secretory cells in the CNS, can trigger neurotoxic inflammatory responses or promote neurogenesis and neuronal survival. To study microglial release of secretory cues, we developed an in vitro model system in which microglia are cultured upon transwell membranes suspended above mechanically damaged or undamaged primary neuronal cultures. This system allowed us to investigate the levels of select cytokines secreted by microglia in response to neuronal damage. Microglia responding to neuronal damage increase their secretion of MCP-1, and decrease expression of Ccl3, Ccl5, TNF, and Ifng. RTPCR is underway to verify ELISA data. Also, the presence of neurons alone significantly changes the levels of cytokine mRNA. We see significant decreases in Ccl3 and TNF ( $p < .01$ ). This may suggest an innate neuroprotective role of microglia. Microglial-secreted cytokines enhance neurogenesis by regulating neuronal non-coding microRNA expression. We have shown that activated microglia enhance the timing of primary cortical neurons in vitro. Current RTPCR analysis demonstrates that this enhancement of neurogenesis is associated with time-dependent regulation of miR-9, miR-124, let-7c levels in differentiating neurons. Comparing neurons co-cultured in presence of microglia to those cultured without microglial presence, we observe increases in miR-9, miR-124, and let-7c levels quantified by RT-PCR in response to damage, all of which inhibit neural stem cell proliferation and promote neuronal lineage commitment. We have also investigated the role of miRNAs in microglial regulation. We observed significant increases in miR-9, miR-124, and let-7 when compared to resting microglia, suggesting these microglia are functioning in a neurotrophic manner. Understanding the mechanisms that drive neurotrophic processes may help develop immune therapies that promote these phenotypes over neurotoxic phenotypes during neurodegenerative diseases and traumatic brain injury.

16. **DIFFERENCES IN MITOCHONDRIAL METABOLISM IN REGENERATIVE AND NON-REGENERATIVE SENSORY EPITHELIA**

Arnold, Kara, Lisa Higuchi<sup>1</sup>, Kenneth Kramer<sup>2</sup>, Michael G Nichols<sup>3</sup>, Heather Jensen Smith<sup>2</sup>, <sup>1</sup>Department of Biology, <sup>2</sup>Department of Biomedical Sciences, and <sup>3</sup>Department of Physics, Creighton University, Omaha, NE.

**Purpose:** In the mammalian cochlea, sensory cells are readily damaged by acoustic trauma, ototoxins, and age-related decline, each resulting in permanent hearing loss (HL). While HL is permanent in mammals, zebrafish contain similar sensory organs that are capable of regenerating after insult. Other studies have shown mitochondrial metabolism can regulate cellular regeneration and proliferative capacity. These are the first studies to determine if mitochondrial metabolism limits sensory cell regeneration in mammalian cochleae.

**Methods:** Fluorescence lifetime imaging (FLIM) of the metabolic intermediates, nicotinamide adenine dinucleotide (NADH) and flavoproteins, were used to determine if metabolic differences exist between cells housed in regenerative and non-regenerative sensory organs. Differential NADH- and FADH<sub>2</sub>-enzyme binding produces distinctive fluorescence lifetimes for each metabolic intermediate.

**Results:** Mammalian and zebrafish sensory organs contain sensory and supporting cells. In the zebrafish, supporting cells are capable of regenerating sensory cells. NADH fluorescence lifetimes are significantly shorter in regenerative zebrafish supporting cells compared to non-regenerative mammalian supporting cells. Short NADH lifetimes, indicative of unbound NADH, are characteristic of proliferative cancer and stem cells.

**Conclusion:** We have identified fundamental differences in mitochondrial metabolism between sensory and supporting cells housed in regenerative zebrafish and non-regenerative mammalian sensory organs. In zebrafish sensory organs, the majority of NADH is unbound while NADH in mammalian sensory organs is predominantly enzyme bound. Free NADH can bind C terminal binding protein (CtBP), a transcriptional co-regulator of cell fate determination in developing and proliferative mature cells. Future studies will determine if CtBP is differentially expressed in regenerative and non-regenerative hearing organs.

**Acknowledgment:** Supported by the National Institute on Deafness and Other Communication Disorders (NIDCD,RO3 DC012109), COBRE (8P20GM103471-10) to HJS.

17. **DIFFERENCES IN AMINOGLYCOSIDE ENTRY AND MITOCHONDRIAL METABOLISM IN REGENERATIVE AND NON-REGENERATIVE SENSORY EPITHELIA**

Altfillisch, Charles, Kara Arnold<sup>1</sup>, Lisa Higuchi<sup>1</sup>, Kenneth Kramer<sup>2</sup>, Michael G Nichols<sup>3</sup>, Heather Jensen Smith<sup>2</sup>, <sup>1</sup>Department of Biology, <sup>2</sup>Department of Biomedical Sciences, and <sup>3</sup>Department of Physics, Creighton University, Omaha, NE.

**Purpose:** Despite causing irreversible hearing loss (HL) in approximately 120,000 individuals every year, aminoglycoside antibiotics (AGs) remain the most frequently used antibiotics worldwide. Our research group has shown gentamicin, a representative AG, rapidly alters mitochondrial metabolism in mammalian cochlear cells. These changes damage cochlear sensory cells causing permanent HL. While ototoxins permanently damage mammalian cochlear sensory cells, zebrafish contain similar sensory organs and cells that are capable of regenerating after AGs. The reason for this difference is unknown. These studies compare AG accumulation and mitochondrial metabolism in mammalian and zebrafish sensory organs.

**Methods:** Fluorescently-labeled gentamicin (GTTR) was used to measure gentamicin accumulation in acutely-cultured murine cochlear explants and zebrafish neuromasts. GTTR fluorescence intensities were measured in sensory and supporting cells during a 45 min GTTR exposure. Fluorescence lifetime imaging of the metabolic intermediate, nicotinamide adenine dinucleotide (NADH) was used to determine if metabolic differences exist between cells housed in regenerative and non-regenerative sensory organs.

**Results:** Gentamicin rapidly and specifically accumulates in both mammalian and zebrafish sensory, not supporting, cells. NADH lifetimes are significantly shorter in sensory and supporting cells housed in regenerative sensory organs.

**Conclusion:** Zebrafish are considered a model system for studying mammalian HL. Differences in AG accumulation and mitochondrial metabolism exist between non-regenerative mammalian and regenerative zebrafish sensory and supporting cells. Such differences may explain cell fate determination in regenerative and non-regenerative sensory cells after ototoxic insult.

Understanding the link between mitochondrial metabolism and cell fate is critical for developing HL prevention and treatment strategies.

**Acknowledgment:** Supported by National Institute on Deafness and Other Communication Disorders (NIDCD, RO3 DC012109), and COBRE (8P20GM103471-10) to HJS.

18. **OLFACTORY AND VOMERONASAL SYSTEMS ARE BOTH PRESENT IN A CARTILAGINOUS HOLOCEPHALIAN ELEPHANT SHARK, CALLORHINCHUS MILII**

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This experiment was completed in order to determine when distinct olfactory systems first appeared in evolutionary history by examining the peripheral and olfactory organization in a chondrichthyan. In the experiment, we labeled the olfactory sensory neurons (OSNs) of both the general olfactory system and the vomeronasal system in elephant sharks using antibodies. Anti-Gas/olf was used to identify olfactory neurons, anti-Gao and anti-calbindin were used to identify OSNs of the vomeronasal system, and anti-calretinin was used to identify a mixed population. This study was the first to show separation of main olfactory and vomeronasal targets in the forebrain of the elephant shark. Because of this, we conclude that distinct olfactory systems were present in the common ancestor of jawed vertebrates.

19. **IN VIVO FATIGUE DAMAGE IN BONE LINKED TO CYTOKINE EXPRESSION**

McCumber, Travis, B. T. Hackfort, M. P. Akhter, and D. M. Cullen, Department of Biomedical Sciences Creighton University, Omaha, NE.

**Purpose:** When mechanical loads of extreme force or repetition create tissue damage cytokines are released in order to regulate the targeted remodeling of the damaged bone matrix. The purpose of this project is to examine both the cytokine and osteoclast response to in vivo fatigue loading in order to better understand the molecular pathways involved in targeted bone remodeling.

**Methods:** In Sprague Dawley female rats (6 months, n = 8), the right ulna was fatigue loaded in compression to 40% loss of ulna stiffness. Right and left (loaded and non-loaded contralateral control) ulna and serum were collected at either 24 or 48hrs. post fatigue. Cytokine response was analyzed from bone protein extract and blood; and immunohistochemistry and TRAP staining were performed on ulnar cross sections to localize IL-2 expression and osteoclast presences.

**Results:** Analyses of bone protein extract 24hrs. after loading showed an up-regulation of IL-2 in the loaded ulna compared to the non-loaded control. Serum IL-2 was up-regulated at 48hrs. in loaded rats compared to unloaded rats. Immunohistochemistry and TRAP staining showed a systemic presence of IL-2 within the cortical blood spaces of bone sections, and an increase in osteoclast presence within loaded bone sections at 48hrs.

**Conclusion:** The up-regulation of IL-2 and osteoclasts following fatigue loading of bone tissue suggests a relationship between the fatigue loading of bone and T cell recruitment of osteoclast. IL-2 is not known to be produced by osteocytes or osteoblasts, but is a cytokine related to increased activation and recruitment of T cells. These results provide new insight into potential signaling mechanisms associated with bone tissue damage. Further work is needed to identify how T cells might be interacting with bone to initiate tissue remodeling.

**Acknowledgments:** This project was supported by a grant from AMGEN.



20. **CLINICALLY RELEVANT ALLERGEN MIXTURE INDUCES ROBUST IMMUNE RESPONSE BY INCREASING CD11C+CD11B+MHCII<sup>+</sup>CD103<sup>+</sup> LUNG DENDRITIC CELLS**

Hall, Sannette<sup>1</sup>, and Devendra K. Agrawal<sup>1,2,3</sup>, <sup>1</sup>Department of Biomedical Sciences, <sup>2</sup>Department of Medical Microbiology and Immunology, and <sup>3</sup>Center for Clinical and Translational Sciences, Creighton University, Omaha, NE.

**Rationale:** Dendritic cells (DCs) in the airway epithelium and submucosa detect inhaled allergens and present processed antigens to T-lymphocytes to induce allergic immune responses. The phenotype of DCs is important in determining the nature of a response, whether immunogenic (Th2-mediated) or tolerogenic (Th1-mediated). Here, we examined the effect of multiple allergen sensitization on lung DC population and phenotype in a murine model of asthma.

**Method:** Female Balb/c mice were sensitized intranasally and challenged by aerosolizing a combination of house dust mite, ragweed and *Alternaria* or PBS for a total of 5 weeks. Lung tissue from both groups were harvested and sorted using MACS and FACS to determine phenotype of DC population.

**Results:** Sensitization and challenge with house dust mite, ragweed and *Alternaria* resulted in increased airway hyper-responsive and mucus secretion. This correlated with increased total cell number and eosinophil infiltration in the BALF of antigen sensitized and challenged mice. Analysis of lung DCs in allergen-sensitized and challenged mice revealed greater percentages of CD11c<sup>+</sup> and CD11b<sup>+</sup> cells which expressed high levels of MHCII. CD103 expression was marginally increased in CD11c<sup>+</sup> cells and decreased in the CD11c<sup>+</sup>CD11b<sup>+</sup>MHCII<sup>+</sup> DCs.

**Conclusion:** Multiple allergen exposure increases the population of dendritic cells associated with promoting an immunogenic response.

**Acknowledgement:** This work was supported by research grant from the National Institutes of Health (R01AI075315) to D.K. Agrawal

21. **EPIDERMAL GROWTH FACTOR RECEPTOR REGULATION OF STATHMIN 1 IN MOUSE SKIN CANCER**

Plunkett, Cassidy, Brianna Hammiller, Kyle Bichsel, Jessica Gaulter, Carol Trempus, and Laura A. Hansen, Department of Biomedical Sciences, Creighton University, Omaha, NE.

One in five Americans will develop skin cancer during their lifetime. According to the American Cancer Society, 3.5 million cases of nonmelanoma skin cancer are diagnosed annually in the United States. Expression of the epidermal growth factor receptor (EGFR) is increased in many of these skin cancers. Our preliminary data examining EGFR in normal skin during development suggested that EGFR suppresses the expression of Stathmin 1 (Stmn1) and RCC2, two mitotic regulatory proteins during hair follicle cycling. From these data, we hypothesized that EGFR may suppress Stmn1 and RCC2 expression during skin carcinogenesis. Treatment of skin-targeted *Egfr* mutant and control mice with a single topical application of 7,12-dimethylbenz[a]anthracene (DMBA) followed by twice weekly 12-O-tetradecanoyl phorbol-13-acetate (TPA) treatment induced 0.33±0.13 and 2.00±1.26 tumors per mouse in skin-targeted *Egfr* mutant and control mice, respectively. Immunohistochemical analysis of Stmn1 and RCC2 in tumors and in adjacent non-tumor bearing skin from skin-targeted *Egfr* mutant and control mice was performed in sections of skin and tumors from these mice. These analyses revealed that Stmn1 levels were increased in *Egfr* mutant skin tumors compared to control tumors, while RCC2 levels were not affected. From these data, we conclude that EGFR regulation of Stathmin 1 may be a mechanism through which EGFR contributes to skin tumorigenesis.

22. **ENDOLYMPH FACILITATES OTOLITH NUCLEATION IN EARLY ZEBRAFISH EAR DEVELOPMENT**

Thiessen, Kevin, and Kenneth Kramer, Department of Biomedical Sciences, Creighton University, Omaha, NE.

**Purpose:** Deflecting bio-mineralized crystals attached to vestibular hair cells are necessary for maintaining bodily balance. Zebrafish (*Danio rerio*) are useful tools to study these bio-mineralized crystals called otoliths, as many required genes are homologous to human otoconial development. We identified and characterized a pair of genetically-linked mutants, no content (*nco*) and corkscrew (*csr*), that fail to develop otoliths during early ear development.

**Methods:** We sought to characterize the novel *csr* mutation using: (1) whole-genome homology mapping to identify gene mutations, (2) immunohistochemical staining of homologous proteins during early ear development, (3) alizarin-3-methyliminodiacetic acid staining to assess calcium in the otocyst and (4) various exogenous ion concentrations to assess its effect on otolith formation.

**Results:** No causative mutations were readily identified in genes known to be required for otolith development. An otoconial seeding protein, *Oc90*, and other otolith matrix proteins (Keratan Sulfate Proteoglycans and *Starmaker*) show diffuse expression inside the otocyst of the *csr* mutant. In water treatments supplemented with potassium chloride (N=59), we found a significant increase in embryos lacking otoliths ( $p= 0.029$ ). In embryos treated with calcium chloride (N=64), we observed a partial rescue of normal otolith formation; however, it was not statistically significant ( $p= 0.148$ ). We observed no significant change in the frequency of mutant phenotype in calcium nitrate-treated embryos (N=119). Additionally, we observed no significant change in water treatments supplemented with potassium chloride (N=107) or calcium chloride (N=120) compared to calcium nitrate-treated *nco* embryos.

**Conclusions:** Otolith nucleation is impaired in the genetically-linked zebrafish mutants *csr* and *nco*. While otoconial seeding and matrix proteins are found in the otocysts of *csr*, otoliths fail to develop. Furthermore, exogenous ions can affect the penetrance of otolith formation in the *csr* embryos, suggesting the ionic composition of the endolymph facilitates otolith nucleation.

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23. **CYTOPLASMIC LOCALIZATION OF 14-3-3 IS ASSOCIATED WITH SUPPRESSION OF CELL DEATH IN CUTANEOUS SQUAMOUS CELL CARCINOMA**

Tran, Nicholas, Lauren Nicola; Jenan Al-Matouq; Brianna Hammiller; and Laura A. Hansen, Department of Biomedical Sciences, Creighton University, Omaha, NE.

**Purpose:** Cutaneous squamous cell carcinoma (SCC), one of the most common cancers in the United States, frequently arises from premalignant precursors and is a significant cause of mortality in immunocompromised patients. Our laboratory recently demonstrated 14-3-3 epsilon localization shifts from the nuclear compartment in normal epidermal keratinocytes to the cytosolic fraction in 5 of 5 human cutaneous SCC cell lines examined, and that targeting of 14-3-3 epsilon triggers apoptosis in cultured SCC, but not in normal cells, making it an appealing target for therapy. Because 14-3-3 epsilon requires another 14-3-3 isoform to heterodimerize, we hypothesized that mouse and human skin cancers in vivo would have increased cytosolic localization of 14-3-3 epsilon and other isoforms when compared to normal skin.

**Methods:** Sixteen mice were topically treated with 100 nmol of 7,12-dimethylbenz[a]anthracene (DMBA) in acetone or vehicle alone, followed by 13 weekly application of 50 nmol DMBA or vehicle alone. Premalignant precursors (papillomas), malignant SCC tumors and normal skin

were harvested at euthanasia. Immunohistochemistry for 14-3-3 eta, gamma, theta, and zeta was performed using standard techniques.

**Results:** Consistent with our hypothesis, mouse and human tumors exhibited increased 14-3-3 epsilon immunopositivity when compared to normal skin and primarily localized in the cytosol. Immunostaining patterns for 14-3-3 eta, zeta and gamma in both mouse and human skin and tumors were similar to those of epsilon. 14-3-3 theta immunostaining, which exhibited nuclear localization in skin and tumors with faint cytosolic signals, decreased in intensity throughout tumor progression. Immunostaining of all 14-3-3 isoforms in the premalignant papillomas was similar to that of the SCC.

**Conclusion:** 14-3-3 epsilon localization shifted from nuclear to cytosolic during tumor development and progression in mouse and human samples. 14-3-3 eta, zeta and gamma similarly relocated to the cytosol during carcinogenesis. In contrast, 14-3-3 theta remained primarily nuclear in skin and tumor.

#### 24. **ASSESSING FEAR BEHAVIOR IN DANIO RERIO**

Uy, Daniel, Department of Biomedical Sciences, Creighton University, Omaha, NE.

Zebrafish (*Danio rerio*) are a tiny species of fish which have the potential for a lot of natural predators. One of the most natural instincts of an organism is to react to stimuli that might cause harm. These behaviors affect the individual's chance for basic survival. In order to characterize the fear reaction, an animal must correlate a stimulus with a memory that it is linked to a harmful event (ex: a red light (conditioned stimuli) precedes a mild shock (unconditioned stimulus)). Appropriate responses in fear reactions are so crucial to an organism's survival that parts of the brain associated with controlling fear must have developed early in evolution. The basis for our present study is to set the groundwork for a larger study with mutant varieties of the zebrafish that lack genes known to be important for the formation of amygdalar memories in mammals by (1) designing the behavioral equipment for the following three tests; (2) programming the computer to time onset of the conditioned and unconditioned stimuli, and (3) running preliminary tests with zebrafish. This study tests the hypothesis that the parts of the mammalian brain that are linked with fear (which in mammals is in the amygdala), have been conserved evolution, and will be present in zebrafish, *Danio rerio*. By determining the areas of the brain that are necessary to regulate fear in the zebrafish, we will be able to analyze the pathways that express fear in zebrafish and will gain a greater understanding the evolution of the regulation of fear. The results match with those found in previous studies with normal, wild-type fish, but further investigation with a larger population is required in order for this data to be significant.

#### 25. **MMP-2 AND MMP-14 SILENCING INDUCES THE DIFFERENTIATION OF PORCINE ADIPOSE-DERIVED MESENCHYMAL STEM CELLS TO ENDOTHELIAL CELLS**

Almalki, Sami, Yovani Llamas, and Devendra K. Agrawal, Department of Biomedical Sciences, Creighton University, Omaha, NE.

**Rationale:** The molecular mechanisms that control the ability of adipose-derived mesenchymal stem cells (AMSCs) to remodel 3-dimensional extracellular matrix barriers during differentiation are not clearly understood. Herein, we studied the expression of matrix metalloproteinases (MMPs) during the differentiation of AMSCs to endothelial cells (ECs).

**Methods:** MSCs were isolated from porcine abdominal adipose tissue, and characterized by CD44+, CD90+, CD105+, CD14-, and CD45-. The plasticity of AMSCs was detected by multi-lineage differentiation. The mRNA transcripts, protein expression of EC marker, MMPs and TIMPs, and enzyme activity of MMP-2 were analyzed.

**Results:** The differentiation of ADMSCs to ECs was confirmed by protein and mRNA expression of EC markers. The mRNA transcripts for MMP-2 and MT1-MMP were significantly increased during the differentiation. Western blot, zymography and ELISA showed an elevated MMP-2 and MT1-MMP expression and activity. MMP2 and MT1-MMP silencing showed significant increase in the expression of EC markers, formation of capillary tubes, and acetylated-LDL uptake.

**Conclusion:** We, for the first time, report that the up-regulation of MMP2 and MT1-MMP has an inhibitory effect on the differentiation of AMSCs to ECs, and silencing these MMPs can induce the differentiation. These findings could have significant clinical impact in developing better therapeutic approaches to re-endothelialize coronary arteries following interventional procedures or inducing angiogenesis to regenerate myocardium.

## 26. **ROMAN CHILD PORTRAITURE**

Weed, Ashley, Joe Baronovic, and Sarah Copeland, Department of Classical and Near Eastern Studies, Creighton University, Omaha, NE.

This poster is a report on research carried out on two Roman portraits (JAM inv. 1947.208, JAM inv. 1952.33) in the Joslyn Art Museum. The first, Portrait of a Roman Boy (JAM inv. 1947.208) is a roughly life-sized bust, depicting the head and approximately 1 one-third of the torso of a child. This portrait presents several intriguing problems in terms of style and coherence. Careful observation of the object in the Joslyn's vaults seems to indicate that the portrait has been assembled from several disparate pieces to form a pastiche, probably for the art market. Our poster details the trends and rise in popularity of fabricating restorations and pastiches to sell on the art market and we are thus able to explain the incongruities in style and several other difficulties raised by our initial examination of the object. The second portrait (JAM inv. 1952.33) portrays the head of an infant. Examinations of this object have lead us to believe that it, unlike Portrait of a Roman Boy, is authentic, and most likely a funerary monument. Comparisons to other authentic, dated evidence support our hypothesis that the portrait was created during the Julio-Claudian period in the first half of the first century CE.

## 27. **ARTEMIS IN ATHIENOU-MALLOURA: REVEALING GENDERED RELATIONSHIPS AMONG CYPRIOT DEITIES**

Ewers, Caitlyn, Department of Classical and Near Eastern Studies, Creighton University, Omaha, NE.

The Athienou-Malloura sanctuary in south-central Cyprus, in use from the Geometric through Roman periods, has yielded over three thousand votive sculptures. About ninety percent of these depict males: the deities Herakles, Apollo, Zeus Ammon, and Pan are all represented, as are generic male figures. Of the comparatively few female votives, most are thought to depict the goddess Artemis, the potnia theron (mistress of animals) whose cult was imported from Greece in the mid-fifth century BCE. Significant in part because of their rarity, these statuettes represent a largely unexplored aspect of worship at Malloura. The imagery examined by this project reveals the associations between the goddess and the male deities represented at the site and evinces the gendered aspects of their depiction and worship. The goddess's affinity for animals and her faunal attributes have strong parallels with all four major male deities known to have been worshipped at Malloura, though her gender alters how this affinity was perceived because the combination of feminine identity and young animals strongly emphasize her role as a fertility goddess. Comparanda for the Malloura pieces, the majority of which have not been published, was drawn from examples recovered from Cypriot sanctuaries in use around the same time period and featuring votives depicting both Artemis and one or more male deities within their corpuses.

This project was made possible by a Creighton University College of Arts and Sciences 2014 Dean's Summer Research Scholarship, the generosity of the Larnaca Archaeological District Museum and the Athienou Archaeological Project, and the guidance of Dr. Erin Walcek Averett.

## 28. NOTORIOUS FEMINIST ANALYSIS

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This essay applies feminist criticism to Alfred Hitchcock's 1946 movie *Notorious* to uncover rhetorical strategies used in film to maintain a patriarchal Post-World War II society. Specifically, I analyzed the depiction of the female character's sexuality and agency and found that sexual objectification, oppression, and undermining female independence were strategies used to maintain the patriarchal status quo. This analysis concurs with and adds to previous literature on feminist criticism of films. Previous authors (e.g., Renov, Boozer, & Gates) have noted that women featured in films reflect their position in society. Post-World War II Hollywood films were part of the patriarchal structure used to discourage women from the assembly lines. The objective of feminist criticism is "...to discover how the rhetorical construction of identity markers, such as gender, are used as a justification for domination, how such domination is constructed as natural, and how that naturalness can be challenged" (Foss, 2009, p. 213). The emergence of second wave feminism during the 1960's was a result of challenging oppression, which is what this type of analysis aims to achieve.

## 29. REGULATION OF K<sup>+</sup>-INDUCED [3H]D-ASPARTATE RELEASE BY THE NON-ENZYMATIC, DHA-DERIVED METABOLITE, 4(S)-F4t-NEUROPROSTANE IN BOVINE RETINA, IN VITRO

Jamil, Jamal, Fateh Ullah<sup>1</sup>, Hang Yin Kwong<sup>1</sup>, Thierry Durand<sup>2</sup>, Jean-Marie Galano<sup>2</sup>, Alexandre Guy<sup>2</sup>, Catherine A. Opere<sup>1</sup>, <sup>1</sup>Department of Pharmacy Sciences, Creighton University, Omaha, NE; <sup>2</sup>Faculté de Pharmacie, Institut des Biomolécules Max Mousseron (IBMM), Montpellier Cedex, France, School of Pharmacy and Health Professions, Creighton University, Omaha, NE.

**Purpose:** We have evidence that the non-enzymatic metabolite of EPA, 5-epi-5-F3t-isoprostane regulates excitatory neurotransmitter release in isolated bovine retina (Jamil et al., 2014 *Neurochem Res* (2014) 39:2360-2369). However, the pharmacological role of spontaneous DHA metabolites on retinal neurons has not been fully elucidated. In this study, we investigated the regulation of K<sup>+</sup>-induced glutamate release (using [3H]D-aspartate as a marker) by 4(S)-F4t-neuroprostane (4(S)-F4t-NeuroP) in isolated bovine retina.

**Methods:** Freshly isolated bovine retina were incubated for 60 mins in carbogen-gassed Krebs buffer solution (pH 7.45; 37 °C) containing 200nM of [3H]D-aspartate. Retinal tissues were placed in thermostatically controlled superfusion chambers and release of [3H]D-aspartate was evoked by iso-osmotic concentration of K<sup>+</sup> (50mM)-stimuli applied at 80-88 mins (S1) and 116-124 mins (S2) after the onset of superfusion.

**Results:** The DHA-metabolite, 4(S)-F4t-NeuroP (1 nM to 1 μM) enhanced K<sup>+</sup>-induced [3H]D-aspartate release from bovine retina in a manner that was sensitive to inhibition by the prostanoid D2/TP-receptor inhibitor, ramatroban (10 μM). For instance, 4(S)-F4t-NeuroP (10 -7M) enhanced the excitatory neurotransmitter release by 17% (n=4; p<0.05). Interestingly, pretreatment of tissues with the COX-enzyme inhibitor, flurbiprofen (3 μM) unmasked a concentration-dependent inhibitory action for 4(S)-F4t-NeuroP, with the maximal inhibition of 45.7% (n=3; p<0.05) being achieved at the 1 μM concentration of the drug.

**Conclusions:** The DHA-derived neuroP, (S)-F4t-NeuroP regulates K<sup>+</sup>-induced [3H]D-aspartate release in bovine retina.

30. **CENTRALITIES AND DEPENDENCIES IN THE INTERNATIONAL EQUITIES MARKET**

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The international equities market may be conceptualized as a network of smaller markets existing in different countries, thereby being subject to different market forces. Yet, as a network, fluctuations in one equities market can induce fluctuations in another. This interconnectivity of world markets can cause ripple effects to occur across financial sectors, industries, and countries. This study applies social network analysis (SNA) techniques to the international equities network in order to better understand the causal structure of the network as well as the historical trends of its evolution.

31. **STATE PERSPECTIVES: RESTRICTING IMMIGRANT ACTIVITY IN THE U.S.**

Maxwell, Megan, Department of Economics, Creighton University, Omaha, NE.

President Barack Obama's recently announced plan to defer deportation of young unauthorized immigrants has prompted a range of responses from states, from admiration of to preparing lawsuits against the President. While there is a plethora of studies on US immigration reform and US immigration policy, very little research exists at the state level. What's more, there is very little research on why immigration policies differ from state to state. Therefore, I ask the question what influences state laws that affect immigrants? I test whether demographic, financial preconceptions of immigrants, and sympathetic characteristics of state populations forecast a state's laws affecting immigrants. I use data from 2008 to 2012 from the National Conference of State Legislatures to rank states on their policy restrictiveness based on their laws that limit immigrant activities and laws that are more tolerant and encourage immigrant activities. I then examine whether American nationalism among a state's population and a state's percent foreign-born population influence state laws, which are characteristics of American sympathy and compassion. Using an ordinary least squares regression, I find that the cost-benefit analysis for immigration by state is a significant predictors of state laws affecting immigrants but not in the way in which the literature suggests.

32. **EFFECTS OF NEONATAL INDUCED HYPOTHERMIA ON COAGULATION IN NEONATES**

Haroon, Maha, Zoha S. Haroon, Katie McDonald RN, and Terence Zach MD, Department of Pediatrics, School of Medicine, Creighton University, Omaha, NE.

Neonatal induced hypothermia, also known as head cooling, as used as a protection measure for neonates suffering from encephalopathy. The benefits of hypothermic temperatures are decreases in cerebral edema, neurotoxicity, and inflammation. Although head cooling has these beneficial effects, one side effect can be a change in the ability to coagulate. Therefore, we retrospectively studied how head cooling affects coagulation in six neonates. We found that on days where the infants were head cooled, prothrombin time and INR were increased while fibrinogen was decreased. Platelet counts tended to decrease during and after head cooling. Our conclusion is that head cooling decreases the ability to coagulate in neonates.

### 33. **NEUROPROTECTION AND LIVER FUNCTION IN NEONATES**

Haroon, Zoha, Maha Haroon, Katie McDonald, RN, and Terence Zach, MD, Department of Pediatrics, School of Medicine Creighton University, Omaha, NE.

**Purpose:** Neonatal induced hypothermia, also known as head cooling, is used as a neuroprotective measure for neonates suffering from neonatal encephalopathy. Hypothermic temperatures in the brain decrease blood flow, which prevents edema. These low temperatures also prevent inflammation and neurotoxicity. Impaired liver function is a common presentation in asphyxiated patients, since blood flow is shunted away from the liver and towards more critical organs such as the heart and brain. Our project looks at how liver function is affected by head cooling in seven preterm infants.

**Methods:** We retrospectively analyzed the levels of ALT (alanine aminotransferase) and AST (aspartate aminotransferase) from seven premature neonates who received head cooling.

**Results:** The seven patients we analyzed were between the gestational ages of 35 and 40 weeks. These seven patients had acidotic cord pH levels (<7.31-7.49). All of the patients were cooled for at least the first three days of life. The average levels of ALT during the first five days of life remained within the normal range of 12-78 u/l. However, the average levels of AST were above the normal range of 10-40 u/l, but decreased to within the normal range by the fifth day of life.

**Conclusion:** We found that on days where the infants were head cooled, average ALT levels remained in the normal range. However, head cooling brought average AST levels to within the normal range by 5 days post-natal. We discovered that head cooling did not have an appreciable effect on ALT (alanine aminotransferase) levels, but the increased levels of AST (aspartate aminotransferase) decreased to within the normal range by day five post-natal.

### 34. **EVALUATION OF EVEROLIMUS USE IN MIDWESTERN TUBEROUS SCLEROSIS PATIENTS WITH RENAL ANGIOMYOLIPOMAS**

Pomajzl, AJ, and Michael Feloney, MD, School of Medicine, Creighton University, Omaha, NE.

**Purpose:** Tuberous sclerosis complex (TSC) is a rare but well-known syndrome which causes numerous benign tumors in multiple organs. The most lethal features of adults with TSC are enlarging renal angiomyolipomas resulting in hemorrhage. The pathogenesis behind the uncontrolled cell growth found in TSC is a disruption of either TSC1 or TSC2 causing increased mammalian target of rapamycin (mTOR) activity. In 2012, the FDA granted accelerated approval to everolimus (Afinitor®), an mTOR inhibitor, for the treatment of renal angiomyolipomas in patients with TSC. Multiple studies since then have shown the drug to reduce kidney tumor burden while maintaining an acceptable safety profile. Although U.S. clinics specializing in TSC exist, few are located in the Midwest. Couple this fact with the recent approval and success of everolimus, it is possible that Midwestern clinics not specializing in the treatment of TSC are unaware of this medical alternative for the renal manifestations of TSC. The purpose of this study was to examine the rate of everolimus use in Midwestern, non-TSC clinics for patients diagnosed with TSC and renal angiomyolipomas.

**Methods:** The CHI Health electronic medical record (EMR) was queried for TSC (ICD-9-CM 759.5) and angiomyolipomas (ICD-9-CM 223.0). Radiographic reports were also searched to confirm angiomyolipomas. The medication lists of patients matching both queries were then examined for everolimus.

**Results:** Of the 360,585 unique entries included within the CHI Health EMR, ten patients were found to have been diagnosed with TSC. Of those ten patients diagnosed with TSC, five (50%) were found to have renal angiomyolipomas. None had ever taken or been prescribed everolimus.

**Conclusion:** Midwestern TSC patients with renal angiomyolipomas are possibly medically undertreated—perhaps due to the lack of awareness of everolimus’s usefulness in preventing angiomyolipoma growth. More education is needed for the clinicians handling these disorders in Midwestern non-specialty clinics.

### 35. **TARGETED THERAPY FOR KRAS MUTANT MUCINOUS COLORECTAL CANCERS**

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**Purpose:** A significant proportion of sporadic colorectal cancers (CRCs) (10-15%) are of the mucinous subtype (>50% of the tumor). Mucinous colorectal adenocarcinomas (MCAs) are clinically, morphologically and molecularly distinct from nonmucinous CRCs as they show a different spectrum of genetic alterations (higher KRAS mutations, MSI-H, lower p53, high MUC2) and exhibit more aggressive behavior (more prone to peritoneal dissemination and lymph node involvement). MCAs are associated with poorer response to chemotherapy and have limited treatment options. The purpose of this study was to test the effectiveness of combinatorial targeting of two KRAS-associated parallel pathways in an attempt to counter adaptive resistance associated with single pathway inhibition.

**Methods:** Two KRAS mutant MCA cell lines LS174T and RW7213 were treated with two small molecule inhibitors, GDC0973 and GDC0941, to block mitogen-activated extracellular regulated kinase kinase (MEK) and phosphoinositide 3-kinase (PI3K) respectively. Adaptive resistance of these two cell lines to the PI3K inhibitor (PI3Ki) was examined by protein phospho-receptor tyrosine kinase (RTK) arrays, western blots and immunocytochemistry.

**Results:** Bioinformatic analysis of the colon cancer datasets in the cancer genome atlas (TCGA) showed increased mutation rates in mucinous over nonmucinous CRCs for effectors of RAS-RAF-MEK-ERK (80% versus 41.9%) and PI3K-AKT-mTOR (60% versus 21.8%) pathways. Both MCA cell lines were sensitive to MEK inhibitor (MEKi) treatment. In contrast, these cell lines, though initially sensitive to PI3Ki, later became resistant. Concomitant with the development of resistance were a) increase in phosphorylated RTKs including IR, IGF-1R, EGFR, ErbB2 b) increase in phosphorylated ERK and AKT, c) nuclear translocation of the transcription factor FOXO3A and d) a decrease in proapoptotic protein BIM. Combinatorial treatment of PI3Ki and MEKi synergistically reduced viability of MCA tumor cells with attendant decrease in phosphorylated ERK and AKT and increase in BIM.

**Conclusions:** Our data suggest cellular dependence (‘addiction’) of KRAS-mutant mucinous CRC cells on hyperactivation of MEK and PI3K pathways. Interestingly, PI3K single agent inhibition initially triggers pathway downregulation and reduced tumor cell viability but later leads to development of adaptive resistance. Our studies suggest this resistance involves dynamic rewiring of signaling circuits mediated through FOXO3A nuclear localization, relief of RTK inhibition, MEK-ERK activation and BIM reduction. Adaptive resistance however, can be overcome by co-targeting of PI3K and MEK. Our studies thus provide a rational basis for MEKi and PI3Ki combination therapy for KRAS mutant CRCs.

**Acknowledgements:** Research supported by funds from the National Organization for Rare Disorders (VG)



36. **DEVELOPMENT OF A DEVICE TO CREATE TRAUMATIC BRAIN INJURY IN RATS**

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**Purpose:** Our purpose was to construct a device to induce mild traumatic brain injury (mTBI) in rats, and then measure the impact force which would be applied to the anterior of the rat's skull by the device to develop a preclinical model to investigate interventions to enhance recovery from human mTBI.

**Methods and Materials:** A ramp was made using steel conduit and stabilized using a wooden frame. A 0.225kg steel ball was rolled down the ramp from various heights (25cm, 51cm, 76cm, 101cm, 127cm, 152cm) and redirected horizontally into a force sensor (Loadstar Sensors, Fremont, CA). Impact forces were measured and statistically analyzed. We also calculated the mean impact energies corresponding to the heights from which the ball was dropped.

**Results:** The measured forces were: 358±9N, 553±10N, 600±19N, 726±24N, 866±20N, and 946±30N. The calculated impact energies were: 0.4J, 0.8J, 1.2J, 1.6J, 2.0J, and 2.4J.

**Conclusions and Significance:** Approximately 1.7 million TBI occur in the US annually, in which 80% are mild TBI (mTBI). Animal models have an important role in developing new therapies needed to improve functional recovery after mTBI. Our apparatus has the ability to apply a range of measured impact forces to the anterior of a rat's skull to induce the three clinically defined categories of TBI: mild, moderate and severe. Therefore, we can determine the ranges of impact force needed to produce varying degrees of severity of injury in the rat model. This ability to induce TBI in rats can be used for the assessment of both pathophysiological changes associated with TBI as well as potential treatment options.

37. **POSTERIOR HIP DISLOCATION WITH ACETABULAR WALL FRACTURE: A CASE REPORT AND CADAVERIC STUDY**

Olinger, Catherine, Timothy Evans, Brent Smoots, Sean O'Mara, Kate Englert, Jason Jeffress, and Dr. Thomas Quinn, School of Medicine, Creighton University, Omaha, NE.

**Purpose:** The purpose of our report is to demonstrate the anatomical relationship between the dislocated femoral head and the posterior acetabular wall through case presentation and anatomical models.

**Case Description:** 24 year-old female brought into Creighton University Medical Center through emergency department as non-trauma patient. Patient was involved in a motor vehicle accident in which she was a non-restrained passenger. She sustained a "dashboard injury" in which inertia brought her left knee into contact with the dashboard upon an abrupt stop of the vehicle.

**Methods and Materials:** Our project utilized literature reviews of relevant journal articles, the anatomy lab and cadaver dissection tools, and case report.

**Results:** Based on our case report and anatomical study, we demonstrated the anatomical relationship between the dislocated femoral head and posterior acetabular wall. According to supporting literature posterior hip dislocations are the most common form of dislocation with posterior wall fractures being more rare. Sciatic nerve injuries are demonstrated in 8-19% of posterior dislocations. Surgical intervention of hip dislocations with posterior wall fractures is based on the Thompson-Epstein classification along with the stability of the hip after reduction.

**Conclusions:** Our report demonstrated the relationship of the posterior acetabular wall with posterior hip dislocations through a case report, anatomical dissections, and literature review.

The posterior wall fractures associated with dislocations are less prevalent, with sciatic nerve injuries and unstable fractures being indications for surgical management.

38. **OSTEOCYTE LACUNAR CHARACTERISTICS AS A FUNCTION OF GENOTYPE AND AGE IN BONE TISSUE**

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**Purpose:** To examine and compare the osteocyte lacunar characteristics in mouse femurs representing different genotype and age.

**Methods and Materials:** Osteocytes are the most abundant cells in the skeletal system and are responsible for regulating its health. Each osteocyte resides in a void called a lacuna. It is hypothesized that osteocyte lacunar properties in bone tissue (volume, surface area, density, etc.) are a function of genotype and age. To test our hypothesis we used two mouse genotypes (high bone mass [HBM], and C57BL/6J wild type [WT]) and two age groups (6 and 22 month old, Table-1). HBM mice are known to be more sensitive to mechanical loading or exercise and produce a stronger skeleton as compared to WT mice.

**Sample Scanning and Data Analysis:** One at a time, samples were placed in the MicroXCT-200 and high resolution scan settings were programmed. All scans were done with 40X lens objective, thus allowing us to obtain the highest possible resolution of 0.6 $\mu$ m pixel size. Six femurs from each group were scanned at the anterior-medial site with a field of view (FOV) of 0.5mm x 0.5mm. 1200 images were collected with a scan time of 3 to 4hrs. After reconstruction of the images for each specimen, separate analyses software (Avizo 8.1, FEI) was used to segment the osteocyte lacunar voids in the bone tissue.

**Results:** Osteocyte lacunar properties showed both genotype- and age-related differences in some of the measured properties (Table-2). While lacunar volume showed no difference due to genotype and age, the surface area was greater in HBM at younger age when compared to WT. There is a significant age-related increase in the lacunar density for WT (due to age-related mineral loss) which was also greater than HBM at older age. As expected, the opposite was true for the near neighbor distance among osteocyte lacunae. That is, near neighbor distances decrease with age in WT and remained lower than HBM at older age.

**Conclusions:** The HBM's sensitivity to mechanical stimulus and stonger bone strength can be explained in the context of greater surface area of osteocyte lacunae and non-signficant increases in volume at younger age as compared to the WT. We conclude that there is both genotype- and age-related influence on osteocyte lacunar characteristic in some of the measured variables and that may play a major role in the skeletal health and response to exercise (mechanical stimuli).

39. **EXPANDING THE REPERTOIR OF PRION STRAINS THAT BLOCK THE EMERGENCE OF HIGHLY PATHOGENIC SHORT INUBATION PERIOD STRAINS**

Langenfeld, Katie, and Jason C. Bartz, Department of Medical Microbiology and Immunology, Creighton University, Omaha, NE.

**Purpose:** Prion diseases are infectious, fatal neurodegenerative disorders that affect mammals. When a host is infected with more than one prion strain, one strain can block the emergence of a second strain (i.e. strain interference). The long incubation period drowsy (DY) strain of transmissible mink encephalopathy (TME) can interfere with several short incubation period strains by many different routes of infection, but it is unknown if other long incubation period

strains can interfere with short incubation period strains. The purpose of this study is to determine if the long incubation period strain 139H can act as a blocking strain.

**Methods:** Hamsters were inoculated with 139H via the sciatic nerve 25, 50 or 75 days prior to superinfection with the short incubation period strain hyper (HY) TME. Animals were observed for clinical signs and the disease incubation periods were determined.

**Results:** The 25-day and 50-day interval groups had incubation periods and clinical signs similar to hamsters inoculated with HY TME alone. Four of the five animals from the 75-day interval group had 139H clinical signs and incubation period an incubation period similar to animals inoculated with 139H alone. It was also determined that sciatic nerve inoculation of 139H results in transport of PrPSc along the same four descending motor tracks as HY and DY TME.

**Conclusions:** Based upon these results, 139H was able to block the emergence of HY TME in the 75-day interval group, indicating that strain interference had occurred. Also, sciatic nerve strain interference with 139H and HY TME likely occurs in ventral motor neurons of the lumbar spinal cord. Overall, these studies indicate that prion strain interference is a common property of prions and has implications for the maintenance and evolution of prion strains.

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#### 40. **CREATININE ACTS AS AN IMMUNOMODULATOR IN VITRO**

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**Purpose:** The purpose of this study was to determine if creatinine hydrochloride (CRN-HCl) could function as an anti-inflammatory agent by decreasing the expression of tumor necrosis factor-alpha (TNF- $\alpha$ ) in vitro.

**Methods:** qRT<sup>2</sup>-PCR and immunohistochemical staining were used to study the effects of 10 mM CRN-HCl on expression of TNF- $\alpha$  in a human T cell line (Jurkat clone E.6), a human macrophage cell line (THP-1), and a mouse macrophage cell line (RAW 264.7).

**Results:** CRN-HCl treatment significantly reduced TNF- $\alpha$  mRNA levels in the RAW, THP-1, and Jurkat cell lines as compared to untreated control cells. To determine whether these alterations in mRNA levels result in changes at the protein level, immunohistochemical staining for TNF- $\alpha$  was performed on RAW cells incubated with CRN-HCl for 24 or 48 hours. The staining intensity of CRN-HCl treated RAW cells was reduced as compared to control-treated cells, indicating that protein levels of TNF- $\alpha$  were also affected by CRN-HCl treatment.

**Conclusion:** CRN-HCl effectively reduced TNF- $\alpha$  mRNA levels compared to untreated control levels in all cell lines tested. Immunohistochemical staining for TNF- $\alpha$  was less intense following incubation with CRN-HCl. Together, these data demonstrate that CRN-HCl effectively reduces the levels of a potent pro-inflammatory mediator, TNF- $\alpha$ , in both human and mouse cell lines. Previous work determined the nuclear factor-kappa B (NF- $\kappa$ B) pathway was directly inhibited following CRN-HCl in RAW cells. Future investigation to further define the immunomodulatory potential of creatinine will focus on expression of additional pro-inflammatory mediators and determining the mechanism of how creatinine inhibits the NF- $\kappa$ B pathway.

**Acknowledgements:** This work was supported by LB692.

41. **STRUCTURAL AND FUNCTIONAL CHARACTERIZATION OF VprBP, A NOVEL RAG1-INTERACTING FACTOR**

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**Purpose:** Previous work in our laboratory established that B lymphocyte-specific conditional disruption of VprBP, a substrate adaptor for the Cullin4 E3 ubiquitin ligase, results in developmental arrest at the Pro-to-Pre B cell transition, as well as impaired recombination of the immunoglobulin loci. This implicates VprBP as an important factor in B cell maturation. To gain more insight into the role that VprBP plays in this process at the cellular and molecular level, the present work evaluates how loss of key structural domains in VprBP affects its interaction with binding partners and investigates the activity of a recently reported VprBP kinase inhibitor.

**Methods:** This work incorporates three approaches:

- i) Expression of recombinant wild-type and mutant VprBP in cultured mammalian cells, followed by purification by affinity chromatography and western blotting to identify interacting proteins.
- ii) Use of affinity-purified VprBP for in vitro kinase assays using radiolabeled ATP and recombinant protein substrates to investigate potential histone kinase activity of VprBP.
- iii) Use of a VprBP-specific kinase inhibitor to block V(D)J recombination in virally-transformed pre-B cells expressing a GFP-reporter recombination substrate detected by flow cytometry.

**Results:**

- i) Deletion of VprBP exons 7 and 8 disrupts VprBP's interaction with the CRL4 E3 ligase.
- ii) VprBP supports histone kinase activity in vitro and may do so in conjunction with DYRK2, another kinase found to copurify with VprBP.
- iii) Treatment with a VprBP-specific kinase inhibitor blocks recombination of a reporter substrate in virally-transformed pre-B cells, suggesting a role for VprBP's kinase activity in V(D)J recombination.

**Acknowledgments:** Funded by grants to PCS from the NIH: AI091748 and GM102487.

42. **1,25-DIHYDROXYVITAMIN D ENHANCES VEGF-STIMULATED PORCINE ADIPOSE-DERIVED MESENCHYMAL STEM CELLS TOWARD THE ENDOTHELIAL PHENOTYPE**

Llamas, Yovani, Sami Almalki and Devendra K. Agrawal, Department of Medical Microbiology and Immunology, and Department of Biomedical Sciences, Creighton University, Omaha, NE.

**Background:** Cell-based therapy using adipose-derived mesenchymal stem cells (AMSCs) is an attractive option for re-endothelialization post-angioplasty procedures. Vitamin D levels in circulating blood may regulate AMSC-based re-endothelialization of injured arteries. To our knowledge, the role of vitamin D and vascular endothelial growth factor (VEGF) in the differentiation of adipose-derived AMSCs into endothelial cells (ECs) has not been examined. In this study, we investigated the effect of vitamin D on VEGF-induced differentiation of MSCs into ECs.

**Methods and Results:** MSCs isolated from porcine adipose tissue were CD11b-CD34-CD44+CD73+CD90+ and showed characteristics of MSCs. The MSCs were stimulated and differentiated into ECs with endothelial growth media (EGM+50ng/ml of VEGF) and EGM media containing 10nM of calcitriol (EGM+50ng/ml of VEGF +10nM calcitriol) for 10 days. The EC differentiation was assessed by mRNA expression by qPCR and protein expression by flow cytometry for endothelial cell markers. Calcitriol enhanced EGM+VEGF-induced differentiation of MSCs into ECs, as revealed by 2-fold increase in mRNA and 4-fold increase in protein expression of EC markers. Angiogenesis assay and acetylated low density lipoprotein (LDL) uptake assay were used to assess the endothelial functionality that showed significant increase in capillary tube sprouting, and an increase in LDL uptake by the differentiated cells in response to EGM +VEGF+ calcitriol. Examination of the findings from Wnt Pathway array revealed a 3-fold decrease in  $\beta$ -catenin and 3-fold increase in KREMEN1 protein in the cells treated with EGM + VEGF+calcitriol.

**Conclusion:** Vitamin D significantly enhanced VEGF-induced differentiation of MSCs into endothelial cells. Thus, vitamin D status of the patients undergoing coronary intervention might regulate the development of thrombosis and intimal hyperplasia.

43. **INDUCTION OF EPITHELIAL-MESENCHYMAL TRANSITION IN HOUSE DUST MITE, RAGWEED, AND ALTERNARIA SENSITIZED AND CHALLENGED MICE**

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**Rationale:** Airway epithelial cells differentiate into a pool of myofibroblasts which contributes to airway remodeling. Myofibroblasts are able to invade and migrate outside the epithelium, augmenting subepithelial fibrosis and leading to airway remodeling. Differentiation of epithelial cells into myofibroblasts occurs through epithelial-mesenchymal transition (EMT). EMT involves a loss in E-cadherin with an increase in mesenchymal markers such as vimentin and N-cadherin. An atopic individual is most often allergic to multiple allergens. Therefore, we examined the effect of different allergens to induce EMT and airway remodeling in mice.

**Methods:** Female Balb/c mice were sensitized (intranasal) and challenged (aerosolized) with house dust mite, ragweed, and Alternaria extracts (HRA). Airway hyper-responsiveness to methacholine was measured by whole body plethysmography. Histological sections were evaluated by H&E, PAS, and trichrome staining. E-cadherin, vimentin, and N-cadherin expression was assessed in tissues by immunofluorescence.

**Results:** Sensitization and challenged mice with HRA mice had a significant increase in enhanced pause (Penh) compared to PBS mice. Examination of lung sections from HRA mice revealed increased airway inflammation, mucus hypersecretion, collagen content, and airway thickening compared to PBS mice. There was a decrease of E-cadherin expression along with increased vimentin and N-cadherin expression in the sub-epithelial area in the lungs of HRA mice.

**Conclusions:** Thus, exposure to multiple clinically relevant allergens induces a robust EMT response and allergic airway inflammation.

44. **Preparation and Characterization of Multifunctional Chitosan Microparticles for Lung Delivery**

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**Purpose:** To develop and characterize multifunctional chitosan microparticles intended for pulmonary delivery for lung cancer treatment. This multifunctional approach is designed with an aim of utilizing both chemotherapeutic agent as well as radio frequency (RF) heating for targeted therapy.

**Methods:** Iron oxide nanoparticles were prepared by chemical co-precipitation. The particle size of these nanoparticles was determined using dynamic light scattering. Chitosan microparticles containing iron oxide nanoparticles were prepared using a Buchi mini spray dryer. Particle size of the microparticles was determined by laser diffraction and surface charge was measured by a zetameter. Iron content in the microparticles was analyzed using spectrophotometry. The iron nanoparticles as well as the microparticles were subjected to radiofrequency heating using RDO Model HFI Induction Heating System. The temperature was monitored as a function of RF exposure time using a FOT Fluoroptic Lab Kit (Luxtron Corp, Santa Clara, CA). In vitro release of iron oxide from iron loaded chitosan microparticles were conducted in phosphate buffer (pH 7.4) over a period of 24 hours.

**Results:** The particle size of iron oxide nanoparticles was  $215.6 \pm 12.2$  nm. Laser diffraction analysis indicated that the  $d_{0.5}$  of chitosan microparticles was  $2.18 \pm 0.10$   $\mu$ m. The surface charge of the microparticles was  $25.2 \pm 0.18$  mV. The entrapment efficiency of iron oxide in the chitosan microparticles was found to be  $64.4 \pm 0.76$ %. On application of RF exposure for 500 seconds, a linear increase in temperature with increase in exposure time was observed. In case of nanoparticles, the temperature increased from room temperature to  $56.6^\circ\text{C}$ . The iron loaded microparticles showed an increase from room temperature to  $41.9^\circ\text{C}$ . The heating observed for blank chitosan microparticles was from room temperature to  $35.6^\circ\text{C}$ . The in vitro release studies over a period of 24hrs indicated that release of Iron oxide from the system was around 0.45%.

**Conclusion:** The chitosan microparticles prepared by spray drying show a size distribution which is favorable for lung deposition upon pulmonary administration. This can further be used for RF heating and imaging in targeted therapy of lung tumors.

45. **HARNESSING THE SYNERGISM OF CURCUMIN AND RESVERATROL COMBINATION THROUGH USE OF CYCLODEXTRINS**

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**Purpose:** Curcumin and Resveratrol have synergistic pharmacological potential in treatment of several types of cancer. However, both drugs are poorly water-soluble and thus, have poor oral bioavailability. Herein, we select a suitable cyclodextrin to enhance dissolution of the drugs.

**Methods:** In aqueous solutions of Beta( $\beta$ ), Gamma( $\gamma$ ) and Hydroxypropyl-beta(HP- $\beta$ ) cyclodextrins(CDs), excess of Curcumin(C) and Resveratrol(R) [separately] were added and stirred. The concentration of dissolved drug was determined using UV-spectroscopy.

Ternary complexes of Curcumin and Resveratrol with CDs were prepared in 1:1:2 molar ratios using solvent evaporation method. The pure drugs, CDs, their physical mixtures(PMs) and complexes(Coms) were characterized using Thermogravimetric-analysis[TGA], Modulated-Differential-Scanning-Calorimetry[MDSC], X-ray-powder-Diffractometry[XRPD], Dispersive-Raman-Microscopy and Infrared-spectroscopy[IR]. Dissolution studies using USP-tyrell

apparatus, phosphate buffer pH-7.4(100ml), paddle speed of 150rpm at 37±0.5°C were carried for C:R:HP-βCD Com and PM.

**Results:** Significant solubility enhancement was achieved for both the drugs individually, with all CDs. TGA data showed all complexes were thermostable until 250°C. MDSC data showed sharp melting endotherms for Curcumin and Resveratrol at 175.7°C and 261.1°C respectively during first heating cycle. The melting endotherm of Curcumin was significantly depressed for β-CD containing complex and disappeared for remaining two complexes. No Resveratrol melting endotherm was observed for any of the complexes. XRPD results showed HP-β-CD containing complex was amorphous. Raman Microscopy indicated chemical interactions between components of the complexes and IR results showed possible H-bonding between drugs and CDs. Within the first 30min, 4.34% of Curcumin and 55.3% of Resveratrol is released from C:R:HP-βCD Com as compared to 1.273% and 23.3% respectively from C:R:HP-βCD PM.

**Conclusion:** HP-β-CD based formulation seems most promising for dissolution enhancement of Curcumin and Resveratrol, and should be explored further.

#### 46. **DIRECT SOLID PHASE PEPTIDE SYNTHESIS ON CHITOSAN MICROPARTICLES FOR TUMOR TARGETING**

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**Purpose:** The purpose of this study was to utilize the primary amino groups of chitosan for the direct assembly of tumor targeting peptide on chitosan based microparticles using solid phase peptide synthesis methods.

**Methods:** Microparticles were prepared by spray-drying from 1% (w/v) solution of chitosan in 0.1M acetic acid. Peptide synthesis was performed on microparticles in a glass reaction vessel with a frit bottom and a Teflon lined screw cap. After washing with dimethylformamide (DMF), Fmoc-amino acid derivatives (4 eqs) were mixed with a solution HBTU in DMF (0.38 M, 3.8 eqs) in the presence of diisopropylethylamine (6 eqs). Prior to coupling each next amino acid, N-terminal Fmoc groups were removed using 20% piperidine in DMF. After full assembly of sequence of interest, its N terminus was optionally coupled with 5(6)-carboxyfluorescein to provide fluorescent marker for affinity studies. After full assembly, side chain protecting groups were removed with 50% (v/v) trifluoroacetic acid in dichloromethane, and the product was characterized by HPLC and mass spectrometry.

**Results:** Utilizing the Fmoc-chemistry, assembly of the amino acid sequence AEYLR on chitosan particles was successfully achieved. Cleavage of the peptide assembled directly on chitosan's amines was unsuccessful, however it was achieved when the first amino acid was preceded by coupling of aminoethylthio-isobutyrate or several glycyl residues as a spacer (cleaved by thiolysis and trypsinization respectively). The peptide identity was confirmed by reversed phase HPLC, 1H-NMR and mass spectroscopy. Test for affinity of peptide-modified chitosan particles to A549 lung cancer cells showed increased binding to these cells in comparison with unmodified chitosan particles or the same particles applied to normal lung cells WI26-V4 cells.

**Conclusion:** Chitosan microparticles possessing primary amino groups can be used directly as a solid phase peptide synthesis support to assemble targeting peptides on their surface providing them with enhanced affinity for cancer cells.

47. **INNERVATION OF NASAL ASSOCIATED LYMPHOID TISSUE IN THE GOLDEN SYRIAN HAMSTER**

Tellman, Michael, Melissa D. Clouse, and Anthony E. Kincaid, Department of Pharmacy Sciences, Creighton University, Omaha, NE.

**Purpose:** Nasal inhalation is an efficient means of transmission of prion diseases in animals. Prion diseases are fatal neurodegenerative diseases characterized by an extended incubation period with no visible clinical signs. During this period there is progressive accumulation of the pathogenic agent in peripheral lymphoid tissues followed by transport of the agent into the central nervous system (CNS). Nasal associated lymphoid tissue (NALT) is an important component of the rodent immune system and demonstrates early prion accumulation. It is not known if prions enter the CNS via nerves that innervate the NALT, but there is evidence that innervation of the nasal cavity is involved in prion neuroinvasion. The pattern and density of innervation of the NALT has not been comprehensively investigated. We hypothesize that NALT innervation may be a route of neuroinvasion in prion disease.

**Methods:** Axons were visualized using immunohistochemical techniques with antibodies directed against neurofilament protein (NF), tyrosine hydroxylase (TH), calcitonin gene related peptide (cGRP), and choline acetyltransferase (ChAT). Tissue sections not greater than 140  $\mu$ m apart throughout the extent of the NALT of 3-5 Syrian hamsters were stained, imaged and analyzed for the presence of immunoreactive axons .

**Results:** Few NF positive axons were observed in or adjacent to the NALT; fewer than were identified in nearby tissues, indicating that innervation in the NALT may be less dense than in surrounding tissue. TH positive immunoreactive tissue was largely associated with blood vessels within the periphery of the NALT and cGRP was consistently associated with boutons in the basal membrane of the epithelium directly superior to the NALT.

**Conclusion:** The paucity of axons within the NALT suggests that any neuroinvasion occurring within the nasal cavity is associated with nerves that innervate other tissues.

**Acknowledgements:** NIH (RO1 NS061994)

48. **CORRELATION OF KEY PHYSICOCHEMICAL FACTORS WITH THE PERFORMANCE OF SOLID DISPERSION**

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**Purpose:** Solid dispersion is a promising technique for improving the solubility of poorly water soluble drugs. The objective of this study was to explore the key physicochemical properties that improve the performance solid dispersions (dissolution enhancement, physical stability).

**Methods:** Solid dispersions of five different drugs (Griseofulvin, Flutamide, Curcumin, Indomethacin and Dipyridamole) with drug loading of 70% w/w were prepared by solvent evaporation method using vacuum drying. Four hydrophilic polymers including polyethylene glycol (PEG), Eudragit EPO (EPO), hydroxypropyl methylcellulose (HPMC) and polyvinyl pyrrolidone (PVP) with varied physicochemical properties were used to prepare the solid dispersions. Physical state of drug in the solid dispersions was characterized by X-ray diffraction (XRD). Crystallization behavior of pure drug and drug-polymer systems was determined by modulated differential scanning calorimetry (MDSC). Drug-polymer miscibility was evaluated using solubility parameter, glass transition temperature deviation. Crystallization tendency of pure



drug, the ability of polymer to inhibit drug crystallization and drug-polymer miscibility was correlated to the dissolution enhancement and physical stability reported in literature.

**Results:** Polymers are able to modify the crystallization tendency of drug in a concentration dependent manner. The ability of polymer to inhibit drug crystallization investigated by thermal analysis was correlated to the physical state of drug in solid dispersions. Drug-polymer systems with higher miscibility were found to have better dissolution profile as well as higher physical stability.

**Conclusion:** Properties like crystallization tendency of pure drugs, the crystallization inhibition effect of polymer and drug-polymer miscibility appear to be in correlation with the performance of solid dispersions.

#### 49. **SPRAY CHARACTERISTIC TESTING FOR THE FORMULATION OF TOPICAL AEROSOL DELIVERY SOLUTIONS**

Munt, Daniel, and Alekha Dash, Department of Pharmacy Sciences, Creighton University, Omaha, NE.

**Purpose:** To develop a method for spray pattern testing of topical formulations that allows us to examine the effect formulation changes have on spray pattern diameter, particle size, density, and mixing for binary formulations with respect to distance pressure and spray nozzle characteristics.

**Methods:** To provide even pressure and flow from and allow variable mixture ratios, from binary spray solutions a syringe pump method was selected. In order to ensure constant pressure, speed, zero start lag, and adequate force a Unite Motor Co. Pulse Reverb 24v 100W electric motor (MY6812) was given direct drive of 3 inch plate assembly with a linear geared base. Syringes were clipped into a fixed aluminum mount and plungers were clipped into a bracket on the drive plate of the pump. A RioRand Adjustable DC motor Speed PWM controller with reversing switch (X000JMKVGX) was used to set the pump speed and direction. And power was provided by a Genssi regulated switching power supply (S-350-24). Fibrijet® spray nozzles (Nordson Micromedics) were purchased for use in these tests (SA-3674, SA-3675, SA3660). Formulations of varying viscosity and density were dyed using FD&C dyes as indicators; 100ul from each syringe attached to the pump was sprayed through the nozzle at a fixed rate. In order to examine spray characteristics on a surface that would retain specimens with minimal bleeding 300# Aquarelle cold press watercolor paper was mounted to an adjustable vertical post on a variable distance rail capable of 0.5-13" distance from nozzle discharge point. Spray patterns were tested 5-12" from nozzle discharge point in one inch increments. Sample sheets were digitized and examined using ImageJ software to determine particle density, size, spray diameter and mixing characteristics.

**Results:** The spray pattern testing device produced spray patterns with an average by group standard deviation in spray diameter and coverage area of 4.92% across the three different nozzle types for 8 distances.

**Conclusion:** The resulting patterns were clear and well grouped allowing for accurate droplet size, density, and mixing comparisons by nozzle, distance, and vehicle indicating the usefulness of this design for determination of spray properties for topical aerosol delivery of two incompatible liquids.

50. **LOW REGULARLY MILD SOLUTIONS TO THE gMHD EQUATION**

Schmachtenberger, Benjamin, AJ Hagen, and Lucia Magos, Department of Mathematics, Creighton University, Omaha, NE.

The incompressible magnetohydrodynamics (MHD) system governs the dynamics of the velocity and magnetic fields in electrically conducting fluids such as plasmas and liquid metal. The generalized magnetohydrodynamic (GMHD) system differs from the standard MHD system by replacing the viscosity terms  $(-\triangle)$  by the generalized operator  $(-\triangle)^\alpha$ . Besides their mathematical interest, this allows the GMHD system to model more complex interactions than the MHD system. In this paper, we prove the local existence of a unique short-time solution to the GMHD system with initial data in non- $L^2(\mathbb{R}^n)$  based spaces. These solutions are the first step toward establishing unique global solutions in  $L^p(\mathbb{R}^n)$  based spaces for  $p > 2$ .

51. **MATHEMATICAL MODELING OF HUMAN PAPILLOMAVIRUM AND CERVICAL CANCER IN COLLEGE "HOOK-UP CULTURE"**

Budney, Sarah, Department of Mathematics, Creighton University, Omaha, NE.

Infection with human papillomavirus (HPV) has been known to cause genital warts, cervical and other cancers, and respiratory papillomatosis. It is the most common sexually transmitted infection (STI) affecting nearly all sexually active individuals at some point in their life. Concerns about college "hook-up culture" and transmission of STIs has led to the question of how increased sexual partners may influence the rate of cervical cancer. It is known that two strains, HPV 16 and 18, cause about 70% of all cervical cancers. Thus, it is predicted that decreased transmission of these two strains will lead to decreased incidence of cervical cancer. Here we model a heterosexual population to determine how different proportions of high and low contact individuals leads to varied prevalence of cervical cancer after 30 years.

52. **MODELING CANCER METASTASIS THROUGH MECHANICAL PROPERTIES DETECTED BY A MICROFLUIDIC MICROCIRCULATION**

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The Lagrangian Averaged Euler and Lagrangian Averaged Navier-Stokes equations are recently derived approximations to the Euler and Navier-Stokes equations, respectively. As the name suggests, the Lagrangian Averaged Navier-Stokes are derived by averaging at the Lagrangian level, and the resulting PDE's have more easily controlled long time behavior at the cost of a more complicated nonlinear term. In this project we consider the vanishing viscosity problem for circularly symmetric flows.

53. **IMPLEMENTING COLLABORATIVE LEARNING IN UNDERGRADUATE NURSING CURRICULA: STUDENT PERCEPTIONS AND LEARNING OUTCOMES**

Goodman, Joely<sup>1</sup>, Anne Schoening<sup>1</sup>, Susan Selde<sup>1</sup>, Cindy Selig<sup>1</sup>, Amy Cosimano<sup>1</sup>, Chris Wichman<sup>2</sup>, and Kimberly Galt<sup>3</sup>, College of Nursing, <sup>2</sup>Research and Compliance and <sup>3</sup>School of Pharmacy and Health Professions, Creighton University, Omaha, NE.

Purpose: The purpose of this study was to evaluate learning outcomes and student perceptions of collaborative learning in an undergraduate nursing course using different methods of curricular delivery in three phases: traditional lecture, collaborative learning groups, and collaborative learning groups with a wiki.

**Methods:** Traditional lectures in phase one were replaced with collaborative teams in phase two. Based on student feedback, two changes were implemented during phase three. Instructors created a wiki feature in the course learning system. Students completed their assigned case activity outside the class, placed the information on the wiki and presented the information to their peers in class. Student perceptions were assessed at the end of each phase using an open ended questionnaire. Student outcomes were assessed through exam performance. Participants were enrolled in the same course, and in either the traditional (4-year; n=193) or accelerated (12-month; n=153) baccalaureate program.

**Results:** The one-way ANOVA with teaching method ( $P=.03$ ) had a significant association with the mean exam score. Mean unit exam scores for lecture vs collaborative groups were significantly higher (87.126% vs 84.398%;  $p=.02$ ). Lecture vs collaborative & wiki were also significantly higher (87.126% vs 83.557%;  $p=.02$ ). The proportion of students that passed the unit exam was not different between the three phases. The students' positive perception of collaborative learning related to enjoying the problem solving nature of the learning experience. Students' negative perception of collaborative learning related to difficulty in identifying what material to study for exams. Additionally, students tended to prefer the collaborative method over the collaborative + wiki method, regardless of whether they were in the traditional or accelerated nursing programs.

**Conclusion:** The collaborative classroom provides students with opportunities to master content, increase critical thinking and problem solving abilities, and improves interpersonal communication skills; however careful planning and orientation to this process is required for teaching and learning success.

#### 54. **DETERMINATION OF EXPRESSION OF TREM-1 AND TREM-2 IN ORAL KERATINOCYTES**

Kum, Jason, Laura C. Barritt, William J. Puetz, Sonia M. Sanchez, Shikha Tarang, and Barbara J. O'Kane, Department of Oral Biology, School of Dentistry, Creighton University, Omaha, NE.

**Purpose:** Chronic periodontitis is an inflammatory disease of the supporting tissues of the teeth caused by microorganisms. This oral disease induces a systemic inflammatory response and increases the risk of developing cardiovascular disease. TREM-1 and TREM-2 are receptors that propagate an inflammatory response due to bacteria. Studies have identified TREM-1 and TREM-2 modulation in hematopoietic tissue and lung airway cells during chronic inflammation, but current research is unclear of their role in the oral cavity. The purpose of this study is to determine if TREM-1 and TREM-2 are expressed in gingival keratinocytes and if it can be differentiated in the gingiva of normal healthy patients versus those with periodontitis.

**Methods:** Gingival samples were obtained from discarded teeth of patients from Creighton University School of Dentistry. Western blot analysis was performed on 22 samples using a primary antibody, mouse-anti  $\beta$ -actin, and a secondary antibody anti-rabbit and anti-mouse for TREM-1 and TREM-2 protein expression. Semi-quantitative PCR assay was performed on the same samples using SYBR green. Amplification was performed using primers set specific for TREM-1 and TREM-2 genes and normalized to endogenous  $\beta$ -Actin using StepOne Software.

**Results:** The data from Western blot suggested an increase in TREM-1 expression in healthy tissues, while TREM-2 expression was elevated in periodontitis samples. Interestingly, the qPCR results showed upregulation of TREM-2 in healthy tissue while TREM-1 expression is increased in periodontal samples.

**Conclusions:** Both TREM-1 and TREM-2 can be identified in oral gingiva. The results from the Western blot and qPCR were inconclusive regarding differential expression of these proteins when comparing periodontitis versus healthy tissue. Increasing sample size should help to

determine if there is a statistically significant difference between the amounts of transcript and protein found in normal versus periodontitis gingival tissue.

55. **COMPLEMENTING CONFOCAL DETECTION OF ANTIBODY-LABELED LYSOPHOSPHATIDIC ACID RECEPTORS IN HUMAN GINGIVAE WITH LABEL-FREE SECOND HARMONIC GENERATION CONFOCAL MICROSCOPY DETECTION OF COLLAGEN**

Hironaka, Michael D. Roselyn Cerutis<sup>1</sup>, Michael G. Nichols<sup>2</sup>, Takanari Miyamoto<sup>1</sup>, Shakeel A. Khan<sup>2</sup>, Afolabi Ogunleye<sup>1</sup> and Timothy P. McVaney<sup>1</sup>, <sup>1</sup>Department of Oral Biology, School of Dentistry, and <sup>2</sup>Department of Physics, Creighton University, Omaha, NE.

We have found that lysophosphatidic acid (LPA) controls the healing and [Ca<sup>2+</sup>]<sub>i</sub> responses of human gingival fibroblasts via the LPA1 and LPA3 receptor subtypes, and that LPA3 may modulate their inflammatory responses. We have used immunofluorescence to detect LPA receptor (LPAR) distribution in human gingivae, but that technique does not afford visualization of the state of collagen fiber organization. Rationale: We hypothesized that using the second harmonic generation (SHG) technique would enable detection of changes in the appearance, collagen fibril density, and fibril organizational structure of human gingiva, and that this technique would complement visualizing LPAR expression by confocal microscopy. Methods: Pieces of intact, paraformaldehyde-fixed, methanol:acetone (1:1) de-lipidated attached gingivae [~1.25 mm thick (from IRB-approved, consented donors) normal or with moderate-severe periodontal disease] were used. Results: Confocal analysis using anti-LPA1 and anti-LPA3 antibodies confirmed that LPA3 is primarily found in the epithelium, and that nuclear LPA1 expression in the sub-epithelial connective tissue is greatly diminished in periodontal disease. SHG analysis clearly showed the normal collagen structure and subsequent reduction in the abundance and organization in the collagen fibrils of periodontal gingivae. Conclusion: This multidisciplinary study shows that SHG effectively complements confocal microscopy as a tool to help understand periodontal changes at the level of receptors and collagen organization.

56. **A LITERATURE REVIEW OF THE INFLUENCE OF THE STOMATOGNATHIC SYSTEM ON BODY POSTURE.**

Nation, Philip, Margaret A. Jergenson, Department of Oral Biology, School of Dentistry, Creighton University, Omaha, NE.

**Rationale:** The stomatognathic system (SS) is a functional unit made up of the jaws, dental arches, masticatory muscles, and associated structures. The components of the SS act in unison to influence or control functional activities such as phonation, deglutition, mastication, and respiration. The aim of this literature review was to determine the impact of functional activities of the stomatognathic system on overall body posture based on available research studies.

**Methods:** A thorough literature review of scholarly publications from peer reviewed journals was conducted. The review included available research material dealing with the functional impact of the SS on body posture. Emphasis was placed on similar findings and correlations to dental occlusion.

**Results:** The literature has shown that body posture appears modifiable under experimental conditions, however, these findings seem limited to the head and neck region and in the case of occlusal interference evidence points to predominantly transient changes.

**Significance:** A proven causal link or predictable relationship between stomatognathic function and positioning of the spine, ribcage, or pelvis would influence clinical treatment methods for a wide range of orthopedic issues such as scoliosis and low back pain. A causal link or predictable

relationship between dental occlusion and body posture did not emerge from the studies included suggesting low clinical significance of findings.

57. **TREM-1 AND TREM-2 PROTEIN EXPRESSION IN NORMAL AND HEALTHY HUMAN GINGIVAL TISSUE**

Puetz, William, Laura C. Barrett, Jason M. Kum, Sonia M. Sanchez, Shikha Tarang, and Barbara O'Kane, Department of Oral Biology, School of Dentistry, Creighton University, Omaha, NE.

**Purpose:** Inflammation of gingival tissue (periodontitis), affects both the gingiva and the supportive alveolar bone leading to tooth loss and other health risks. Studies have shown that chronic inflammation in some systems is modulated by TREM-1 and TREM-2. TREM-1 amplifies inflammation while TREM-2 functions as an inhibitor. This study aimed to analyze the expression of TREM-1 and TREM-2 proteins in situ and to determine if there is differential expression of these markers in normal versus inflamed gingiva.

**Methods:** Gingival tissue was harvested from the coronal area of extracted teeth, and processed for frozen sections. Tissues were submitted to immunohistochemistry with antibodies against TREM-1 & TREM-2 and qualitative analysis of protein expression was performed by fluorescent microscopy.

**Results:** Preliminary data from the immunofluorescence studies showed little expression of TREM-1 & TREM-2 in oral keratinocytes. Moreover, TREM-1 expression was found to be slightly increased in healthy tissues, while TREM-2 expression was decreased in inflamed tissues.

**Conclusions:** Preliminary data showed no significant changes in TREM-1 and TREM-2 expression in oral keratinocytes. Noteworthy, some cells in the connective tissue, as well as a subgroup of cells in the epithelial basal layer showed positive reaction for both proteins in healthy and inflamed gingiva. Whether this observation is the result of a technical artifact, decreased sensitivity of the immunofluorescence method compared to Western blot, or the actual expression pattern for both proteins, remains to be assessed. The possibility of decreased sensitivity on immunofluorescence is highlighted by our Western Blot findings from our pilot study, suggesting an association between TREM-1 and TREM-2 with tissue from healthy and periodontitis patients, respectively. Further studies are required to specifically identify the epithelium where these proteins are expressed.

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58. **INDOLECARBOXAMIDE ANALYSIS AS POTENT BROAD-SPECTRUM ANTI-MYCObACTERIAL AGENTS**

Dunn, Louis, E. Jeffrey North<sup>1</sup>, Wei Li<sup>2</sup>, Vinicius D.C. de Moura<sup>2</sup>, Mary Jackson<sup>2</sup>, David Bruhn<sup>3</sup>, and Richard Lee<sup>3</sup>, <sup>1</sup>School of Pharmacy and Health Professions, Creighton University, Omaha, NE, <sup>2</sup>Colorado State University, and <sup>3</sup>St. Jude Children's Hospital.

**Purpose and Rationale:** Tuberculosis (TB), primarily a pulmonary infection is caused by the Mycobacterium tuberculosis (M. tb) pathogen where one-third of the world's population is currently infected. M. tb is the leading killer in patients who are also co-infected with HIV/AIDS. However, TB is only one form of many different mycobacteria strains and recent literature indicates a steep increase in the number of mycobacterial cutaneous infections in the United States over the past 30 years. With the emergence of multidrug-resistant (MDR) and extensively drug-resistant (XDR) TB along with the increasing prevalence of non-tuberculosis mycobacteria (NTM) infections, the development of new anti-mycobacterial antibiotics is strongly needed. Towards these efforts, the evaluation of indolecarboxamide (IC) derivatives as broad spectrum

anti-mycobacterial agents aim to provide effective and potent treatment to these widespread infections.

**Methods:** A small series of IC derivatives were designed, synthesized and tested against a panel of mycobacteria, including *M. tuberculosis*, *M. smegmatis*, *M. abscessus*, *M. massiliense*, *M. bolletii*, and *M. chelonae*. In addition to antimycobacterial evaluation, *in silico* pharmacokinetic profiles have been calculated, using the QikProp module (Shrödinger, LLC), to assess potential oral bioavailability.

**Results:** Several IC compounds have potent MIC values against all mycobacterial strains. Theoretical pharmacokinetic profiles are consistent with published orally bioavailable IC analogs. Mechanism of action for the IC series is supported through whole genome sequencing of IC-resistant mutants of *M. tb* showing mutation(s) in the *mmp13* gene.

**Conclusions and Future Directions:** IC compounds are potent inhibitors of a panel of mycobacteria, establishing them as broad spectrum anti-mycobacterial agents. *In silico* PK profiles support their ability to be orally bioavailable. The design, synthesis, microbiological and pharmacokinetic evaluation of future IC scaffolds with rational substitution patterns is currently on-going.

**Acknowledgments:** Creighton University, St. Jude Children's Research Hospital and Colorado State University.

## 59. THE PHARMACOKINETIC STUDY OF DYE LOADED PLGA NANOPARTICLES

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The use of nanoparticles has been promising in developing a novel Human Immunodeficiency Virus (HIV) drug delivery system. Nanoparticles can significantly affect the cellular pharmacokinetic profiles of drugs by altering the cellular uptake and residence time of a drug. Confocal and fluorescence microscopy has been proved to be useful for real-time monitoring of intracellular trafficking of nanoparticles, and cell functionality. The nanoparticles will be made using poly(lactic-co-glycolic acid) or PLGA. This copolymer creates lipophilic nanoparticles that can be internalized into cellular compartments pinocytosis and phagocytosis. Depending on the sustainability of the nanoparticle, its contents will be released into the endosome and/or the cytoplasm. The purpose of this study is to utilize confocal and fluorescence microscopy to evaluate the kinetic of PLGA nanoparticles being internalized and released by immune cells.

## 60. ELECTRICAL NERVE STIMULATION OF AIRWAYS AND PULMONARY VASCULATURE

Kieffer, Cameron, and Peter W. Abel, Department of Pharmacology, Creighton University, Omaha, NE.

**Purpose:** Current pharmacological treatment for pulmonary hypertension focuses directly on the pulmonary vascular walls. There is mounting evidence that nerves play a role in pulmonary hypertension. Our hypothesis is that nerves, which can be stimulated by electrical fields to release their neurotransmitters, play a role in mediating tone in mouse lung airways and arteries and that blocking these neurotransmitters can decrease the severity of pulmonary hypertension.

**Methods:** Male CF-1 mice were kept in microisolator cages until they weighed over 30 grams. Precision-cut lung slices were prepared using a Leica VT1200 vibratome. Slices were imaged under an inverted light microscope. Airway and pulmonary constriction was measured as a decrease in luminal area. Slices were electrically stimulated in a Warner RC-27NE2 perfusion chamber at 50V at a duration of 1ms and increasing frequencies from 1 to 30 Hz. The

antagonists prazosin (1  $\mu$ M) or atropine (10  $\mu$ M) in Hank's Buffered Saline Solution were added using a peristaltic pump at 2 mL/min for 5 minutes.

**Results:** Frequency-response curves were generated for both airways and pulmonary arteries. Both showed an increase in contraction at increased frequencies, with maximum contraction at 30 Hz. Maximal airway contraction was decreased in the presence of atropine from 67% of baseline to 81%. Maximal pulmonary artery contraction was decreased with prazosin from  $27 \pm 7.4\%$  of baseline to  $69 \pm 9.2\%$  ( $p < 0.05$ ).

**Conclusions:** By blocking the direct effects of endogenously released neurotransmitters we were able to inhibit contraction in mouse lung airways and arteries. This suggests that lung innervations may play an important role in lung diseases such as asthma and pulmonary hypertension.

61. **ACTIVATION OF VOLTAGE-GATED SODIUM CHANNELS WITH BREVETOXIN-2 (PBTX-2) INCREASES DENDRITIC SPINE DENSITY IN MURINE ORGANOTYPIC H**

Akasheh Gomez, Dina, and Thomas F. Murray, Department of Pharmacology, Creighton University, Omaha, NE.

The N-methyl-D-aspartate receptor (NMDAR) is essential for activity-dependent neurite outgrowth, dendritic arborization and spine formation. We previously demonstrated that the voltage gated sodium channel activator, PbTx-2, augments NMDAR function in dissociated cultures of cerebrocortical neurons. Here we assessed the effect of PbTx-2 on spine dynamics in an organotypic hippocampal slice culture that better retains neuronal cytoarchitecture and synaptic circuits. This system also allowed us to ask whether the effects of PbTx-2 on cerebrocortical neurons generalized to hippocampal neurons. The effects of PbTx-2 on spine dynamics were compared to those of NMDA. Organotypic hippocampal slice culture (450  $\mu$ m thick sections) was prepared from postnatal day 5-6 mouse pups.. Hippocampal slices were placed on a membrane at the interface between air and culture medium. The slices were treated with vehicle, PbTx-2 or NMDA 18 hours after plating. Slices were diolistically or biolistically labeled, fixed and mounted. A Leica SP8 microscope was used to generate Z-stack confocal images and Imaris-XT software was used create 3D-reconstructed images of dendrites to analyze dendritic spine dynamics. Our results demonstrated that NMDA and PbTx-2 treatment produced significant increases in spine density. The use of the organotypic slice culture confirmed the impact of a voltage-gated sodium channel activator on spinogenesis, and demonstrated that this effect generalizes to hippocampal neurons. Sodium channel activators may represent a novel pharmacological strategy to promote neuronal structural plasticity.

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62. **FUMONISIN B1 EXPOSURE AND INCREASED RISK OF NEURAL TUBE DEFECTS: A GLOBAL HEALTH CONCERN**

Gardner, Nicole, Andrew J. Sachs, Ronald T. Riley, Joyce R. Maddox, Simon G. Gregory, Allison E. Ashley-Koch and Janee B. Geli, Department of Pharmacology, Creighton University, Omaha, NE.

**Purpose/Rationale:** Fumonisin B1 (FB1) is a mycotoxin produced by a common fungal contaminant of corn. Ingestion of fumonisin-contaminated food during early pregnancy is associated with increased risk for birth defects, specifically, neural tube defects (NTDs). On average, NTDs occur in approximately 1/1000 live births; however, in regions of the world where corn is a dietary staple, (Northern China, South Africa, Mexico, Guatemala) the reported incidence of NTDs is often 6-11 fold higher than the global average. Biochemically, fumonisin inhibits the enzyme ceramide synthase in de novo sphingolipid biosynthesis, causing

accumulation of the bioactive sphingolipid metabolite, sphinganine-1-phosphate (Sa1P), in blood and tissues.

**Methods:** Analysis of blood spots and urine collected from Guatemalan women, of child-bearing age, who consume corn-based foods (ie. tortillas) on a daily basis demonstrates a strong correlation between urinary fumonisin concentration and elevated blood levels of Sa1P.

**Results:** In our experimental mouse model, maternal exposure to fumonisin similarly results in a dose-dependent correlation between urinary fumonisin concentrations, elevated blood levels of Sa1P, and the incidence of NTDs in exposed mouse embryos. The exact mechanism(s) linking fumonisin disruption of sphingolipid metabolism and elevation of Sa1P to NTDs is currently unknown. However, our studies in cultured mouse neural progenitor cells have identified cell signaling and epigenetic pathways that are altered in response to fumonisin exposure and elevation of Sa1P.

**Conclusions/Significance:** Our in vivo mouse studies, coupled with sample collection from human populations in Guatemala, have also allowed us to identify genetic polymorphisms that may contribute to NTD susceptibility in offspring exposed to fumonisin.

63. **OPTICAL PROPERTIES OF COPPER SULFIDE THIN FILMS PRODUCED BY EX SITU SULFIDATION**

Rayyan, Ala'a, Karen Sass, Erin Cheese, Anton Yanchilin, and Andrew Baruth, Department of Physics, Creighton University, Omaha, NE.

Copper sulfide (Cu<sub>x</sub>S<sub>y</sub>) thin films with x and y equal 1 are optically transparent yet exhibit nearly metallic p-type conduction. These properties, which are exceedingly sensitive to precise stoichiometry, are attractive for use in architectural window glazing due to infrared absorption and photovoltaic applications as transparent wires. A series of Cu<sub>x</sub>S<sub>y</sub> thin films of nominal thickness 110 nm were prepared by ex situ sulfidation of thermally evaporated Cu films of thickness 50 nm. In this process, Cu films are vacuum-sealed in glass ampoules containing S powder, where the S charge densities (S mass / ampoule volume) were varied between 1.71 to 1.96 mg/cm<sup>3</sup>. The sealed ampoule is heated to 400°C for 8 hours, where chemical vapor transport of S and grain boundary diffusion sulfidizes the Cu film. UV-Vis spectroscopy of the resultant Cu<sub>x</sub>S<sub>y</sub> films reveal peak optical transmission at 563 nm to be ~30% with an indirect band gap of ~1.6 eV. By analyzing the strong infrared suppression due to free carrier absorption with ATR-FTIR spectroscopy and a Drude model for conduction, we are able to measure carrier concentration and hole mobility as a function of S charge density. Results reveal a high carrier concentration in the vicinity of 1–2 × 10<sup>19</sup> holes/cm<sup>3</sup> and a hole mobility of ~ 30 cm<sup>2</sup> /Vs. Finally, we show the results of atomic force microscopy to elucidate the surface morphology of the sulfidized films and the effect of grain size on optical transmission. We acknowledge the Omaha Public Power District for project funding and E.C. acknowledges the Clare Booth Luce Foundation for additional support.

64. **COMPARISON OF ATOMIC FORCE MICROSCOPY AND OPTICAL PROFILOMETRY IN ENAMEL ETCHING – CAN SEEMINGLY IDENTICAL MEASUREMENTS REALLY BE COMPARED?**

Fischer, Nicholas, and Andrew Baruth, Ph.D., Department of Physics, College of Arts and Sciences, Creighton University, Omaha, NE.

Evidence-based dentistry collects and analyses data to support, alter, or disprove time-honored techniques. Atomic Force Microscopy (AFM), a nanoscopic imaging technique, utilizes an atomically sharp tip and cantilever while Optical Profilometry, a common dental imaging technique, uses white light interference. Both record roughness values (Ra), but at unique lateral



scales. We have analyzed extracted third molars etched with four commercial products (n=10) at three etch times, collecting the Ra values from both AFM and Optical Profilometry. By merging the two disparate imaging techniques and observing the notable trend, the correlation between AFM and Optical Profilometry Ra values can potentially be rectified in order to bridge two distinct methodologies of research.

65. **CONFORMATIONAL DYNAMICS OF THE CELLULAR FORM OF THE PRION PROTEIN OF TWO MUSTELIDS**

Zhao, Bo, and Patricia Soto, Department of Physics, Creighton University, Omaha, NE.

Prion diseases are fatal neurodegenerative disorders in mammals, including humans. Prions are agents that induce abnormal folding of the normal, cellular form of the prion protein (PrPc). Interspecies infectivity is not fully understood because of the difficulty in identifying the critical features that determined the so called species barrier effect. To shed light on this intriguing behavior, our research focuses on understanding the conformational differences between the PrPc protein of two closely related mustelids (ferret and mink, which primary sequence differs only at two positions: Phe → Leu at residue 179 and Arg → Gln at residue 224). From our analysis, we observed that:

1. In seven out of ten 3D models, the conformational rigid clusters include from residue 204 to residue 224.
2. Conformational rigid clusters may exhibit low or high local conformational fluctuations.
3. In all cases, the most rigid cluster corresponds to  $\alpha$ -helix secondary structure elements.

66. **MONITORING THE REGULATION OF CELLULAR METABOLIC STATE AND EPIGENETIC ACTIVITIES IN CANCEROUS CELLS BY NADH AND FLAVORPROTEIN FLUORESCENCE LIFETIME IMAGING MICROSCOPY (FLIM)**

Pham, Dan, and Michael G. Nichols, Department of Physics, Creighton University, Omaha, NE.

**Purpose:** NADH and FAD play many important roles within the cell including functioning as electron carriers in the electron transport chain of cellular respiration, which takes place in the mitochondria of the cell. The metabolic profile of a cell serves as an indicator for its metastatic potential since cancer cells show a high level of glycolysis and thus, an increased level of cellular NADH. Through the regulation activity that NADH has on the C-terminal binding protein family members, which work as transcriptional corepressors, cancerous cells can sense changes in cellular metabolic state and optimize their epigenetic activities. In this research, we studied the metabolic states of two squamous cell carcinoma cultures by comparing NADH and FAD signals in both cytosolic and nuclear regions of the cells following mitochondrial inhibition and uncoupling.

**Methods:** Because NADH and FAD are fluorescent molecules, we investigated their intensity, concentration, average lifetime and lifetime distribution through FLIM.

**Results:** NADH and FAD fluorescent signals were clearly identified in both nuclear and cytosolic regions. The ratio of fluorescent intensity between mitochondrial and nuclear regions was consistent despite the changes in the cellular metabolic state.

**Significance:** Separation of nuclear and mitochondrial signals could provide insight into the regulation of cellular metabolism of cancerous cells. Based on the relationship between the cellular metabolic state and epigenetic activities, cancerous cells' developmental behavior could be monitored through metabolic signals.

**Acknowledgement:** This study was conducted at CU-IBIF. We would like to thank Dr. Laura Hansen (BMS) for provision of cells. This study was made possible through the great support from Christina R. Miller.

67. **MODELING CANCER METASTASIS THROUGH MECHANICAL PROPERTIES DETECTED BY A MICROFLUIDIC MICROCIRCULATION MIMETIC**

Prathivadhi, Sruti, Michael Nichols, Erin Gross, and Andrew Ekpenyong, Department of Physics, Creighton University, Omaha, NE.

**Rationale:** Metastasis is a complex multi-step process by which cancer spreads to organs away from the primary tumor site. More than 90% of all cancer deaths are directly related to metastasis. Unfortunately, existing cancer drugs target cell proliferation and not metastasis, largely because our understanding of metastasis is only beginning to emerge. Thus, there is an urgent need for anti-metastasis therapy. Incidentally, mechanical properties have been shown to be good markers for metastatic potential of cancer cells and are altered during drug treatment. We have therefore developed and validated a microfluidic device that mimics the microcirculation by deforming cells as they advect through constrictions, thereby assessing the pro- and anti-metastatic effects of cancer drugs.

**Methods:** Using standard photolithographic techniques and PDMS-based replica molding, we developed a microfluidic lab-on-chip platform for mimicking the capillary constrictions of the pulmonary and peripheral microcirculation. With a syringe pump, we advect cells and measure their transit times through the device. The transit time, which is related to the mechanical properties of the cells, is extracted from the video files recorded using a CCD camera that is connected to a phase contrast microscope.

**Results:** In line with results obtained using a time-consuming and more expensive technique (the atomic force microscope), we found that cancer cells exposed to a chemotherapeutic drug (doxorubicin) take significantly longer transit times through the 187 constrictions in our device, compared to untreated cells. Testing with candidate anti-metastatic drugs is our next goal.

**Significance:** Our fast and inexpensive device for biophysical assessment of effects of cancer drugs may assist in effective drug development.

**Acknowledgment:** Success in Science Fund allocated to AE by the Physics Department.

68. **SYNTHESIS OF COPPER SULFIDE THIN FILMS FOR PHOTOVOLTAIC APPLICATIONS**

Yanchilin, Anton, Karen Sass, Erin Cheese, Ala'a Rayaan, and Dr. Andrew Baruth, Department of Physics, Creighton University, Omaha, NE.

Copper sulfide ( $Cu_xS_y$ ) with  $x$  and  $y$  equal 1 is a p-type conductor that, as a thin film, is transparent in the visible spectrum and has potential photovoltaic applications for space and terrestrial platforms. We report on an ex situ sulfidation synthesis method, where a Cu film (<50nm) and a variable S charge (~5-20mg) are sealed in a vacuum evacuated ampoule. Upon heating, the S sublimates and incorporates into the Cu film via chemical vapor transport and grain boundary diffusion, producing  $Cu_xS_y$  with a final thickness of ~110 nm. There are five stable compounds at room temperature; we are investigating the S charge density (mass of S / ampoule volume), over a range of 1.5 to 2.0 mg/cm<sup>3</sup>, on final stoichiometry. We characterize the sulfidized films via X-ray diffraction to investigate phase purity and temperature-dependent resistivity measurements in a four-terminal van der Pauw geometry. Results reveal a room temperature resistivity of 90-105 m $\Omega$ -cm and  $\rho$  versus T slope of 0.19-0.24 m $\Omega$ -cm /K. To compare these results, we map out measured parameters versus S charge density and define ranges for producing various film stoichiometries, including Cu<sub>1</sub>S<sub>1</sub>.

**Acknowledgements:** Thanks to NASA Nebraska Space Grant and Omaha Public Power District for helping fund this project within the Creighton University Physics Department.

69. **INVESTIGATION OF THE SOLVENT VAPOR ANNEALING TIME DEPENDENCE IN POLYSTYRENE–BLOCK–POLYLACTIDE THIN FILMS**

Gnabasik, Ryan, G. Nelson, C. Drapes, A. Baruth Department of Physics, Creighton University, Department of Physics Creighton University, Omaha, NE

Solvent vapor annealing exposes a block polymer film to the vapors of one or more solvents, swelling the film and lowering the glass transition temperature. This process increases polymer mobility and can direct the nanoscale self-assembly process by tuning the surface energy and mediating unfavorable block interactions. Despite its efficacy to produce well-ordered, periodic nanostructures, no standardized production scheme exists. This is primarily due to a lack of understanding the intricate role multiple, incommensurate parameters play. By analogy to thermal annealing of elemental solids, the time a thin film spends in an equilibrium solvent concentration is one factor that we expect to dictate the degree of lateral ordering. To elucidate, optimized annealing conditions for perpendicular cylinder forming polystyrene-block-poly lactide exist at solvent concentrations just on the order side of the order-disorder transition, where the kinetic and thermal processes required for recrystallization and crystal growth are optimally fast (similar to thermal annealing). We report on a purpose-built, climate-controlled solvent vapor annealing chamber, which provides the ability to map out the annealing time dependence for both optimized and non-optimized solvent concentrations. For example, we can expect that lower solvent concentrations, where mobility is more limited, will require longer times to produce large lateral correlation lengths. In situ spectral reflectance monitors solvent concentration regulated via a mass-flow controlled solvent vapor inlet and micrometer valve outlet. In collaboration with pneumatically actuated valves, the system offers unparalleled precision control over the entire annealing process at both long and short time scales; including initial swelling, steady state, and evaporation. Atomic force microscopy, in conjunction with O<sub>2</sub> plasma etching and liquid Nitrogen enhanced film removal, provides access to 3-dimensional imaging of the nanoscale morphology, specifically at the film-air and film-substrate interfaces.

**Acknowledgement:** This work is funded by the NASA Nebraska Space Grant and the Nebraska EPSCoR FIRST Award.

70. **ANALYSIS OF BIOPHYSICAL PROPERTIES OF PRION PROTEINS ACROSS SEVERAL SPECIES USING MOLECULAR MODELING TECHNIQUES**

Lax, Angela, Natalie Bui, Margaret Carter, Chad Nieri, and Dr. Patricia Soto, Department of Physics, Creighton University, Omaha, NE.

Prions are infectious agents responsible for transmissible spongiform encephalopathies, a fatal neurodegenerative disease in mammals, including humans. Prions propagate biological information by conversion of the non pathological version of the prion protein to the infectious conformation, PrP<sup>Sc</sup>. Our purpose is to identify specific biophysical properties of the cellular prion protein, PrP<sup>C</sup>, including the hydrophobicity, conformational flexibility, solvent accessible surface area, and binding affinity of cofactors for misfolding in order to recognize trends in the amyloidogenic regions of PrP<sup>C</sup> across several mammal species. We use structural bioinformatics and molecular modeling techniques to perform our calculations.

71. **MOLECULAR DYNAMICS SIMULATIONS OF ALZHEIMER'S A $\beta$  AGGREGATES INTERACTING WITH MODEL MEMBRANES**

Bertsch, Colin, and Patricia Soto, Department of Physics, Creighton University, Omaha, NE.

Alzheimer's disease is a common form of dementia that affects about 5 million people in the United States of America. A wealth of data links the disease to the misfolding and clumping of the

Ab peptide. The precise mode by which the aggregates induce toxicity, however, is unknown. Recent findings suggest that cell membrane disruption induced by Ab aggregates triggers cytotoxicity. The goal of our research project is to gain insight into the mechanism by which Ab aggregates perturb the local environment of model plasma membranes. We use coarse grain molecular dynamics simulations to monitor the interactions of the aggregate at different levels of insertion in model membranes. Our preliminary results suggest that the aggregate's motion is modulated by the relative orientation and surface electrostatics of the protofilaments. These observations shed light on the stability of the aggregate's insertion mode and the mechanism of membrane disruption.

## 72. **PASSIVE MAGNETIC FIELD CANCELLATION DEVICE FOR USE IN ATOM TRAPPING EXPERIMENTS**

Holman, Nathan, and Barak Gruberg, Department of Physics, Creighton University, Omaha, NE.

**Purpose:** Since the development of laser cooling, ultracold atomic gases have become invaluable tools for probing fundamental physics with technological applications ranging from atomic clocks to fetal heart monitors. To achieve the high degree of control over these systems significant efforts are made to control background magnetic fields that can alter atom's electronic structure via the Zeeman effect. Currently, active electronics are used to measure and sequester these fields via powered Helmholtz coils. These devices require external magnetic field sensors to extrapolate the magnetic field at the trapping region and adjust the coil currents as necessary. Our work is on the development of a 1D passive magnetic field cancellation device based on a modified Helmholtz coil design using superconducting wire. Unlike other passive magnetic shielding devices, our device does not sacrifice shielding efficiency for optical access to the region of interest. Theoretically, this device is capable of providing nearly instantaneous, perfect cancellation at its center and comparable cancellation to active systems over a 1 cm region. This is possible without the aid of any electronics or sensors due to the dynamic response of superconductors to external magnetic fields.

**Methods:** The apparatus uses high temperature superconducting wire supplied by SuperPower Inc. in a double Helmholtz coil configuration to shield external magnetic fields in one dimension. To characterize this device, we constructed a field perturbing Helmholtz coil capable of producing magnetic field variations 300 times typical background fluctuations at drive frequencies up to 1 kHz. The field along the shielding direction is characterized using a gauss probe before and after the superconducting phase is achieved. We report on the design considerations and preliminary data for the magnetic field along the shielding axis.

## 73. **THE ROLE OF COMPLEX I IN MITOCHONDRIAL REACTIVE OXYGEN SPECIES FORMATION IN COCHLEAR SENSORY AND SUPPORTING CELLS DURING OTOTOXIC AMINOGLYCOSIDE EXPOSURE**

Desa, Danielle, Michael G. Nichols<sup>1</sup> and Heather Jensen Smith<sup>2</sup>, <sup>1</sup>Department of Physics, and <sup>2</sup>Department of Biomedical Sciences, Creighton University, Omaha, NE.

**Purpose:** Despite causing permanent hearing loss by damaging inner ear sensory cells, aminoglycosides (AGs) remain the most widely used class of antibiotics in the world. Cell-damaging reactive oxygen species (ROS) form during AG ototoxicity but the source of these free radicals is poorly understood. During normal mitochondrial metabolism low levels of ROS, primarily superoxide, are produced at complexes I and III in the electron transport chain. These levels can increase when mitochondrial dysfunction occurs.

**Methods:** Fluorescence intensity-based measurements of changes in mitochondrial membrane potential and the metabolic intermediate, nicotinamide adenine dinucleotide (NADH), were used to detect alterations in mitochondrial metabolism in acutely-cultured murine cochlear explants.

Cardiolipin, a facilitator of mitochondrial metabolism, was oxidized by exposure to gentamicin (GM, 300 µg/ml), a representative AG antibiotic. The complex I-inhibitor rotenone (250 nM) was used to assess complex I superoxide production during acute GM exposure.

**Results:** GM caused a rapid increase, then decrease in NADH concentration and mitochondrial membrane potential. Rotenone significantly increased superoxide in low- and high-frequency sensory cells ( $p < 0.001$ ). However, GM pre-treatment decreased rotenone-stimulated superoxide production at complex I. This suggests 1) AGs decrease NADH reduction capacity at complex I and 2) complex I is not the primary site of GM-induced ROS. These metabolic changes were sufficient to release apoptosis-inducing factor from mitochondria.

**Significance:** This project provides a base for understanding the underlying mechanisms of mitochondrial ROS production in cochlear cells during exposures to ototoxic antibiotics.

**Acknowledgements:** National Institute on Deafness and Other Communication Disorders (NIDCD,RO3DC012109), and COBRe (8P20GM103471-09) to HJS and a Ferlic Undergraduate Research Scholarship to DD.

#### 74. **METABOLIC PROFILING OF SQUAMOUS CELL CARCINOMA THROUGH TIME- AND WAVELENGTH-RESOLVED MULTIPHOTON MICROSCOPY**

Miller, Christina, and Michael G. Nichols, Department of Physics, Creighton University, Omaha, NE.

**Purpose:** Every year millions of people in the US are affected by skin cancer, and like other cancers, the key to an effective treatment is early detection. To this end, we are developing a noninvasive optical technique to diagnose and monitor early changes in cellular metabolism that occur with disease.

**Methods:** We have utilized time- and wavelength-resolved multiphoton microscopy to measure NADH and flavoprotein fluorescence as indicators of cellular metabolism. The metabolic dynamic range of high- and low-HER2 expressing squamous cell carcinoma (SCC) cultures were studied by systematically altering cellular metabolism with mitochondrial uncouplers and inhibitors.

**Results:** Changes in the metabolic state led to measurable changes in fluorescence lifetime distributions and intensities in both SCC cell lines. In addition, these cell lines could clearly be distinguished on the basis of the fluorescence intensity dynamic range (difference between high and low respiring states) and lifetime distributions. Metabolic differences due to HER2 have been characterized by inhibiting HER2. This imaging technique has also been adapted to living skin in vivo. Specifically, metabolic fluorescence signals have been identified and separated based on two-photon-excited fluorescence excitation and emission spectra of excised mouse skin.

**Significance:** Success with preliminary in vitro studies suggest that this technique will be able to effectively monitor changes in metabolism with the onset of disease in vivo. Further experiments will establish the specificity and sensitivity for optical diagnosis.

**Acknowledgements:** This study was conducted at the CU-IBIF and was supported by NIH P20 RR16469 (NCRR) and 5P20GM103427 (NIGMS) and the Ferlic Summer Research Program. Cells and mouse skin were provided by Dr. Laura Hansen (BMS). We also gratefully acknowledge the assistance of Brianna Hammiller.

75. **NETWORK DIFFUSION: STRATEGIC INFLUENCE IN THE INTERNATIONAL SYSTEM**

Boyce, Maureen, Department of Computer Science, Creighton University, Omaha, NE.

We develop a new approach to determining the influence of actors in networks on diffusion in the international system. We construct a dynamic diffusion model that represents the interactions and evolution of the current international network and determines the rate of the diffusion of Islamism based on external and internal pressure exerted on states. We find that, given the current structure of the international system, the overall level of Islamism will decrease. Using this method, we are also able to study the most effective strategy for influencing another state, or targeting paths to reduce a given state's influence.

76. **PROLONGING PEACE: EXTERNAL INTERVENTION AFTER CIVIL WAR**

Hernandes, Carissa, Department of Political Science and International Relations, Creighton University, Omaha, NE.

In the past twenty years, peacekeeping has become an important staple of the international community's response to civil war. While research abounds on the effectiveness of these forces, not much exists on how the type of intervention affects the duration of peace. I argue that non-United Nation missions are uniquely suited to respond to post-conflict challenges as opposed to United Nations missions for several reasons. In addition to UN and non-UN intervention, I include other variables in order to account for inherent selection bias and degree of difficulty: battle deaths, war type, size of government army, fragmentation, and outcome of the war. This analysis uses three separate time-bounded Cox proportional hazards models. Finally, I discuss the possible implications of the results for research and policy in this field, which include a better understanding of both types of external intervention as well as the role they play in the post-conflict landscape.

77. **ICT DIFFUSION AND THE CAUSES OF MODERN PROTEST TRENDS**

Lievens, Elizabeth, Department of Political Science and International Relations, Creighton University, Omaha, NE.

This paper argues that the dissemination of information and the presence of technology infrastructure are the most important predictors of protest, and focuses on the years 1994-2004 to determine the effects of rising Information and Communication Technology (ICT) use as the Internet and similar media began to gain popularity around the world. The effects of Internet use, censorship, democracy, education, and economic situation on protest rates in 160 countries are analyzed. Internet use did not increase the likelihood of protest, likely because its use had not yet become a popular and widespread enough tool for organization and inciting dissent.

78. **TESTING THE PROPOSED EFFECT OF JUDICIAL PERFORMANCE EVALUATIONS: DO VOTERS USE THIS INFORMATION?**

Rossiter, Erin, Department of Political Science and International Relations, Creighton University, Omaha, NE.

Extent research has repeatedly revealed the ill-informed reality of the American voting public. But in the event that expert, unbiased information is publicized to the electorate, will voters rely upon such information to educate their vote? Many states say yes, as evidenced by their support for judicial performance evaluations (JPEs). In this research, I address the claims that JPEs foster a more informed judicial voter. JPEs are a resource produced in many states where state Supreme Court justices face periodic retention elections. These evaluations are then publicized with the

proposition that voters will look to the evaluations' suggestions when deciding whether or not to vote to retain a justice. Proponents of JPE programs posit the evaluations are able to provide voters with expert and unbiased information, making JPEs different from most information inundating voters during elections. But do voters use JPE suggestions when casting their votes? The weight these evaluations carry in voters' decision making, and similarly, in election outcomes has yet to be scrutinized empirically. Thus, I test the effect of these evaluations in election outcomes by analyzing 120 evaluations of justices sitting on the states' court of last resort across 9 states in 12 election years. I find JPEs have no statistically significant effect on the votes received by state Supreme Court justices. Accordingly, I find no evidence to support that voters rely on this form of information when casting their judicial vote.

79. **EXPLAINING HYDRAULIC FRACTURING ACROSS TOWNSHIPS IN NEW YORK: DOES POPULATION SIZE MATTER?**

McEwen, Morgan, Department of Political Science and International Relations, Creighton University, Omaha, NE.

I ask the question of what factors will make it more likely for a town to approve a ban on hydraulic fracturing in the state of New York. I narrowed my research to the state of New York because towns and cities have the power, by way of zoning laws, to ban hydraulic fracturing within their borders. I test the effect of population size, average household income, political partisanship, ethnicity and education on a town's likelihood to approve a ban on hydraulic fracturing. I find that income, ethnicity and education are all factors that affect whether or not a town will approve a ban on hydraulic fracturing.

80. **TECHNOLOGICAL INVENTION: SPURRING INNOVATION IN FREE MARKETS**

Riley, Patrick, Department of Political Science and International Relations, Creighton University, Omaha, NE.

Some states experience higher levels of technological innovation than others. I argue that the presence of a well-educated labor force in combination with high worker productivity in a state that enforces strong property rights laws, has a high amount of foreign direct investment, and has a high gross national savings rate will result in high levels of technological innovation. Well-educated and productive labor forces are better suited to create technological invention, which sits at the heart of innovation; these labor force characteristics coupled with strong property rights laws and a free, democratic political system leads to high levels of innovation. I test this hypothesis using three robust OLS regression models, one including the education rate and productivity in terms of GDP production, one including the previous variables plus the legal environment and the strength of their intellectual property rights laws, and one including the first model and an aggregate score encompassing the legal environment, physical property rights, and intellectual property rights. None of the models are significant by themselves as a whole; however they do support my hypothesis that worker productivity and property rights laws do play a substantial role in explaining levels of technological innovation within free-market states.

81. **THE ILLICIT FINANCIAL FLOW GLOBAL NETWORK: EXPLAINING CONNECTIONS WITH STATE CHARACTERISTICS**

McCoy, John, Department of Political Science and International Relations, Creighton University, Omaha, NE.

International Relations scholars have begun to re-conceptualize the previously held notions of global structure and interaction using the tools of social network analysis. Thus far, much study has focused on illegal global networks, in areas such as terrorism, human trafficking, and narcotics trafficking. The literature supports the notion that illicit networks share similar structures,

members, and help fund each other. Illicit financial flows can be conceptualized as international money laundering and fit into the broad body of literature supporting a nexus of illicit networks. I study the international illicit financial flow network using basic tools of social network analysis. I ask what explains the number of connections states have in this network using degree centrality. I analyze both weighted degree centrality scores and un-weighted degree centrality scores against they hypotheses that states with lower economic and political development have greater numbers of connections in the international illicit financial flow network. The economic and political development variables are generally significant, but the relationship is opposite to the one described in the hypotheses. My results suggest the states with higher economic and political development levels have a greater number of connections in the international illicit financial flow network.

82. **SOURCE COUNTIES IN INTERNATIONAL HUMAN TRAFFICKING: A TIME SERIES ANALYSIS**

Jinete, Bianca, Department of Political Science and International Relations, Creighton University, Omaha, NE.

Using the State Department Trafficking in Persons Report I construct the international human trafficking network for each year from 2001 to 2013. I classify source countries by the degree to which they exhibit export ties, and using a time series regression I identify the factors that explain the variation in the degree to which a country is a source state for human trafficking over time. I test whether GDP per capita, unemployment, literacy, and corruption, when combined with external shocks, cause a state to be embedded in the international network as a source country. My results contradict established theory of human trafficking.

83. **INCOME INEQAULITY'S EFFECT ON POLITICAL ENGAGEMENT IN THE UNITED STATES**

Hoover, Matthew, Department of Political Science and International Relations, Creighton University, Omaha, NE.

I examine variation in political interest and political participation in the United States to address the question of whether or not income inequality affects political engagement. Existing research suggests that political engagement is positively correlated with income at the individual level. I hypothesize that variation in income inequality at the state level affects variation in political engagement at the individual level in the United States. To test this hypothesis, I use individual survey data from the American National Election Survey (ANES) as well as state-year level inequality measures created by Professor Mark Frank of Sam Houston State University. Both logistic regression and ordered logistic regression were employed to test this hypothesis. My results are most closely aligned with the relative power theory literature; as income inequality increases in the United States, political interest and electoral participation decrease for all income quintiles. These results indicate that if income inequality in the United States continues to increase as it has over the past thirty years, Americans will become less politically engaged, irrespective of income.

84. **TOY STORY: WHERE DO CHILDREN DRAW THE LINE BETWEEN BLUE AND PINK?**

Wu, Ruomei, Isabelle D. Cherney, and David Herr, Department of Psychology, Creighton University, Omaha, NE.

Children's toys preferences are gender-typed and influence their memory, attitudes, and behaviors. These gender- typed preferences may be based on gender roles, schemas, or other characteristics acquired through socialization. It is unclear, however, how the color of toys



influences children's reasoning and gender stereotyping about toys. The present study examined the categorization of boys' and girls' gender-typed and ambiguously colored toys. Children were shown 40 pictures of gender-typed and neutral toys as well as four abstract objects that were used as a control. The color of the toys was changed to different hues. The findings showed a complex relationship between the children's gender associations and gender reasoning.

85. **TEAM ATTITUDES AND MOTIVATION**

Baumann, Michelle, Department of Psychology, Creighton University, Omaha, NE.

We are interested to see if the attitude of one individual in a team towards a given task will influence the attitude of the other member(s). We hypothesize that the partner's level of motivation to complete the task will determine whether the partner's attitude will be influenced by the outspoken individual. We are also interested to see if the size of the group will have an effect on an individual's likelihood of adopting the outspoken attitude. Lastly, we hypothesize that a negative attitude will yield less creative responses than a positive attitude. To test our hypotheses, we developed a vignette study in which participants were placed on teams of 2 or 5 individuals that work for a marketing agency. We believe placing participants in a job-like scenario will motivate them to complete the task. In the scenario, one individual expresses either a positive or a negative attitude towards the task given. Participants were asked how they would respond to the individual's behavior and to complete the task. Finally, a questionnaire was given to assess the participants' motivation. At this time, we are in the process of collecting data for this study. The results of our study would allow us to see if members of a team has an influence on each other. If our hypotheses are correct, it will show the significance of employers having employees that are motivated to complete and have a positive attitude towards a task. Without motivation and a positive attitude, the team will not be as creative and may not work successfully as a team.

86. **HAVES AND HAVE-NOTS: THE PSYCHOLOGICAL AND SOCIAL EFFECTS OF RELATIVE DEPRIVATION**

Burns, Ashley, Tinotenda Sekeramayi and Dr. Jill Brown, Department of Psychology, Creighton University, Omaha, NE.

The effects of relative deprivation on attitudes and beliefs were examined. According to Crosby, in order for relative deprivation to be experienced, there are five necessary preconditions that must be met by individuals who lack a desired something. Individuals in this condition must observe that someone else has something, want it, feel entitled to it, believe it can be achieved, and perceive that the lack of access to it is not through the fault of their own (Crosby, 1976). To simulate an environment of relative deprivation, participants were divided into two conditions, enriched and deprived, and were placed on opposite sides of the room, respectively. Eighty-nine (age 19-21) undergraduate students from a private, Midwestern university completed the study. Findings showed that the relatively enriched condition displayed significantly higher levels of self-esteem than the relatively deprived, enriched or deprived groups. In terms of social dominance, the enriched condition displayed significantly higher levels of social dominance. Additionally, the relatively enriched group showed slightly more social dominance than the relatively deprived group. These findings suggest that the impact of relative deprivation has a general impact on overall well-being. These results further imply that even experimentally, a lack of available resources in the presence of people who possess more may affect how people perceive themselves and their situations.

## 87. EMERGENT LEADERSHIP IN VIRTUAL TEAMS

Leone, Salvatore, and Michael Baldovino, Department of Psychology, Creighton University, Omaha, NE.

This study explores under which certain conditions members of a team emerge as team-leaders in various levels of virtuality (degree to which team members are not geographically/physically present while working) and varying levels of team cohesion. Participants were randomly placed into three levels of virtuality: a control group consisting of a physically present team (no virtuality), a team communicating via video-chat (moderate virtuality), and a team communicating via instant text-based messaging (high virtuality). Additionally, the teams were also divided into either high cohesiveness (operationally defined by polite interactions, psychological safety, and solely positive reactions to ideas), or low cohesiveness (operationally defined by demeaning remarks, low psychological safety, and solely negative or challenging reactions to ideas). Each team consisted of two confederates and one participant who was observed to determine if he/she displayed behaviors consistent with emergent leadership.

## 88. FEEDBACK VALENCE AND IDEA GENERATION

Cubrich, Marc, Kaboli-Nejad, Sahra, Modrell, Alexa and Fairchild, Joshua, Department of Psychology, Creighton University, Omaha, NE.

In an increasingly digital age, businesses are turning towards social media now more than ever. These platforms often serve as direct lines to their consumers. Complaints, problems, and praise can all be gathered in an instant. This study investigates the difference between traditional and social media feedback and its impact on idea generation. This study seeks to uncover if businesses with strong social media presence are truly on the cutting edge, or if they are simply looking at the same information through a different medium. A web-based study was administered to university undergraduates in order to explore this hypothesis. Participants were presented with a mobile application and a detailed explanation and images of its features. Some participants received feedback about the app in the form of tweets, 140-character excerpts from the web-based microblogging platform Twitter. Other participants received traditional survey feedback including free-response excerpts and consumer ratings. The participants were then charged with the task of making changes to the application given their feedback. The participant's overall comfort with technology and social media were gathered through survey responses along with measures of the Big 5 personality test. Responses provided by the participants were then examined and evaluated on their creativity. After coding the responses, scores were analyzed for statistical significance.

## 89. CREATIVE IDEA EVALUATION

Smith, Ellis, and James Brown, Department of Psychology, Creighton University, Omaha, NE.

Creativity is an important quality but it must be carefully understood in order to be most effectively utilized. In this study, we examined how creative proposals for a potentially useful computer program are evaluated and if an individual's expertise with a topic will play a role, as an expert in a field is more likely to understand the implications of a new idea. If an idea is too novel or too simplistic, we hypothesized that the idea will be considered less useful and therefore rated lower. Each participant answers a survey in order to generate information about who they are and why they might answer the way that they did. They are asked to review three different ideas for creative computer programs to aid the elderly in a variety of ways. The ideas are of low, moderate, and high creative quality and the participants are asked to rate the ideas based on their originality, quality, and usefulness. Following the evaluation of the creative ideas, participants are evaluated on their level of expertise for both working with the elderly and using and producing computer programs. Finally, the participants are evaluated on their Big 5 personality traits in order to determine if there is a correlation that exists between an individual's

personality and their acceptance or rejection of creative ideas. Data collection is currently pending but we believe that our results will show a significant relationship between a person's expertise in a field and their general acceptance of a novel idea, with personality traits playing important roles as well.

90. **EFFECTS OF INFORMATION CHARACTERISTICS ON CREATIVE DECISION-MAKING**

Heinen, Rachel, Michelle Baumann, and Savannah Rodriguez, Department of Psychology, Creighton University, Omaha, NE.

This study evaluated how different factors can influence a decision during a creative task. Each participant was randomly assigned to different prompts that varied in information quantity, perceived information completeness, and time allotted to complete the task. The task consisted of the participants devising an escape plan as a CIA agent and choosing to wait for additional information before executing their plans. Prompts that varied in information quantity included high, moderate, and low amounts of information given to the participants. Participants were also randomly distributed into two different scenarios, where one group was informed that more information would be given at a later time, while the other group was told that all of the information about the headquarters was presented. To investigate the effect of time pressure on the creativity of responses, participants were distributed into two groups with one group having a maximum of ten minutes to complete the task, and the other group was given an unlimited amount of time. Based on our results, time pressure and information overload did not have statistically significant effects on the quality or originality of the responses. However, perceived information completeness had statistically significant effects. Perceived information completeness refers to whether or not the person believes he or she has all the information available to them or if potentially useful information is being withheld. Even though both conditions were given the same amount of information, the responses of the "incomplete" information condition were lower quality and less original than the responses of the "complete" information condition. Thus, results indicate that explicitly telling participants information is withheld from them will negatively influence the decision-making process.

91. **ABNORMAL MEG THETA ACTIVITY IN VETERANS WITH PTSD DURING WORKING MEMORY PROCESSING**

McDermott, Timothy, Amy Badura Brack, Elizabeth Heinrichs Graham, Tara Ryan, and Tony Wilson, Department of Psychology, Creighton University, Omaha, NE.

Posttraumatic stress disorder (PTSD) is a psychiatric condition that may develop following the experience of an emotionally overwhelming and/or traumatic event. Previous studies have demonstrated that these patients suffer from a number of executive functioning deficits, including impairments in working memory. In order to further examine this, we examined how PTSD affects the dynamics of working memory processing by recording the brain activity of 27 male combat veterans with PTSD, and 24 psychologically healthy, demographically-matched control participants using magnetoencephalography (MEG). During the MEG recording, participants performed a Sternberg-type working memory task. Our results showed that, despite comparable performance, veterans with PTSD showed abnormal theta (4-8 Hz) activity in the right dorsolateral prefrontal cortex (DLPFC) and the right supramarginal gyrus during the encoding phase. Aberrant activity in the right DLPFC was strongest in the 400-800 ms range, whereas that in the supramarginal gyrus peaked at 1200-1600 ms post-stimulus onset.

92. **IMMUNIZATION ACCESS THROUGH PHARMACIES LOCATED IN LOW INCOME, MEDICALLY UNDERSERVED AREAS**

Bangsil, Manuel, Linda Ohri<sup>1</sup>, and Ted Kasha<sup>2</sup>, <sup>1</sup>Department of Pharmacy Practice, and <sup>2</sup>Health Services Research and Patient Safety, School of Pharmacy and Health Professions, Creighton University, Omaha, NE.

**Purpose:** In analysis of data from a 2012 telephone survey of immunizing pharmacies in the Omaha Nebraska metropolitan area we assessed service availability based on geographic economic characteristics from the American Community Survey (U.S. Census Bureau).

**Methods:** We assessed the number of immunizing pharmacies located in medically underserved areas, and in zip codes by percent of population living below the federal poverty limit (FPL). Statistical analysis was conducted in SPSS.

**Results:** All 84 immunizing pharmacies provided influenza vaccine; varying proportions provided other commonly recommended adult immunizations. In 16 zip codes with low poverty levels (< 10% FPL), 88% of surveyed pharmacies (43/49) offered immunization services. Among 13 zip codes with moderate poverty levels (10 – 24% FPL), 74% of pharmacies (34/46) immunized. In 9 high poverty zip codes (25%-63% FPL), 78% of pharmacies (7/9) immunized. Most immunizing pharmacies (86%) were in designated medically underserved areas (MUAs) for high poverty zip codes, compared to 18% and 5% in moderate and low poverty areas. Immunizing pharmacy distribution was 0.27, 0.23, and 0.24 per square mile, and 0.81, 1.68 and 1.64 per 10,000 population by high, moderate or low poverty levels. Pharmacies in high, moderate and low poverty areas, respectively, offered the following vaccines: Pneumococcal: 86%, 79%, 77%; Shingles: 100%, 77%, 74%; and Tdap: 86%, 62%, 63%.

**Conclusion:** There were similar numbers of pharmacies available per square mile in high poverty areas, but twice the average population per pharmacy compared to lower poverty areas. Literature suggests that pharmacy capacity can be increased fairly readily for larger immunization demand. Immunizing pharmacies in high poverty areas were more likely to provide commonly recommended adult vaccines versus the moderate and high income areas. Pharmacies constitute an excellent access point for adult immunizations, with good geographic availability in high poverty areas.

93. **ANALYSIS OF ESSENTIAL MEDICATIONS FOR TREATMENT OF MENTAL AND BEHAVIOR DISORDERS**

Yavid, Stanislav, Paul L. Price, Department of Pharmacy Practice, School of Pharmacy and Health Professions, Creighton University, Omaha, NE.

**Purpose:** Every two years the World Health Organization (WHO) presents a Model List of Essential Medicines (MLEM) which serves as a guide for the development of national and institutional essential medicine lists. This study compared the medications included in the Medicines for Mental and Behavioral Disorders (MMBD) section of MLEM to the list of psychotropic medications selected by fourth year pharmacy students upon completion of an Adult Psychiatry Advanced Pharmacy Practice Experience (APPE).

**Methods:** Forty pharmacy students participated in a survey conducted at a private non-profit free standing psychiatric hospital and a private non-profit community hospital with acute psychiatric units. Participants were asked to compose an adult psychiatric formulary with five medications based on the experience and knowledge at the time of APPE completion. The survey responses were classified into nine categories including Psychotic Disorders (PD), Depressive Disorders (DD), Bipolar Disorders (BD), Anxiety Disorders (AD), Sleep Disorders (SD), Extrapyramidal Disorders (ED), and Alzheimer's Dementia.

**Results:** A total of 217 responses were recorded. Aripiprazole (37.2%), sertraline (39.5%), lithium (51.3%), and lorazepam (82.3%) were the most selected agents for use in PD, DD, BD, and AD respectively. Additionally, lorazepam was the most preferred AD agent (82.3%). Three of 9 response categories are not included in the MLEM: SD, ED, and Alzheimer's Dementia. A total of 18 responses (8.3%) were selected for treatment of SD.

**Conclusions:** The results showed lorazepam, aripiprazole, sertraline, and lithium are the most essential psychotropic medications. This contrasts WHO's selection as none of these medications are included in the MMBD section of MLEM. Consequently, these agents should be given a priority in development of a psychotropic formulary list for use in this Midwestern community. Furthermore, based on substantial amount of survey responses addressing treatment of SD, this category can be considered as an addition to future updates of MLEM.

94. **ASSESSING PROFESSIONAL STUDENTS' BELIEFS AND ATTITUDES ABOUT ACADEMIC MISCONDUCT**

Dalke, Brian, Jennifer A. Tilleman, Kelli Coover, Yongyue Qi, School of Pharmacy and Health Professions, Creighton University, Omaha, NE.

**Purpose:** The purpose of this study was to determine professional students' beliefs and attitudes about academic misconduct and to measure the reported rates of academic misconduct.

**Methods:** Current literature on academic misconduct was reviewed and a survey tool was developed. This survey was administered to all pharmacy, physical therapy, and occupational therapy students within Creighton University. The survey administered to students included Likert Scale questions, case-based questions, and open ended questions that assessed student beliefs and attitudes about academic misconduct. The survey administered was anonymous but demographic data was collected. The survey was administered online during the first two weeks of the spring 2015 semester so that we could report current grade point averages. The survey was available to students for two weeks and a reminder email was sent to all students one week after the initial request.

**Results:** The survey was sent to 1122 pharmacy, physical therapy, and occupational therapy students. 328 students responded to the survey. Of the students who responded to the survey, 47.9% attended a public university and 39.9% attended a private university prior to professional coursework. Of the students who attended a public university, 61% report that they would report a peer engaging in academic misconduct versus 41.2% of students who attended a private university report they would report a peer who engaged in academic misconduct. Of the students that responded to the survey, 17% perceive that academic misconduct is a problem within the School of Pharmacy and Health Professions.

**Conclusions:** Only 29.2% of students that were sent the survey responded. The authors believe that there is a possibility of selection bias due to the sensitive nature of the subject.

95. **AN EXPLORATION OF THE NEUROLOGICAL TECHNOLOGY USED WITHIN OCCUPATIONAL THERAPY**

Zellner, Kristin, Ricardo Altahif, Catherine Crivellone, and Jeremy Palmiscno, Department of Occupational Therapy, Creighton University, Omaha, NE.

**Objective:** This study aimed to discover the types of neurotechnology (NT) used by occupational therapists with patients who have a cerebrovascular accident, traumatic brain injury, or spinal cord injury, the perceived effectiveness of NT, and barriers to the use of NT.

**Methods:** Participants were OTR/Ls (N = 52) with greater than one year of clinical experience. Participants, obtained via a convenience sample, were given a survey containing open- and closed-ended questions regarding their perception on NT via BlueQ.

**Results:** The most frequently identified barriers to using NT included: complicated to use (34.6%), lack of training (61.5%), clinic time (38.5%), and the cost of NT (42.3%). Majority of participants (59.6%) indicated that NT can be an occupation-based treatment modality and (69.2%) a preparatory method. The most frequently used NT was the Mirror Box (n = 3) and REO (n = 1). Participants disagreed that NT was widely available in their practice setting (63.4%). Evidence was listed as the most important factor for the use of NT (M = 2.33).

**Conclusions:** Participants reported barriers to using NT, identified ways to overcome these barriers, and described their current perceptions towards NT. Responses were generally consistent regardless of participants' degree level, practice area, or years of experience.

**Significance:** Evidence-based research was identified as an important factor in using NT in the occupational therapy practice. Incorporating NT into OT treatment could possibly increase both the frequency and duration of therapy, but more research is needed in order to provide reimbursement for services. Further research should be conducted to build upon this study and increase evidence available to the OT profession.

96. **INTERNATIONAL CLINICAL EDUCATION IN OCCUPATIONAL THERAPY: CHALLENGES, BENEFITS, AND FUTURE CONSIDERATIONS**

Beribak, Amy, Keli Mu, and Sarah Colen, Department of Occupational Therapy, Creighton University, Omaha, NE.

**Purpose:** International clinical education is gaining popularity in teaching cultural competency to students in healthcare (Kinsella, Bossers, & Ferreira, 2008<sup>1</sup>). There is limited research that examines occupational therapy program leaders' perspectives on the operation of international clinical education (ICE). The purpose of this study was to identify the number of occupational therapy programs currently operating international clinical education; to determine the perceived barriers and benefits of conducting ICE by occupational therapy program leaders; and to explore future considerations in ICE implementation.

**Methods:** A mixed-methods study was used to incorporate quantitative and qualitative data. A self-developed questionnaire was sent to 158 occupational therapy programs in the United States. Eighteen surveys were returned complete. Telephone interviews were conducted in order to clarify survey responses.

**Results:** Perceived benefits of ICE for occupational therapy programs include increased program notoriety, cultural competency in students and faculty, research opportunities, and a draw for prospective students. Perceived challenges of ICE for occupational therapy programs include time required for preparation, logistics of the entire ICE experience, and funding. Future considerations include the type of international experience offered; communication with other programs to discover ICE best practices; and completing research on the international site.

**Significance:** This study provides valuable insight into the perceptions of occupational therapy program leaders regarding the benefits of ICE to students, faculty, and occupational therapy programs. The study also raises awareness to the challenges of operating ICE. In addition, the study provides advice about what occupational therapy programs are doing for successful preparation, operation, and management of ICE. This is the first study in occupational therapy literature that focuses on the program leaders' perspective.

<sup>1</sup>Kinsella, E. A., Bossers, A., & Ferreira, D. (2008). Enablers and challenges to international practice education: A case study. *Learning in Health and Social Care*, 7(2), 79-92.

97. **FAMILY-CENTERED CARE: A REVIEW OF THE UTILIZATION WITH ASD**

Hart, Matthew, Melissa James, Kristin Schneller, and Megen Wulf, Department of Occupational Therapy, Creighton University, Omaha, NE.

Autism Spectrum Disorders (ASD) are increasing in prevalence and children with ASD are commonly seen in early intervention settings to provide early comprehensive treatment. Family-centered practice (FCP) is considered a best practice within the field of pediatrics and recommended by the American Occupational Therapy association in the area of early intervention. Despite the evidence presenting effectiveness of FCP, there is little research on how FCP is used by occupational therapists in early intervention with children with ASD. The purpose of this study is to explore how early intervention occupational therapists are using FCP with children with ASD in regards to setting and age, examine the barriers that prevent FCP use, and understand specific education and preparation methods that teach FCP. The current study used a mixed-method cross-sectional survey design of 18 occupational therapists working in early intervention settings. Results show an increased use of FCP in early intervention with children aged birth to 3 compared with those aged 3-5. Participants in the current study represented similar norms on the MPOC-SP as compared with previous findings. Participants noted common barriers preventing the use of FCP: The administrative structure, settings of services, family motivation and willingness to participate, and time with family. Participants also noted they felt "somewhat prepared" for use of FCP with their patients and would prefer "a little more preparation" in this area. These findings indicate a trend toward increased use of FCP in early intervention with children of any diagnosis. However, there continues to be barriers that limit the use of FCP and further research is needed to explore how to overcome these barriers and sufficiently train occupational therapists in the concepts of FCP.

98. **INTERPROFESSIONAL EDUCATION: CHANGES IN STUDENT PERSPECTIVES AFTER ENGAGING IN AN INTERPROFESSIONAL COURSE FOCUSED ON VULNERABLE**

Flanagan, Emmylou, Maida Avdic, Michelle Wang, and Joy Doll, OTD, OTR/L, Department of Occupational Therapy, Creighton University, Omaha, NE.

The purpose of this study was to examine healthcare students' perceptions of their own abilities to work in IP teams, as well as focus on differences in perspectives between students who took an IPE course compared to healthcare students who do not take the course. This study utilized a quasi-experimental research design in the form of a nonequivalent posttest-only control group. Participants were a convenience sample of students from across healthcare disciplines at Creighton University. Complete data from the 21 participants' responses to the Attitudes Toward Health Care Teams (ATHCT) survey were analyzed using descriptive statistics. Nonparametric Mann-Whitney U tests were used to compare the median scores of the two groups. The only question that was shown to be statistically significant difference in participants' responses was "hospital patients who received interprofessional team care are better prepared for discharge than other patients." For every other item, there was no statistically significant difference between the two groups when analyzed. Further research utilizing a larger and more diverse interdisciplinary cohort should be included to assess the impact of an IPE course on student's self-perceptions of their own IP skills.

99. **HIPPOTHERAPY GOALS AND PROCESSES: A SURVEY OF PRACTITIONERS' CURRENT PRACTICE AND TRENDS**

Konecky, Katie, Kelsey Nenneman, Emma Trueblood, and Dr. Linda Gabriel, Department of Occupational Therapy, Creighton University, Omaha, NE.

Hippotherapy is a treatment technique used by licensed occupational, physical, and speech therapists using the movement of the horse as a treatment modality. In current literature a wide variety of hippotherapy methods exist with little consensus on best practices for age, client characteristics, intervention activities, and outcomes of therapy.

**Purpose:** The present survey aimed to determine current trends in hippotherapy with specific focus on clients served in hippotherapy, intervention activities used, therapist training, and future training needs.

**Methods:** This survey was distributed to licensed occupational and physical therapists currently utilizing hippotherapy in their practice. Speech therapists were excluded in order to focus on physical impairments.

**Results:** Results of the present study included 194 responses from 44 states including 87 occupational and 107 physical therapists which met all inclusion criteria.

**Conclusion:** The results of this study will inform best practices of hippotherapy to improve client outcomes and support evidence-based practice by describing the current practice and trends in hippotherapy as reported by licensed occupational and physical therapists.

100. **OCCURRENCE OF MEDICAL ERRORS AND REPORTING IN OCCUPATIONAL THERAPY IN HOSPITAL SETTINGS**

Todd, Kari, Linda S. Scheirton, Margaret R. Geraghty, Molly K. Ham, and Lindsay J. Records, Department of Occupational Therapy, Creighton University, Omaha, NE.

**Objective:** The purpose of this study was to determine incident reporting systems used by occupational therapists, training of use of these systems, and if occupational therapists report practice errors.

**Methods:** Participants included licensed and registered occupational therapists currently working in a Midwestern hospital setting (N = 37). The instrument used for data collection was a 19-question, anonymous online Blue Q survey.

**Results:** The results of this study indicated that although approximately 87% of participants reported being somewhat familiar to very familiar with the available reporting system at their hospital facility, only 52.38% always report witnessed errors and 23.81% frequently report witnessed errors.

**Conclusions:** Although this study supports previous literature's findings indicating a variety of reporting systems, training methods, and incidents of reporting by occupational therapists, more data is needed due to several study limitations including small sample size.



101. **PATIENT PREFERENCES AND SATISFACTION WITH EXERCISE PROGRAMS IN MANAGING SYMPTOMS OF LYMPHEDEMA**

Malone, Erin, Brooke Dentlinger, Stephanie Rinzel, and Alisa Rotman, Department of Occupational Therapy, Creighton University, Omaha, NE.

**Background:** Approximately one in five individuals in the United States develops lymphedema after breast cancer treatment. Lymphedema symptoms may interfere with a woman's ability to engage in daily activities. Literature indicates that exercise can be used to effectively manage lymphedema symptoms. However, there is lack of research on patient perceptions regarding the effectiveness of exercise in managing symptoms of lymphedema.

**Purpose:** The purpose of the study is to identify perceptions of patients with lymphedema regarding reasons for exercise choices, commitment to continuing their exercise programs, satisfaction with current exercise routines and functional outcomes, and confidence in using other methods of exercise to manage symptoms of lymphedema.

**Methods:** Within this concurrent mixed methods design, participants completed a customized survey. Participants were women (N = 6) 19 years or older, with lymphedema symptoms after breast cancer treatment who had exercised for treatment of lymphedema symptoms. Participants were receiving or had previously received services provided by a lymphedema therapist at an Omaha hospital.

**Results:** Results indicated that participants chose exercise methods for multiple reasons, a majority (n = 5) were committed to continuing their current exercise programs, all were satisfied with their current exercise routine, and all felt that exercise was helpful in increasing their ability to perform daily tasks, and a majority (n = 5) felt confident about engaging in new forms of exercise.

**Conclusions:** Some individuals who have lymphedema perceive that exercise is effective in managing symptoms. Exercise routines tailored to patient preferences are recommended to increase satisfaction, commitment, and confidence.

102. **CHRISTIAN BASE COMMUNITIES IN PERU: LESSONS FOR NORTH AMERICA**

Rainwater, Conan, Department of Theology, Creighton University, Omaha, NE.

**Purpose/Rationale:** This project was instigated because of an interest I developed of the Church in Latin America while on a summer faculty-led-study-abroad program to Peru through Creighton University. This research hopes to bridge the gap between the Churches of North and South America by advocating for Christian base communities in North America.

**Method:** In order to understand Christian base communities (CEBs), it is necessary to look at Catholic Action in conjunction with Catholic social thought, which was an early attempt to empower lay people in the Catholic Church. Second, it is important to take into account the Second Vatican Council, particularly its new idea of the Church as the People of God, whose responsibility is to transform the world in the direction of the Kingdom of God. Finally, it is helpful to speak to those involved with CEBs based on personal interviews in two districts of Lima, Peru – Villa El Salvador and El Agustino. After remarking on the failure of CEBs to develop in those two respective areas, it is possible to glean lessons for North America in addition to what CEBs could offer parishes in the United States.

**Results:** Despite the failure of CEBs to develop in Villa El Salvador and El Agustino, CEBs are relevant to North America as they can contribute lessons for parishes in the U.S.

**Conclusion:** The Catholicism in CEBs in Peru is not prevalent in North America because the standard is to focus on individual spirituality and of the lack of struggling together for survival.

**Acknowledgement:** This research is indebted to a research scholarship through the College of Arts and Sciences Dean's Fellowships at Creighton University.

103. **OPTIMIZATION OF THE DETERMINATION OF PROTEIN BY SPECTROPHOTOMETRY**

Hiyoto, Kimberly, Dr. Erin Gross, and Dr. Jess Gunn, Department of Chemistry, Creighton University, Omaha, NE.

The purpose for this study is to improve the accuracy of a bioanalytical experiment for Quantitative Analysis laboratory. In addition to reinforcing spectroscopy concepts, this experiment also provides an opportunity for students to learn to properly use a micropipette. Beginning with the standard Bradford Assay procedure, it was found that adding 10  $\mu\text{L}$  of 1M NaOH to the sample and plotting a calibration curve using a ratio of the solution's absorbance at 595 and 470 nm improved the sensitivity and precision of the calibration curve of the prepared standards. In addition, "unknown" samples with a concentration range of 25.0 to 45.0  $\mu\text{g/mL}$  had the greatest accuracy when using this modified procedure to calculate concentration. When analyzing the student data obtained from the original and modified procedures, generally the sensitivity of the calibration curve and accuracy of their calculated unknown concentration improved. This result means that this experiment is more reproducible and can be added back to the laboratory curriculum.

104. **ANTIMICROBIAL PROPERTIES OF 1,2,3-TRIAZOLE DERIVATIVES AND METAL COORDINATION COMPOUNDS**

Acacio, Danielle Dawn, and James T. Fletcher, Department of Chemistry, Creighton University, Omaha, NE.

The goal of this study was to synthesize various 1,2,3-triazole derivatives with aromatic substituents, utilize them to create 2:1 and 3:1 coordination compounds with metal ions, and to create a structure-activity relationship profile to assess the antimicrobial properties of both the ligands and complexes. Bidentate compounds were prepared using tandem copper-catalyzed click reactions with ethyl propiolate, varying benzyl bromide analogs and sodium azide. The ethyl ester functional group of the resulting compounds was converted to either carboxylic acid or tetrazole groups to form compounds that acted as anionic bidentate chelators. 2:1 metal coordination compounds were formed with these chelators using Fe(II), Zn(II) and Ag(I) salts. Tridentate compounds were prepared similarly from 6-trimethylsilylethynylpyridine-2-carboxyethyl ester. Saponification gave the corresponding carboxylic acid derivatives, resulting in analogs acting as anionic tridentate chelators. 2:1 metal coordination compounds were formed with these chelators using  $\text{RuCl}_3$  in triethylamine-alcohol environments at 80°C. 3:1 metal coordination compounds were also formed with these chelators using  $\text{Eu}(\text{OTf})_3$  and  $\text{Tb}(\text{OTf})_3$  in triethylamine and tetrahydrofuran at 50°C. Both the ligands and metal complexes were analyzed via  $^1\text{H}$  NMR in DMSO. Each compound and complex was assayed in a high-throughput manner using 96-well plates to find the minimum inhibitory concentrations against several gram-positive and gram-negative bacteria, as well as fungi. MIC values ranging from 4 to 250  $\mu\text{M}$  were observed, with activity varying as metal ion and ligand varied. Those compounds containing silver had the lowest MIC values, which was general for most analogs studied and attributed to the presence of Ag(I) itself. For the 3:1 Eu(III) and Tb(III) compounds the MIC values were analog dependent and activity increased significantly relative to ligand or metal controls, indicating a possible multivalent effect for these systems.

105. **DEVELOPMENT OF A MECHANISM FOR CONTROLLED RELEASE OF AN ANTIMICROBIAL AGENT**

Fischer, Kaitlyn<sup>1</sup>, Trevin Nishibun<sup>1</sup>, Mark A. Latta<sup>2</sup>, William A. McHale<sup>3</sup>, Stephen M. Gross<sup>1,2</sup>, <sup>1</sup>Department of Chemistry, <sup>2</sup>School of Dentistry, Creighton University, Omaha, NE, and <sup>3</sup>Premier Dental Products Company, Plymouth Meeting, PA.

**Purpose:** Antimicrobial agents can be used in many different applications, such as medical devices, wound dressings, fabrics, and numerous consumer products to protect against microbial growth for public health purposes. While there have been a variety of methods developed to deliver antimicrobial agents, there are challenges that remain to control the release profile of therapeutic agents, especially in the oral environment.

**Methods:** This project has focused on the development of microencapsulated antimicrobial agents. Microcapsules that contain an antimicrobial agent, specifically benzalkonium chloride, have been prepared. Four types of polyurethane were used to encapsulate different concentrations of aqueous solutions of benzalkonium chloride. Release profiles were set up for eight different types of microcapsules, and a method of detection was developed for sensing the release of benzalkonium chloride from the microcapsules.

**Results:** Release profiles were obtained and benzalkonium chloride was shown to release from each of the eight types of microcapsules when submerged in nanopure water.

**Conclusion:** Preliminary studies show a potential for release from the microcapsules. Future efforts will focus on incorporation of the antimicrobial agent into dental materials and identifying the key parameters for targeting desirable release profiles.

**Acknowledgements:** We thank the Premier Dental Products Company, the Creighton University School of Dentistry and College of Arts and Sciences, the NSF University-Industry Partnership Phase I and Phase II grants.

106. **ILAC WATER QUALITY PROGRAM: SUSTAINING RURAL DOMINICAN HOUSEHOLDS THROUGH EDUCATION AND EMPOWERMENT**

Byer, Stefano, James Barsetti, and Jakob Dovgan, Department of Chemistry, Creighton University, Omaha, NE.

The Institute for Latin American Concern (ILAC) is a Jesuit mission that for over 40 years has provided healthcare to impoverished, developing Dominican communities. ILAC works to create a system of healthcare overseers in communities, known as cooperadores. In educating cooperadores, ILAC has catalyzed a shift towards a sustainable public health model by focusing on the family. The Water Quality program is organized through ILAC and exists to create accessible sources of clean water to rural, Dominican households, a fundamental human right. The program has a focus on the personal responsibility of the family to sustain clean water through point-of-use filters in developing Dominican communities. Success in the program is reflected in longitudinal data collected from 16 common communities in 2009, with an average potability of 84.4% from 228 filter samples collected, to 2014, with an average potability of 90.7% from 346 filters. This data suggests that through educating, investing in, and empowering impoverished Dominican households, they too invest time and commitment to their own health and well-being through the filters. Through interpretation of this data, we can identify the effectiveness of the filtration and the impact of the program. In proper usage of the filter, Dominican households can have economical and feasible access to clean water with a decreased probability of exposure to water-borne pathogens. The Water Quality program model aims to establish a sustainable public health system with access to clean water and empowerment of rural households to commit to their own health.

107. **DOUBLE HYDRIDE REDUCTION TO 3-(2-PHENYLETHENYL)-2-METHYL-2-CYCLOHEXENONE**

Huang, Ricky, and Martin Hulce, Department of Chemistry, Creighton University, Omaha, NE.

The double hydride reduction to 3-(2-phenylethynyl)-2-methyl-2-cyclohexenone is known to synthesize a product with not only the hydride reductions but the formation of an allenyl group from the movement of electrons from the C2-C3 double bond to the ethynyl triple bonds. Given the closely similar organic compound, 3-(2-phenylethenyl)-2-methyl-2-cyclohexenone, it is possible that this structure may react analogously to that of 3-(2-phenylethynyl)-2-methyl-2-cyclohexenone's reaction with 2.2 Red-Al/THF. Upon analysis using <sup>1</sup>H NMR, gas chromatography, and mass spectroscopy, we have concluded that the first hydride reduction is done through an anti-1,2-addition. The second hydride reduction involves a syn-1,4-addition, resulting in an exocyclic Z-double bond.

108. **STERICALLY DIRECTED IMIDAZOLE SIDE CHAIN PROTECTION STRATEGIES FOR PREPARATION OF 4(5)-BENZYL-L-HISTIDINE PEPTIDE SYNTHESIS REAGENTS**

Brendan M. Cokingtin<sup>1</sup>, Kevin P. Cokingtin<sup>1</sup>, Martin Hulce<sup>1</sup>, Rhys T. Ishihara<sup>1</sup>, D. David Smith<sup>2</sup>, and Eric M. Villa<sup>1</sup>, <sup>1</sup>Department of Chemistry, and <sup>2</sup>Department of Biomedical Sciences, Creighton University, Omaha, NE.

Calcitonin gene-related peptide (CGRP) is a potent peptide vasodilator produced in the peripheral and central nervous systems. Binding of CGRP to its receptor causes dilation of cerebral and dural blood vessels, thought to be the source of nociception in migraine. The derivatized CGRP fragment N $\alpha$ -benzoyl-[4(5)-benzyl-L-His10]-CGRP(8-37) is a CGRP antagonist with 100-fold greater binding affinity compared to a standard antagonist, CGRP(8-37). To develop a high yield route to [4(5)-benzyl-L-His10]-CGRP(8-37) by solid-phase peptide synthesis using appropriately protected 4(5)-benzyl-L-His, preparations from L-His side-chain protected prior to Pictet-Spengler cyclocondensation with benzaldehyde and from Pictet-Spengler products using unprotected L-His which were subsequently protected were investigated.

109. **METAL ION DETECTION IN WATER USING GOLD NANOPARTICLE PAPER-BASED COLORIMETRIC ASSAYS**

Inagaki, Asia, and Dr. Erin Gross, Department of Chemistry, Creighton University, Omaha, NE.

**Purpose:** The ability to take laboratory practices and clinical readings to in-field environments has become more popular in recent times. Paper-based analytical devices (PADs) allow for portable and easy-to-use tests that do not require the expensive laboratory equipment to get similar results. The goal of this research project is to develop a method to detect metal ions such as strontium and calcium in water samples on a paper microfluidic surface.

**Methods:** This method required mercaptosuccinic acid-functionalized, citrate capped gold nanoparticles, which would aggregate and cause a visual colour change on the paper if the concentration of metal ions in solution were too high for human consumption. The concentration used for the spiked water samples ranged from 20-4000  $\mu$ M. This was initially done in a 96-well plate instead of on paper, and the results were analyzed using a UV-Vis spectroscopy and a plate reader. Once consistent, positive results were achieved, paper-based experimentation followed. To analyze the results, a scanner and camera phone were used to document the visual results, and Adobe Photoshop was used to analyze the picture.

**Results:** There was a colour change on the paper platform from red to blue with the addition of the spiked water, as well as nano-pure water. After analysis with Photoshop, a graph was made using the ratio of red-to-blue versus the concentration of the metal ion. There was a linear correlation for the lower concentrations, which is indicative of the numerical data agreeing with what was expected, as the concentration of metal ions decreases, the ratio of red-to-blue increases; even the visual analysis did not.

**Conclusion:** Further trials are being run to lower the limit of detection as well as attain consistent results. With the success of this research, cheap, on-site paper trials could be manufactured for quick quality checks on water sources.

110. **METHOD OPTIMIZATION FOR THE IDENTIFICATION OF PLANT OILS BY FTIR-ATR**

Larson, Mark, and David Dobberpuhl, Department of Chemistry, Creighton University, Omaha, NE.

The adulteration of plant oils potentially costs businesses and consumers millions of dollars when high-value oils are diluted with low-value oils. As plant oils largely consist of triglycerides with different fatty acid (FA) composition, the oils can be identified based upon the FA concentrations. Gas chromatography with flame ionization detection (GC-FID) is traditionally used to quantify FA composition and thus provide identification of the plant oil. Unfortunately, this technique is time-consuming and creates chemical waste because GC requires the triglycerides to be derivatized into their more volatile fatty acid methyl esters (FAMES) prior to analysis. Fourier-transform infrared attenuated total reflectance (FTIR-ATR) spectroscopy is a promising, "green" technique that can also be used to identify plant oils based on their fatty acid composition. Unlike GC-FID, FTIR-ATR requires no sample processing and analysis takes seconds rather than several minutes. Previous work investigated various IR spectral regions for the identification of various plant oils. Ultimately, four important spectral regions were identified and the transmittance in these four regions were averaged and converted to ratios during data analysis. The technique consistently discriminates oils, yet one of the identified regions correlates to an IR trans-C=C stretch. Since most plant oils typically contain negligible amounts of trans-fatty acids, other IR regions might better distinguish between plant oils. In work reported here, we identify other promising IR spectral region for discriminating between plant oils while also indicating something about the structure of the fatty acids present. Ultimately, the goal is to develop a fast, robust, and sensitive method for the identification of plant oils using FTIR-ATR.

111. **DEVELOPMENT OF A MICROCHIP-CAPILLARY ELECTROPHORESIS SEPARATION AND ELECTROCHEMILUMINESCENT DETECTION METHOD FOR BIOGENIC AMINES**

Schaffer, Leah, Emily R. Lowry, and Erin M. Gross, Department of Chemistry, Creighton University, Omaha, NE.

**Purpose:** This research, with Dr. Erin Gross in the Chemistry Department, uses carbon paste microelectrodes for electrogenerated chemiluminescence (ECL) detection of biogenic amines, where photons are produced by the reaction of biogenic amines with a chemiluminescent reagent. The intensity of the light is proportional to the concentration of biogenic amine in the sample, so ECL detection can be used to quantitate biogenic amines. Developing methods for the detection and quantification of biogenic amines is important because they cause food spoilage and can be harmful to humans.

**Method:** We are developing a capillary electrophoresis separation and detection method, which will be useful to analyze a sample that contains a mixture of biogenic amines. The detection

method will separate the mixture with an electric field, and then detect the chemiluminescence of each separated biogenic amine in order to quantitate each biogenic amine in a sample.

**Results:** This research began the experimental setup of the capillary electrophoresis (CE) method, including the setup of the avalanche photodiode, which will detect photons from the chemiluminescence reaction. An injection method to inject a sample plug into the separation channel using capillary electrophoresis was also determined.

**Conclusion:** This research began to design and build a new microchip-CE system, which uses CE to separate mixtures of biogenic amines, and then will detect each amine using ECL at carbon paste microelectrodes. Future work will continue to optimize the new microCE system. This work will involve proper alignment with the avalanche photodiode, and the optimization of buffer pH, ECL voltage, and separation voltages for biogenic amines.

**Acknowledgements:** This research was funded by the Ferlic Summer Science Research Scholarship and the Baumann Family Scholarship.

## 112. **OPTIMIZATION OF OXIDATION-DECARBONYLATION REACTION RATES OF CYCLONES**

Morken, Colleen, and Dr. Martin Hulse, Department of Chemistry, Creighton University, Omaha, NE.

In this organic photochemistry experiment, we have been trying to optimize the conditions to create singlet oxygen to react with phencyclone and tetraphenyl cyclone in an oxidation-decarbonylation reaction. We have been altering solvents, wavelengths and intensities of light, and sensitizers to shorten the time it takes for each darkly colored starting molecule to react to a colorless product endpoint. We synthesized tetraphenyl cyclones with methoxy or chloro substitutes to decrease or increase the cyclone-singlet oxygen HOMO-LUMO energy gap to explore the effect on reaction rate. Currently we have determined that 500W tungsten/halogen white light with rose bengal as a sensitizer for phencyclone and methylene blue as a sensitizer for tetraphenyl cyclone in dichloromethane provide the fastest rates. We need to further explore the effects that the methoxy and chloro groups have on reaction rates.

## 113. **REMOVAL OF FREE CHLORINE BY CERAMIC WATER FILTERS**

Oshiro, Merrie, Hanh Nguyen, and Dr. Gary Michels, Department of Chemistry, Creighton University, Omaha, NE.

Although United States municipalities have been using chlorine in tap water treatment for over 100 years, many developing countries still lack appropriate purification and waste management systems. Waterborne illnesses are a severe threat to the health of populations in countries, such as the Dominican Republic. Hypochlorous acid, which is common household bleach, has been shown to kill disease-causing agents present in untreated water. However, bleach-water reactions may result in a filtered product that has an unpleasant taste. It has been shown that the use of activated carbon in filtration systems aids in organic removal and dechlorination. This study focuses on determining the effectiveness of activated carbon-containing ceramic filter elements in the removal of free chlorine. These ceramic filter elements are currently being used in the water filters distributed to families in the Dominican Republic by Creighton University's Institute for Latin American Concern (ILAC). Five-gallon bleach solutions were prepared at a concentration appropriate for 30 days of daily use (150 mg/mL). The solutions were filtered for approximately 13.5 hours, and free chlorine concentration was measured by the N,N-Diethyl-p-Phenylenediamine (DPD) standard colorimetric method, using the Hach Pocket Colorimeter II. Based on the two-year study, it has been shown that the activated carbon filters are capable of effectively removing free chlorine for at least 4 years. Testing continues to determine how long the catalytic activity of the carbon will last.

114. **EXAMINATION OF BACTERIAL glmS RIBOZYME FUNCTION IN MAMMALIAN CELLS**

Shishido, Brent<sup>1</sup>, Garrett Soukup<sup>2</sup>, and Juliane Soukup<sup>1</sup>, <sup>1</sup>Department of Chemistry, and <sup>2</sup>Department of Biomedical Sciences, Creighton University, Omaha, NE.

Riboswitches are bacterial elements within messenger RNAs (mRNAs) that regulate gene expression through direct interactions with specific metabolites. The glmS riboswitch is also a catalytic RNA, or ribozyme, that undergoes self-cleavage upon binding the metabolite glucosamine 6-phosphate (GlcN6P). We examined whether the glmS ribozyme can function in mammalian cells as an artificial means of controlling gene expression. A dual luciferase assay was developed in which the glmS ribozyme resides in a messenger RNA encoding Photinus luciferase, where self-cleavage is expected to inhibit luciferase expression. Cells grown in various concentrations of glucosamine (GlcN) showed no change in luciferase activity that was specific to the ribozyme-containing mRNA versus an mRNA that lacks the ribozyme. Therefore, the glmS ribozyme does not appear to function in mammalian cells. However, further research will be required to determine if the lack of luciferase regulation in response to GlcN results from an inability of the glmS ribozyme to undergo self-cleavage in the context of the eukaryotic mRNA or cell.

115. **DRIVING FORCES OF THE STABILITY OF ALZHEIMER'S A $\beta$  AGGREGATES IN MODEL MEMBRANES**

Aoki, Brendy<sup>1</sup>, Colin Bertsch<sup>2</sup>, and Dr. Patricia Soto<sup>2</sup>, <sup>1</sup>Department of Chemistry, and <sup>2</sup>Department of Physics, Creighton University, Omaha, NE.

Alzheimer's disease is a common form of dementia to which there is no cure. Amyloid  $\beta$  (A $\beta$ ) peptides aggregate to assemble oligomers, protofilaments, and eventually fibrils; it is debatable what the most toxic species is. Recent findings suggest that cell membrane disruption induced by A $\beta$  aggregates triggers cytotoxicity. The goal of our research project is to gain insight into the mechanism by which A $\beta$  aggregates perturb the local environment of model plasma membranes. We use a continuum model to mimic forced translations of the protofilaments into a bilayer at varying depths. Our calculations suggest that the thicker the membrane, the more unfavorable the insertion of the protofilament. These results aid in the interpretation of experimental results in which the interaction between the A $\beta$  protofilament and the membrane is modulated by membrane composition.

116. **BIOCHEMICAL ENGINEERING AND OPTIMIZATION OF THE glmS RIBOSWITCH FOR USE AS A SYNTHETIC GENETIC DEVICE**

Poston, Daniel<sup>1</sup>, Brent Shishido<sup>1</sup>, Audrey Netzel<sup>1</sup>, Shweta Goswami<sup>1</sup>, Juliane K. Strauss-Soukup<sup>1</sup>, and Garrett Soukup<sup>2</sup>, <sup>1</sup>Department of Chemistry, and <sup>2</sup>Department of Biomedical Sciences, Creighton University, Omaha, NE.

**Purpose:** Synthetic biology is a rapidly emerging field focused on engineering biochemical systems and cellular functions for a variety of applications, including therapies for the treatment of infectious diseases and cancer, as well as tactics for vaccine development, microbiome engineering, cell therapy, and regenerative medicine. Many of the advances so far have involved engineering synthetic constructs for use in bacteria, but it is critical that synthetic biology tools be designed for use in mammalian systems. Riboswitches offer a unique set of "devices" for achieving synthetic gene regulation. This presentation describes results of the first investigation exploring the possibility of controlling mammalian gene expression via engineered insertion of the bacterial glmS riboswitch.

**Method:** Plasmids were prepared by genetically engineering the glmS riboswitch into a PMIR-GLO plasmid harboring genes for both firefly and renilla luciferase. DNA encoding the glmS riboswitch was inserted into the 3' UTR of firefly luciferase only. Control plasmids were generated using site-directed mutagenesis. Cells were transfected with the plasmids and grown in the presence or absence of either natural or artificial ligand. Cells were lysed and lysates were assayed by a Dual Luciferase Assay

**Results:** There was no statistically significant downregulation of luciferase expression in response to natural ligand. However, results show significant downregulation of all constructs in the presence of serinol, an artificial ligand.

**Conclusion/Significance:** Further research will involve improved design and operation of riboswitches as synthetic genetic devices, paving the way for the future use of riboswitches in controlling mammalian genes.

**Acknowledgement:** This work was funded by the Honors Program Summer Undergraduate Research Scholarship and the Baumann Family Scholarship.

\* Indicates Summer Faculty Fellow Recipient



## STUDENT ORAL PRESENTATION ABSTRACTS

### 1. PROTEIN PRODUCTION OF THE KPC ENZYME BETWEEN ST131 AND NON-131 E. COLI IS NOT EQUIVALENT

9:45 AM – Harper Center Room 3028A

Harrison, Lucas Yohei Doi and Nancy Hanson, Department of Medical Microbiology and Immunology, Creighton University, Omaha NE.

**Purpose:** Surveillance of antibiotic-resistant bacteria has been identified by a presidential council as key to managing the antibiotic-resistance crisis. E. coli sequence type 131 (ST131) is a widespread uropathogenic strain associated with the spread of the most common group of ESβLs, CTX-Ms. KPC carbapenemases found in ST131 raise concerns over rapid spread of this class of resistance gene and increasing carbapenem resistance in E. coli worldwide. This study evaluated whether KPC protein levels in ST131 differ from levels in non-ST131 E. coli strains.

**Methods:** Eleven KPC-producing E. coli clinical isolates (6 ST131, 5 non-ST131) were obtained from the University of Pittsburg Medical Center. blaKPC expression and production were evaluated with rt RT-PCR and Western blotting. Relative expression of blaKPC and protein production were determined by comparing strains to the lowest KPC-producing isolate, ST131 Doi001.

**Results:** ST131 blaKPC expression ranged from -2.0 fold to a 6.9 fold difference (blaKPC-Avg=2.5) and non-ST131 blaKPC ranged between -0.4-fold and 1.6-fold. (blaKPC-Avg=0.8). ST131 blaKPC expression averaged 3 times less than non-ST131 strains. KPC protein in ST131 ranged from 1 to 54-fold (KPC-Avg=21.2) greater than the comparator while non-131 strains ranged from 16 to 77-fold greater (KPC-Avg=39.4). Translational efficiency was evaluated by comparing expression to KPC production for both ST131 and non-ST131 E. coli. ST131 isolates showed translational efficiency of 8.5 (21.2 KPC-Avg/2.5blaKPC-Avg) while non-ST131 had a translational efficiency of 49.3 (39.4 KPC-Avg/0.8blaKPC-Avg). Between ST131 and non-ST131 (6.36/47.5), there is a 5.8-fold average decrease in translational efficiency in ST131 strains.

**Conclusions:** The 5.8-fold decrease in KPC production in ST131 compared to non-ST131 isolates suggests a regulatory mechanism governing translation of blaKPC transcripts. Average KPC production is less in ST131 than non-ST131 strains. These data indicate acquisition of blaKPC into ST131 strains will not differentially increase the number of carbapenem resistant E. coli.

**Funding Sources:** Streck, Merck

### 2. INNER EAR HAIR CELL LOSS AND STEREOCILIA DEFECTS IN MIR-183 FAMILY KNOCKOUT MODELS

10:00 AM – Harper Center Room 3028A

Pierce, Marsha Jennifer Kersigo, Bernd Fritsch, David Nichols, Garrett A. Soukup, Department of Biomedical Sciences, Creighton University, Omaha NE.

**Purpose:** Moderate to profound hearing loss is the most prevalent sensory defect affecting 360 million people worldwide and is the most frequent congenital anomaly affecting 3:1000 live births. MicroRNA-183 family (miR-183, miR-96, and miR-182) is highly conserved and coordinately expressed in neurosensory cells, and mutations in miR-96 lead to hair cell (HC) loss and

deafness in both humans and mice. To specifically investigate neurosensory miR-183 family member loss of function (LOF), miR-183/96 and miR-182 knockout (KO) mice were assessed.

**Methods:** miR-183/96 KO and miR-182 KO mouse lines were generated by and acquired from the Sanger Institute. Behavioral observations and Preyer's reflex were used to grossly assess HC function. HC loss and stereocilia defects in mice aged P0 to P180 were examined by immunofluorescence microscopy detection of MyoVIIa, scanning electron microscopy, and phase contrast microscopy of plastic embedded sections.

**Results:** In miR-183/96 KO mice, gross stereocilia disorganization was evident at P16, basal HC loss at P21, substantial middle turn and basal HC loss at P30, and mice exhibited no Preyer's reflex at any age. Interestingly, miR-183/96 heterozygous mice showed an age-related loss of Preyer's reflex beginning ~P60, with subtle HC disorganization and punctate HC loss. miR-182 KO mice showed HCs present in the apex and middle with inner HC stereocilia fusion and some outer HC disorganization, and exhibited an age-related loss of Preyer's reflex.

**Conclusions:** Results demonstrate that miR-183 family LOF leads to stereocilia defects and HC loss contributing to hearing and balance deficits, suggesting that each family member is required for HC maintenance and survival. Additionally, analysis of miR-183/96 heterozygous mice suggests that miRNA concentration or "dose" is crucial for HC function and survival. Understanding miR-183 family effects on target genes and pathways is expected to provide insight to approaches for preventing HC loss or stimulating regeneration of neurosensory cells.

### 3. **DUAL OREXIN RECEPTOR ANTAGONISM IMPROVES SLEEP DURING REST PHASE IN Kcna1-NULL BUT NOT WILD-TYPE MICE**

10:15 AM – Harper Center Room 3028A

Roundtree, Harrison Chaz C. Johnson, Stephanie A. Matthews, Timothy A. Simeone, Kristina A. Simeone, Department of Pharmacology, Creighton University, Omaha NE.

**Purpose:** This study was designed to test the effects of almorexant, a dual orexin receptor antagonist (DORA), on the Kcna1-null (KO) mouse, a model of epilepsy and co-morbid sleep disorder with pathophysiology in the orexin-rich area of the lateral hypothalamus, compared to wild-type (WT).

**Methods and Materials:** Mice were implanted with subdural cortical electroencephalography (EEG) and electromyography (EMG) electrodes under isoflurane anesthesia at P35. After 7 days of recovery, mice were given vehicle (25% DMSO in sterile saline, i.p.) followed by almorexant (100 mg/kg in vehicle) for 3 days each. Recordings were divided into 10s epochs and categorized into NREM, REM, and wake states. Total number of epochs and bouts (3 or more consecutive epochs of the same state) for each state were determined and analyzed using two-way ANOVA ( $p < 0.05$  was taken as a significant result). Seizures were scored by a blinded investigator. Number, duration, and severity on a modified Racine scale of seizures were all recorded based on EEG and behavior.

**Results:** KO mice spent significantly less time in NREM and REM than WT mice on vehicle. Almorexant significantly increased NREM sleep in KO mice. This effect can be attributed to an increase in the duration of NREM bouts rather than an increased incidence. Almorexant also decreased the latency to REM in KO mice. Interestingly, the same dose of almorexant had no significant effect on WT mice. Finally, almorexant had no effect on the incidence of seizures in KO mice, but significantly decreased the severity of seizures.

**Conclusions:** In this study, we demonstrate that treatment with a DORA is capable of improving sleep in the Kcna1-null mouse, a clinically relevant model of epilepsy with co-morbid sleep

disorder, at doses with no effect on wild-type mice during their rest phase. Additionally, almorexant was able to reduce severity of seizures in Kcna1-null mice. This is likely an indirect effect of improved sleep, but requires further investigation.

4. **ROLE OF POLO-LIKE KINASE-1 IN INTIMAL HYPERPLASIA IN SAPHENOUS VEIN GRAFT: POTENTIAL IMPLICATION IN VEIN-GRAFT DISEASE**

10:30 AM – Harper Center Room 3028A

Sur, Swastika Songchang Chen, Jeffrey T. Sugimoto, Devendra K. Agrawal, Department of Biomedical Sciences, Creighton University, Omaha NE.

**Rationale:** Coronary artery bypass grafting (CABG) is the choice of procedure in patients with multi-vessel or left main coronary artery disease. Patency of saphenous vein graft (SVG) significantly declines following surgery compared to internal mammary artery (IMA). Intimal hyperplasia is the key event in SVG failure. PDGF-BB is a major growth factor released at the site of pulsatile stretch- and shear stress-induced graft injury. Here, we examined, for the first time, the expression of PLK1 and its phosphorylation/activation in isolated human bypass graft conduits.

**Methods:** Human SV and IMA vessels were freshly collected, SMCs isolated and cultured. In cultured SMCs, effect of PDGF-BB was examined on total and phosphorylated PLK1 (pPLK1) by western blot analysis. Cell proliferation was measured using cell count.

**Results:** PDGF-stimulated SV SMCs had 5-fold increase in the density of pPLK1 and had 2-fold increase in the density of total PLK1. While in the PDGF-stimulated IMA SMCs, increase in pPLK1 was significantly lower than in SV SMCs. Also, this increase was not sustained. A PLK1 blocker inhibited PDGF-induced proliferation in both IMA and SV SMCs.

**Conclusion/Significance:** These data suggest a greater and sustained sensitivity of SV SMCs to PDGF-BB induced PLK1 activity than that of IMA. PLK1 blocker mediated inhibition of PDGF-induced IMA and SV SMCs proliferation demonstrate differential activity of PDGF-induced PLK1 activation, which was greater in SV SMCs than in IMA. This could explain the development of intimal hyperplasia in SV conduits than the IMA following CABG. Thus, inhibition of PLK1 could be a target in developing better therapeutic approach to prevent vein-graft disease.

**Acknowledgment:** This work is supported by NIH R01HL090580 grant awarded to DK Agrawal.

5. **EFFECT OF YOHIMBINE AND CLONIDINE ON FEAR-RELATED BEHAVIORS OF NOVEL DxH RECOMBINANT INBRED MICE**

10:45 AM – Harper Center Room 3028A

Wickramasekara, Rochelle Akkoseoglu S, Yilmazer-Hanke D, Department of Biomedical Sciences, Creighton University, Omaha NE.

**Purpose:** Exaggerated fear can induce an emotional imbalance causing anxiety disorders. Fearful C3H-like recombinant inbred (C3HLRI) mice have enhanced basal tissue norepinephrine (NE) levels and show a poor NE response to stress challenge as seen in patients with principal fear disorders. Yohimbine (YOH) is an  $\alpha_2$ -adrenergic receptor antagonist which promotes panic-like symptoms in anxiety disorders, while the  $\alpha_2$ -adrenergic receptor agonist Clonidine does the opposite. Moreover, chronic stress was shown to increase oxidative stress in the rodent brain. Here, we use YOH and Clonidine to test the hypothesis that fearful/stress-prone C3HLRI mice are a model for principal fear disorders and examine whether a chronically-stressed status leads to enhanced oxidative stress in these mice.

**Methods:** C3HLRI and control DBA/2J mice received i.p. injections of Yohimbine, Clonidine or Saline (8-10 mice/group). Locomotor activity and anxiety-related measures were assessed in the open field test 30 minutes after drug injection. Separate sets of mice were subjected to cue fear conditioning where they received the same doses of drug/saline 30 minutes before fear recall. Oxidative stress was studied in the brain by measuring the ratio of oxidized to total Glutathione levels.

**Results:** In the open field test, YOH reduced locomotor activity in both strains in a dose-dependent manner, whereas anxiety-like behavior was increased in C3HLRI but not control DBA/2J mice. The auditory cue fear conditioning test showed that YOH induces a deficit in fear extinction in both strains. No strain difference in Glutathione levels was observed in four brain regions studied.

**Conclusion:** The findings indicate that YOH administration causes an extinction deficit in both mouse strains. However, oxidative stress does not seem to be involved in inducing a fear phenotype in C3HLRI mice or other mechanisms may compensate monoamine-induced changes in oxidative stress in our mice.

**Acknowledgments:** Funded through NIH-CoBRE 8P20GM103471-09 and LB692 to Deniz Yilmazer-Hanke.

## 6. **SIGNIFICANCE OF BMI ON PHYSICAL WORKING CAPACITY AT THE FATIGUE THRESHOLD**

11:00 AM – Harper Center Room 3028A

Busboom, Morgan Marc Petrykowski, Sam Troia, Anne Sullivan, Gwen Devonshire, Ben Kohler, Cortney Kelley, Nick Hiraoka,, Department of Exercise Science and Pre-Health Professions, Creighton University, Omaha NE.

The purpose of the present study was to examine the effects of BMI on the physical working capacity at the fatigue threshold (PWCFT) during incremental cycle ergometry. Based on previous investigations, it was hypothesized that BMI will have an effect on the PWCFT. Eighteen adults (4 women and 14 men; mean age  $\pm$  SD = 20.7  $\pm$  1.1 yr; mean body weight  $\pm$  SD = 78.70  $\pm$  16.90 kg; mean height  $\pm$  SD = 180.00  $\pm$  10.00 cm; 24.9  $\pm$  3.8 kg/m<sup>2</sup>) volunteered to participate in the study. Body weight was measured to the nearest 0.1 kg and height was measured to the nearest 0.5 cm using a calibrated physician's scale. BMI was calculated by taking the weight divided by the height (kg/m<sup>2</sup>). Subjects were divided (at the median BMI value of 25 kg/m<sup>2</sup>) into two groups of high (n=9) and low (n=9). The results of the independent t-test indicated no significant mean differences (p= 0.46) between PWCFT for the high BMI group (212.5 W  $\pm$  42.5 W) vs. PWCFT for the low BMI group (209.7 W  $\pm$  49.1 W). The non-significant difference in the mean PWCFT between the two groups indicated that BMI may not have an effect on EMG-amplitude based assessment of neuromuscular fatigue during cycling. Due to the well established adverse effect of body fatness on exercise performance, the current results also suggest that BMI may not be an acceptable measure that can relate body fatness and exercise performance, due to the inability of BMI to discriminate between the amount of composition between fat-free mass and fat mass.

7. **CYBORG BEAST: AN OPEN SOURCE LOW-COST 3D-PRINTED PROSTHETIC LINE FOR CHILDREN WITH UPPER-LIMB DIFFERENCES\***

1:15 PM – Harper Center Room 3028A

Carson, Adam J. M Zuniga Ph. D, D. Katsavelis Ph.D., M. Petrykowski, and L. Ploutz-Snyder, Ph.D., Department of Exercise Science and Pre-Health Professions, Creighton University, Omaha NE.

**Purpose:** The aim of this preliminary investigation was to design a low-cost three-dimensional (3D)-printed prosthetic hand for children with upper-limb reductions and propose a prosthetic fitting methodology that can be performed at a distance. We hypothesized that anthropometric measurement of the upper limbs taken from photographs and processed by image editing software would not differ from anthropometric measurements taken directly on upper limbs. **Methods:** Nine children (two girls and seven boys, 3 to 16 years of age) with upper-limb reductions (one traumatic and eight congenital) were fitted with our low-cost 3D printed prosthetic hand. Seven separate two-way repeated measures ANOVAs [2 x 2; hand (affected versus non-affected) x fitting procedures (direct versus photographs)] were performed to analyze the data. A p-value of  $\leq 0.05$  was considered statistically significant for all comparisons. The results of the two-way repeated measures ANOVAs showed no significant mean difference between the anthropometric measures taken directly on the subject's upper limbs and those taken from the photographs. There were no significant two-way interactions for repeated measures ANOVAs performed for hand x fitting procedures. There was a significant main effect, however, for hand (affected versus non-affected), with no significant main effect for fitting procedures (direct versus photographs). **Discussion:** This investigation describes a low-cost 3D-printed prosthetic hand for children and proposes a distance fitting procedure. The Cyborg Beast prosthetic hand and the proposed distance-fitting procedures represent a low-cost alternative for children in developing countries and those who have no access to health care providers. Further studies should examine the functionality, durability, benefits, and rejection rate of this type of low-cost 3D-printed prosthetic device.

8. **THE EFFECTS OF MUSCLE CROSS SECTIONAL AREA ON THE PHYSICAL WORKING CAPACITY AT THE FATIGUE THRESHOLD**

1:30 PM – Harper Center Room 3028A

Barry, Meghan Dr. Jorge Zuniga, Makenna Brown, Bill Garnett, Zach Hadden, Paul Nguyen, Geoffrey Supplee, Claire Svoboda, Department of Exercise Science and Pre-Health Professions, Creighton University, Omaha NE.

The purpose of this study was to examine the effects of quadriceps cross-sectional area (CSA) of the dominant quadriceps muscle in the assessment of the physical working capacity at the fatigue threshold (PWCFT) during incremental cycle ergometry. Eighteen adults (9 men and 9 women; mean age  $\pm$  SD = 20.5  $\pm$  1.04 yr; mean body weight  $\pm$  SD = 73.9  $\pm$  18.2 kg; mean height  $\pm$  SD = 172.3  $\pm$  11.5 cm; mean dominant quadriceps CSA  $\pm$  SD = 68.7  $\pm$  14.5 cm<sup>2</sup>) performed an incremental cycle ergometry test to exhaustion while the electromyographic (EMG) signals were recorded from the vastus lateralis (VL) muscles. Fatiguing and non-fatiguing power outputs were differentiated by examining the slope coefficients for the EMG amplitude versus time relationship at each power output throughout the incremental cycle ergometry test. The equation developed by Housh et al. was used to estimate quadriceps CSA for each subject (8). Subjects were divided into groups of small quadriceps CSA (57.3  $\pm$  10.0 cm<sup>2</sup>) and large quadriceps CSA (80.0  $\pm$  7.6 cm<sup>2</sup>). Independent t-test results indicated no significant mean differences between the PWCFT for the large and small quadriceps CSA groups (p=0.456). Therefore, the PWCFT may be a determinant of neuromuscular fatigue independent of muscle CSA.

9. **CO-EXPRESSION OF Atoh1 AND miR-183 FAMILY IN PLURIPOTENT STEM CELLS TO PROMOTE INNER EAR HAIR CELL FATE**

1:45 PM – Harper Center Room 3028A

Ebeid, Michael Prashanth Sripal, Jason L. Pecka, Timothy M. Hallman, Kirk W. Beisel, Garrett A. Soukup, Department of Biomedical Sciences, Creighton University, Omaha NE.

**Purpose:** A barrier to hearing restoration after inner ear sensory hair cell (HC) loss is the inability of mammalian auditory HCs to spontaneously regenerate. Guiding pluripotent stem cells (PSCs) toward a HC fate represents a potential method for HC regeneration that might be achieved by using factors crucial for HC development. Atoh1 is widely accepted to be necessary and contextually sufficient for driving HC fate. Furthermore, the miRNA-183 family is known to be expressed at the time of HC differentiation. We propose that a combination of Atoh1 and miR-183 can drive HC fate in PSCs.

**Methods:** We have developed plasmid vectors (pVs) co-expressing miR-183 family, Atoh1, and red fluorescent protein (RFP). HEK293 cells were used to validate protein expression by western blot analysis, RFP expression by flow cytometry, and miRNA expression by quantitative RTPCR. Mouse pluripotent stem cells (mPSCs) were transfected with pVs, and RFP-positive cells were sorted using fluorescence activated cell sorting. Gene expression profiling was assessed using Affymetrix Mouse Gene ST Arrays and validated by quantitative RTPCR. Transfected mESCs were used to generate embryoid bodies (EBs) in suspension culture, and subsequent cryosectioning and immunostaining was performed.

**Results:** In HEK293 cells, vectors functioned as expected by yielding Atoh1, RFP and miRNA expression. Atoh1 expression caused down-regulation of the pluripotency markers, and up-regulation of notch ligands and multiple transcription regulators (Hes6, Lbh, Pknox2, Id2, Id1, Nr2f2 & Pou3f1). EB analysis showed myo7a positive cells not associated with F-actin enrichment. Quantification of the number of these cells per EB showed no difference across conditions.

**Conclusions:** Our analysis indicated numerous targets for Atoh1 in mPSCs, some of which can be associated with HC development. miR-183 family had relatively less effect on mPSCs transcriptome, but appeared to fine-tune Atoh1-mediated changes in gene expression.  
Acknowledgments: Nebraska LB606 and LB69, and NIH P20GM103471

10. **DEVELOPING A MODEL FOR AGN STRUCTURE USING MIR SPECTRAL DATA**

2:00 PM – Harper Center Room 3028A

Hagen, AJ and Ryan Ford, Department of Physics, Creighton University, Omaha NE.

Active Galactic Nuclei (AGN) occur in a significant portion of observed galaxies. Over the past decade, NASA's Spitzer Space Telescope has produced Mid-Infrared (MIR) spectra of many AGN. By studying these MIR spectra, we can learn many things about the composition of the AGN, in terms of both material and spacial distribution of this material. Additionally, we can learn about any obstructing medium between us and the AGN. We compare two separate populations of AGN: Those with and those without mass outflows. Then, we look for spectral features unique to either population. In doing so, we can create physical models describing the AGN's makeup and shape, as well as describing any material between the AGN and our observing position. In particular, we seek to identify whether differences in these spectra are caused by possible changes to AGN over time, described by an evolutionary model, or whether the alignment of the AGN reveals features sometimes, and obscures them others, consistent with an orientation model. These models are not necessarily exclusive of one another, so we also explore how to

identify features coming from each model but occurring in the same spectrum. This research was funded in part by the NASA Nebraska Mini Space Grant.

11. **SMALL RNA SEQUENCING ANALYSIS OF INNER EAR FROM CONDITIONAL NOCKOUT MICE WITH HAIR CELL-SPECIFIC DGCR8 OR DICER1 DELETION**

2:15 PM – Harper Center Room 3028A

Pandya, Isha Marsha L. Pierce, Colby W. Bradfield, Sharalyn M. Steenson, Garrett A. Soukup., Department of Biomedical Sciences, Creighton University, Omaha NE.

**Purpose:** Damage to mechanosensory hair cells (HCs) of the inner ear (IE) leads to permanent hearing loss, which warrants investigation of small RNAs, namely endogenous small interfering RNAs (siRNAs) and canonical microRNAs which are known to affect HC development and maintenance. microRNA biogenesis requires both Dgcr8 and Dicer1, whereas siRNA biogenesis requires only Dicer1. Conditional knockout (CKO) of Dgcr8 shows disorganized HC stereocilia and mild HC loss at 1-2 weeks of age, whereas Dicer1 CKO exhibits little stereocilia aborations or HC loss at 2 weeks of age. We hypothesize microRNAs are more depleted in Dgcr8 CKO HCs compared to Dicer1 CKO HCs.

**Methods:** HC-specific Dgcr8 CKO and Dicer1 CKO mice were generated using Atoh1-Cre. Total RNA was isolated from the IEs of two biological replicates from Dgcr8 CKO, Dicer1 CKO, and control mice. Small RNA content was examined by Illumina small RNA sequencing. Normalized reads were analyzed to determine microRNAs and potential siRNAs that exhibited at least twofold differences in abundance between CKO and control. Statistical significance ( $p < 0.05$ ) was determined using Student's t-test.

**Results:** For Dgcr8 CKO versus control, there was 1 downregulated and 0 upregulated microRNAs with at least twofold statistically significant change in expression. In contrast Dicer1 CKO showed 25 downregulated and 11 upregulated microRNAs. Notably, microRNA-96, a known HC-specific microRNA, was significantly downregulateed in both groups. Potential siRNAs showed relatively low abundance compared to microRNAs and were unchanged in the Dgcr8 CKO whereas there were 19 downregulated and 20 upregulated in the Dicer1 CKO.

**Conclusion:** Dicer1 CKO IE exhibited a depletion of microRNAs, whereas Dgcr8 CKO IE showed little microRNA depletion, suggesting that Dgcr8 CKO might affect messenger RNA expression. Further analysis of the relatively low abundant potential siRNAs might indicate an association of target genes that could influence HC fate.

**Acknowledgements:** NIH-NIDCD R01DC009025.

12. **OUTER MEMBRANE PROTEIN EXPRESSION IN CTX-M PRODUCING ESCHERICHIA COLI CLINICAL ISOLATES**

2:30 PM – Harper Center Room 3028A

Suelter, Corey and Nancy D. Hanson, Department of Medical Microbiology and Immunology, Creighton University, Omaha NE.

**Objectives:** Outer membrane proteins (omps) are the primary route of entry for  $\beta$ -lactam antibiotics in Gram negative organisms. CTX-M extended-spectrum  $\beta$ -lactamase (ESBL) enzymes are the most common and widespread of the ESBLs, and confer resistance to cephalosporins yet remain susceptible to carbapenems. Downregulation of OmpC in E. coli has been associated with decreased susceptibility to carbapenems. The objective of this study was to assess the expression of omps in CTX-M-producing E. coli clinical isolates and evaluate their

susceptibility to carbapenems. **Methods:** The expression of ompA, ompC, and ompF was determined using real-time RT-PCR from three biological replicates. A wild-type strain of *E. coli* (K12) was used as a comparator, and relative fold-change in expression was calculated using the equation  $2^{-\Delta(\Delta CT)}$ . Susceptibility to carbapenems was determined by disc diffusion and interpreted using CLSI guidelines. **Results:** No difference was observed in ompA expression compared to K12. All isolates showed a decrease in the expression of ompC and ranged from 14.2 to >100-fold decrease when compared to ompC expression in K12. 8/9 isolates showed a decrease in ompF expression ranging from 1.5 to 4.2-fold and the remaining isolate had a 15.1-fold increase in ompF expression compared to K12. All isolates were susceptible to the carbapenems. **Conclusions:** Variation in omp expression was observed for all three omp genes in the clinical isolates evaluated. The most significant variance in expression was observed in ompC compared to that of ompA and ompF. These data suggest that ompC is downregulated in clinical isolates producing CTX-M  $\beta$ -lactamases, however no decrease in susceptibility to carbapenems was observed in the evaluated clinical isolates. **Acknowledgements:** This research was funded by Streck Inc.

13. **IDENTIFICATION OF OXA-CARBAPENEMASE GENES IN CLINICAL ISOLATES OF ACINETOBACTER SPP. COLLECTED FROM SAUDI ARABIA**

2:45 PM – Harper Center Room 3028A

Schroeder, Sara and Nancy Hanson, Department of Medical Microbiology and Immunology, Creighton University, Omaha NE.

**Purpose:** Carbapenems are the most potent  $\beta$ -lactam antibiotics available for therapeutic use, but the spread of carbapenemases are threatening the utility of this drug. *Acinetobacter* spp. are an emerging multidrug resistant pathogen known to carry OXA-carbapenemases. Three types of OXA-carbapenemase genes have been identified in different isolates of *Acinetobacter* spp. ; OXA-23-like, OXA-24-like, OXA-58-like, with all *A. baumannii*(ab) carrying a chromosomally encoded OXA-51-like gene. The purpose of this study was to evaluate 50 clinical isolates of *Acinetobacter* spp. collected from Saudi Arabia for carbapenem susceptibility and the presence of OXA-carbapenemases.

**Methods:** Fifty clinical isolates of *Acinetobacter* spp. were collected from a hospital in Saudi Arabia. Doripenem, meropenem, and imipenem susceptibilities were evaluated using agar dilution and interpreted by CLSI guidelines. PCR was performed using Taq polymerase with OXA-23, 24, 51 and 58 specific primers. Clonality was determined by pulsed field gel electrophoresis.

**Results:** 36/50 of the isolates were OXA-23-like(+). 43/50 were OXA-51-like(+) confirming them as *A. baumannii*. No isolates were positive for OXA-24-like or OXA-58-like genes. 41/50 of isolates were resistant to meropenem, 38/50 were resistant to doripenem, and 37/50 were resistant to imipenem. 19 clonal groups were identified and the largest group contained 19 isolates. 26/50 isolates showed no relationship to any of the isolates evaluated using PFGE. In the largest PFGE group, 13/19 were OXA-23(+)/OXA-51(+), 3/19 isolates were OXA-23(+)/OXA-51(-), 2/19 isolates were OXA-23(-)/OXA-51(+), and 1/19 isolates was OXA-51(-)/OXA-23(+) and susceptible to all carbapenems tested.

**Conclusions:** OXA-23 was the most prevalent acquired OXA- carbapenemase in the isolates evaluated but not all of the *Acinetobacter* isolates were *A. baumannii* and must be described as *Acinetobacter calcoaceticus-baumannii* complex. OXA-23 is known to be harbored on plasmids and the PFGE data suggest that this gene has mobilized to some but not all of the ab isolates evaluated in this study.

**Funding sources:** Streck



14. **PROGRESSIVE CEREBELLAR ATROPHY IN THE COURSE OF HYPERTROPHIC OLIVARY DEGENERATION (HOD)**

3:00 PM – Harper Center Room 3028A

Insera, Christopher and Angel Mironov, School of Medicine, Creighton University, and Alegent Creighton Medical Center Omaha NE.

**Purpose:** Injury to the dentato-rubro-olivary pathway of the brain may generate a unique pathological and imaging condition called HOD. We present two cases with classic acquired features of HOD associated with progressive cerebellar atrophy very late in the disease. This progressive global cerebellar atrophy has not been considered previously in the context of HOD.

**Methods:** The first case describes a 50 year-old male who suffered a symptomatic pontine hemorrhage due to a cavernoma and was followed 10 years after surgery. The second case describes a 32 year-old female with a history of systemic lupus erythematosus who developed vasculitis with lacunar insults of the brainstem. This patient was followed five years after the first onset. Both patients were evaluated using imaging studies.

**Results:** The first patient was found to have an abnormal T2 symmetrical signal in the olives of the medulla oblongata bilaterally 10 months after surgery. Later, the patient developed progressive diplopia, numbness, poor coordination, dysarthria, and intractable tremor. Repeated imaging over the following 10 years revealed progressive general cerebellar atrophy. Repeated MRI of the second patient revealed abnormal T2 hypersensitivity of the olives involving the entire medulla oblongata. Subsequent imaging showed persistent abnormal T2 signals in the olives, shrinking of the superior medulla, and significant progressive atrophy of the pons and cerebellum.

**Conclusions:** The progressive involvement of the cerebellum in these cases may suggest similarities with the autosomally inherited cerebello-olivary degeneration of Holmes. The evolution of acquired HOD may suggest that the primary injury of the dentato-rubro-olivary pathway may have either the same impact on the cerebellum or that the injury of the pathway may be suitable for the generation of acquired olivopontocerebellar degeneration.

15. **RELATIONSHIP BETWEEN CENTRAL AND PERIPHERAL MEASURES OF QUADRICEPS FUNCTION FOLLOWING KNEE SURGERY**

3:15 PM – Harper Center Room 3028A

Palimenio, Marcus Terry L. Grindstaff, Department of Physical Therapy, Creighton University, Omaha, NE, Department of Physical Therapy, Creighton University, Omaha NE.

**Purpose:** Decreased quadriceps strength is a common impairment following knee joint surgery and has a negative impact on function. Quadriceps strength is known to be influenced by muscle morphology (muscle fiber type, muscle thickness), but descending mechanisms are less understood. The purpose of this study was to determine the relationship between central and peripheral measures of quadriceps function following anterior cruciate ligament reconstruction (ACL-R) or arthroscopic partial meniscectomy.

**Methods:** Thirty-six individuals (age=24.7±5.4 years, height=175.3±11.8 cm, mass=79.3±15.0 kg; IKDC=74.5±18.4) with a history of ACL-R or arthroscopic partial meniscectomy volunteered for this study. Quadriceps strength was obtained during a maximal voluntary isometric contraction (MVIC) and was normalized to body mass (Nm/kg). Active motor threshold (AMT) was used to quantify central contributions using transcranial magnetic stimulation. A resting twitch (RT) was

used to quantify peripheral contributions to quadriceps function and was applied via a percutaneous electrical stimulus with the quadriceps muscle in a relaxed state. Correlations between outcome measures were determined using Pearson product-moment correlation coefficients.

**Results:** Descriptives for the outcome measures are as follows MVIC ( $2.62 \pm .83$  Nm/kg), AMT ( $40.4 \pm 9.6$ ), RT ( $1.19 \pm .32$  Nm/kg). There was a significant negative correlation with MVIC and AMT ( $r = -.489$ ,  $P = .003$ ) and a significant positive correlation with MVIC and RT ( $r = .718$ ,  $P < .001$ ).

**Conclusion:** The results of this study indicate the relevance of both central (AMT) and peripheral (RT) contributions to quadriceps strength following knee joint surgery. This information may be valuable for clinicians to better address the neurological causes of quadriceps weakness following knee surgery.

16. **LIVING THE CHANGE, SHARING THE MESSAGE: NORTHEAST MISSOURI'S SUSTAINABLE INTENTIONAL COMMUNITIES**

9:45 AM – Harper Center Room 3028B

Benevento, Maria , Department of Theology and Department of American Studies, Creighton University, Omaha NE.

**Purpose:** To gain an understanding of the practices and beliefs of the members of Northeast Missouri's sustainable intentional communities, especially related to the interaction of spirituality with sustainable and simple living.

**Methods:** Participant observation at five sustainable intentional communities, and interviews of members, interns, apprentices, and guests.

**Results:** Lifestyles in all five communities are characterized by careful and non-typical technology use. Community members make many choices out of concern for the environment, yet also consider which are most beneficial for human health, spirituality, and relationships. They often believe that simpler technologies based in the natural world can provide benefits for humans that the most recent science cannot. However, members also discover that their technology use may also separate them from outsiders that they wish to connect with or influence. Some complex modern technologies provide practical communication tools, while others make community life appear less demanding to potential new members, or simply make communities seem less strange to outsiders. Lifestyles vary among the communities because each chooses different strategies, compromises, and priorities to cope with this double effect of technology.

**Significance:** Much of the existing literature focuses on intentional communities' successfulness, but this research shows that the question of success is more complicated since the communities have numerous and conflicting goals. It also shows that community members' attitudes toward technology can be more complicated than simple rejection or acceptance.

**Acknowledgement:** Funded by CURAS Summer Research Grant

17. **BEYOND RACISM: POPULATION, BIOPOWER, AND THE ABNORMAL IN MICHEL FOUCAULT**

10:00 AM – Harper Center Room 3028B

McGuire, Mara , Department of Philosophy, Creighton University, Omaha NE.

For many years Michel Foucault's analysis of race and racism received limited attention among critical race theorists and Foucault scholars. While Foucault did not attempt to write a comprehensive theory of race and racism, these ideas occupy a pivotal role in "Society Must Be Defended," where Foucault offers a larger analysis of power. "Society Must Be Defended" is Foucault's most sustained discussion of race and similar themes also appear in the first volume of The History of Sexuality and "Abnormal." In this paper, I analyze Foucault's idea of "internal racism," which he claims emerged as a new form of racism at the start of the nineteenth century. In doing so I focus on Foucault's ideas of population, "biopower," and the category of the "abnormal." Finally, I argue that internal racism is a powerful explanatory tool for making sense of how the controls that society uses to discriminate against, correct, punish and cure certain classes of people may be understood as a form of racism.

**Acknowledgement:** This project was graciously funded through Creighton University's College of Arts and Sciences Undergraduate Research Scholarship.

18. **THE EFFECT OF INFORMATION ON JUDICIAL BEHAVIOR**

10:15 AM – Harper Center Room 3028B

Moe, Brady, Department of Political Science, Creighton University, Omaha NE.

My paper tests what effect information, in the form of oral arguments and litigant briefs, has on the voting behavior of Supreme Court justices. Literature suggests that information, whether oral or written, effects political actors in different ways. Data was collected from Justice Harry Blackmun's evaluation of the quality of oral arguments presented before the court, and from briefs collected on the Lexis-Nexis database. I then examine whether the increased quality of oral argument and the readability of litigant's briefs influences the way a Supreme Court justice will vote in a given case. Results show a strong correlation between quality of oral argument and influence with justice vote; however, results do not show such a correlation with readability of litigant briefs.

19. **THE EFFECTS OF CARDIORESPIRATORY FITNESS ON THE ASSESSMENT OF THE PHYSICAL WORKING CAPACITY AT THE FATIGUE THRESHOLD**

10:30 AM – Harper Center Room 3028B

Sommerhalder, Mariah Alex Heimes, Larissa Hamada, Olivia Chambers, Julia Hummel, Emily Esch, Courtney Cousler, Department of Exercise Science and Pre-Health Professions, Creighton University, Omaha NE.

The purpose of this study was to determine if the overall cardiorespiratory fitness affects the physical working capacity at the fatigue threshold (PWCFT). It was hypothesized that higher VO<sub>2</sub>max will result in a delayed onset of fatigue as measured by the physical working capacity at the fatigue threshold. Twelve adults (Mean ± SD age = 20.83 ± 0.94; body weight = 71.4 ± 27.3 kg) performed an incremental cycle ergometry test to exhaustion while electromyographic (EMG) signals were measured from the vastus lateralis (VL) from dominant leg. The independent t-test showed a significant difference (p=0.005) in the power output for high VO<sub>2</sub>max (250 ± 77.05 W) versus low VO<sub>2</sub>max (145.83 ± 20.21 W). These findings suggested that individuals with higher

VO2max are able to exercise longer without evidence of neuromuscular fatigue than those with lower VO2max. It can be speculated that individuals with high VO2max have greater delivery and utilization of oxygen to the exercising muscles which may help in delaying the onset of neuromuscular fatigue during cycle ergometry. Future studies should analyze blood lactate responses in order to support the finding of the current study.

20. **MORENO COMO YO: RACIAL PERCEPTIONS IN HISPANIOLA**

1:30 PM – Harper Center Room 3028B

Aloziem, Ozioma, Department of Psychology and Department of Anthropology, Creighton University, Omaha NE.

Haiti and the Dominican Republic are two countries that exist side by side making up the island of Hispaniola. Despite their geographical nearness, they are completely different countries with very different colonial histories. To this day, there remains very nuanced racial tension between the two. This study sought to explore how race is experienced in the Dominican Republic. The Clark Doll Experiment was originally conducted in 1939 and designed to examine children's attitudes about race. In the original experiment, children were asked to choose between a Black and White doll and respond to a series of seven questions. This study replicated this experiment in the Dominican Republic to explore how race is perceived in children cross-culturally. Children were shown 6 dolls that ranged in skin color and hair texture and were asked 9 questions. Responses were recorded and coded for analysis. In addition to this research method, semi-structured informal interviews were conducted, field notes were taken and a racial identity survey was distributed to adult participants. A translator was present for interviews conducted in Spanish. The results of the original Clark Doll Experiment found that 59% of participants chose the White doll as the "nice" doll and 59% chose the Black doll as the "bad" doll. This study found that 41.18% chose the White doll as the "nice" doll and 70.59% chose the Black doll as the "bad" doll. This would suggest that racial preference is apparent early on and may be more pronounced in the Dominican Republic.

21. **"JUST THE RIGHT CANDIDATES": ANALYZING THE "CULTURE OF THE PROFESSIONAL" VIA LINKEDIN**

1:45 PM – Harper Center Room 3028B

Balzer, Chelsea, Department of Communication Studies, Creighton University, Omaha NE.

LinkedIn's prominence for professional networking is unmatched: it boasts more than 347 million users with a goal of 3 billion users. As employers increasingly expect some kind of online presence before hiring an employee, participation in LinkedIn is becoming linked to the ability to find work and related social opportunities. Given that the job of recruiting has changed in an era of LinkedIn, how has this discursively (re)created potential candidates? We perform an ideological criticism of the rhetoric of LinkedIn's Business Services tab (which includes "Post a Job", "Talent Solutions", "Advertise", or "Sales Solutions") to analyze the area of the LinkedIn site intended for potential company recruiters. Specifically, we use Giddens's three ideological aspects of symbolic order to analyze the multiple sources of discourse present there, asking: (1) how are organizational interests represented as universal interests? (2) how are contradictions denied? and (3) what is occurring that is naturalized and made to seem unchangeable? We argue LinkedIn users work together within the ideologically informed space of the website to create "professional" identities and simultaneously enforce notions of the "other": the non-professional. The commodification of human experience through "social selling" and by framing corporations as people is both concealed from the average user and also promoted indirectly through LinkedIn's invitations to glorify "professional" culture. "Consenting" to this ideology implies agreement that some (professional) jobs are legitimate and dignified, and that other (blue-collar)

jobs are without value. With the consistent reminder to clients that LinkedIn will help companies sort through to find “just the right candidates” and just the “top talent”, LinkedIn reproduces the notion that individuals with (non-professional) backgrounds are not only incorrect matches for some occupations, but that they are simply not the “right candidate.”

22. **TRANSFORMING ROBERT TANNAHILL**

2:00 PM – Harper Center Room 3028B

Crawford, Cole , Department of English and Department of Computer Science, Creighton University, Omaha NE.

Robert Tannahill (1774-1810) was a Scottish laboring-class poet and songwriter. His work was widely celebrated shortly after his early death; annual performances of his songs attracted large crowds to his hometown of Paisley, and in 1856 the Cyclopedia of English Literature declared him "a lyrical poet of a superior order, whose songs rival all but the best of [Robert] Burns' in popularity." However, his poems and songs have been largely neglected since the late nineteenth century. This digital edition aims to restore Tannahill's status and rehabilitate his work by presenting his first edition of poems and songs alongside a new transcription of his correspondence.

To present Tannahill's work, I developed my own editorial rationale based on the theories of the documentary editors Greg, Tanselle, and Bowers. Using scans from the National Library of Scotland, I carefully edited Tannahill's published work. I also traveled to the University of Glasgow to transcribe Tannahill's letters directly from the holograph manuscripts. While in Scotland, I found a new sonnet of Tannahill's that has never before been presented in an edition of his collected works.

These texts are presented digitally in Transforming Robert Tannahill. By using digital humanities tools and a web interface rather than print, this edition truly transforms Tannahill's work rather than simply reproducing it. Readers can see Tannahill's handwritten letters alongside transcriptions, but also hear recent recordings of his songs. Geographic information systems (GIS) maps encourage users to explore Tannahill's beloved Paisley and understand how he used different location references, while textual visualizations help them envision the most important themes of his work.

**Acknowledgement:** This project was supported by an Honors Program undergraduate summer research grant. My presentation requires a computer and projector to show the website.

23. **IDENTITY CRISIS: RETURNING AS AN ADULT, “NONTRADITIONAL” STUDENT**

2:15 PM – Harper Center Room 3028B

Cunningham, Jennifer with Erika L. Kirby, Department of Communication Studies, Creighton University, Omaha NE.

Kasworm (2008) notes that “Many adult learners experience significant anxiety and self-consciousness about their acceptance, place in a collegiate environment, and ability to perform as undergraduate students” (p. 28)<sup>1</sup>. We explore how adult students “want to be seen” in returning to the role of college student using multiple sources of data. For our method, we combine (a) autoethnographic accounts of Jen and Erika’s own experiences, (b) student discussions in CPS 200 (Making the Transition: Strategies for Degree Completion), (c) document analysis from an article in the Creightonian discussing adult students and a responding letter to the editor from the Nontraditional Student Union, and (d) results from a survey of all College of Professional Studies students to tell the story of potential identity crisis for adult “nontraditional”

students. We chronicle experiences from Jen's informational meeting before even starting Creighton through the current semester. In the process, we address...

1. Issues of expectations and identity—how do adult students feel about Creighton's expectations?
2. "Passing" to fit in in classes—in what ways do adult students consider their embodiment in classes?
3. Naming practices and identity—what do "adult students" want to be called?
4. Celebrating the identity of adult student—what are moments of pride for returning adult students?
5. "Shaming the adult education unit"—what happens when faculty criticize the motivations of adult students?

We conclude with lessons on identity crisis for returning as an adult, "nontraditional" student.

<sup>1</sup>Kasworm, C. E. (2008). Emotional challenges of adult learners in higher education. *New Directions for Adult and Continuing Education*, 120, 27-34.

24. **HEGEMONY WITHIN HIGHER ADMINISTRATION: THE CREATION OF AN "IDEAL" STUDENT**

2:30 PM – Harper Center Room 3028B

Guziec, Amy , Department of Communication Studies, Creighton University, Omaha NE.

This paper is an examination of how higher administration at Jesuit schools use hegemony to create an ideological definition of the "ideal" student. I use rhetorical criticism as a means of explaining how students are characterized and defined based on Creighton University sanctioned webpages. The results provided two major ideological principles that influence Creighton's discussion of the overall student population, the privileging of numbers and the construction of a preferred student model. These ideological themes in combination with hegemonic principles promote the creation of an "ideal" student that no individual is fully capable of attaining.

**Keywords:** ideology, hegemony, third persona, Othering, exemplar characterizations

25. **THE EFFECTS OF CROSS SECTIONAL AREA ON FATIGUE DURING CYCLE ERGOMETRY**

2:45 PM – Harper Center Room 3028B

Andreen, Christian Jorge M. Zuniga, Emalee Patterson, Nicole Dempsey, Andrew Jochum, and Jessica Johnson, Department of Exercise Science & Pre-Health Professions, Creighton University, Omaha NE.

The purpose of the present study was to examine the effects of estimated quadriceps cross-sectional area (CSA) on the assessment of the mean power frequency at the fatigue threshold (MPFFT) during incremental cycle ergometry. Sixteen adults (11 men, 5 women; mean age  $\pm$  SD = 20.3  $\pm$  1.1 years; mean body weight  $\pm$  SD = 75.3  $\pm$  13.6 kg) performed an incremental cycle ergometry test to exhaustion while electromyographic (EMG) signals were measured from the vastus lateralis (VL) muscle. Fatiguing power outputs were differentiated from non-fatiguing power outputs by statistically examining the slope coefficients for the EMG mean power frequency (MPF) versus time relationship at each power output during the incremental cycle ergometry test. Quadriceps CSA for each subject was estimated using an equation developed by a previous investigation. Subjects were divided into groups of large quadriceps CSA (77.7  $\pm$  7.6 cm<sup>2</sup>) and small quadriceps CSA (59.1  $\pm$  7.7 cm<sup>2</sup>). There were no significant mean differences (p

= 0.076) in the mean MPFFT for groups with large and small CSA, and the groups were not significantly correlated ( $r = 0.265$ ). The non-significant difference in mean MPFFT between groups of large and small CSA indicated that the MPFFT can be used to assess fatigue independent of quadriceps CSA.

26. **GENDER DIFFERENCES FOR THE ASSESSMENT OF NEUROMUSCULAR FATIGUE**

3:00 PM – Harper Center Room 3028B

Lesnak, Joseph Jorge Zuniga, Exercise Science and Pre Health Professions, Creighton University, Omaha NE.

The purpose of the present study was to investigate differences between males and females at their physical working capacity at the fatigue threshold (PWCFT) using an incremental cycle ergometry test. Sixteen adults 8 males (mean  $\pm$  SD age =  $22.5 \pm 4.4$  years; body weight =  $93.6 \pm 12.4$  kg) and 8 females (mean  $\pm$  SD age =  $20.6 \pm 0.9$  years; body weight =  $64.5 \pm 11.0$  kg) performed an incremental cycle ergometry test to exhaustion while electromyographic (EMG) signals were measured from the vastus lateralis muscle of each leg. The absolute values for the PWCFT were significantly greater ( $P < 0.05$ ) for males ( $187.5 \pm 56.69$ ) than females ( $134.37 \pm 28.15$ ). However, there was no significant mean difference when the power output was expressed as percentage of test for males (mean  $\pm$  SD=  $66.17\% \pm 18.77$ ) and females (mean  $\pm$  SD=  $75.59\% \pm 16.59$ ). Based on the results of the present investigation we concluded that gender had no significant effect on the relative values of the PWCFT test of neuromuscular fatigue.

27. **TRUE MIDWESTERNER: DECONSTRUCTING RACE AT THE HEARTLAND STATE FAIR**

3:15 PM – Harper Center Room 3028B

Dowdle, Emily , Department of American Studies, Creighton University, Omaha NE.

Utilizing the State Fairs of Nebraska, Missouri, Kansas, and Iowa as cultural artifacts that represent the social culture of the metaphorical "Heart of America," the ways in which racial hierarchies are constructed and represented within the Heartland can be understood. Through presentations, exhibits, and rhetoric enables the fair visitor to perform as the quintessential "Heartlander" - an exclusionary identity that renders the non-white narratives and histories of the Heartland invisible

\* Indicates Summer Faculty Fellow Recipient

## SUMMER FACULTY FELLOW ABSTRACTS

### 1. Roman Child Portraiture

Bucher, Gregory, Ashley Weed, Joe Baronovic, and Sarah Copeland, Department of Classical and Near Eastern Studies, Creighton University, Omaha, NE.

This poster is a report on research carried out on two Roman portraits (JAM inv. 1947.208, JAM inv. 1952.33) in the Joslyn Art Museum. The first, Portrait of a Roman Boy (JAM inv. 1947.208) is a roughly life-sized bust, depicting the head and approximately one-third of the torso of a child. This portrait presents several intriguing problems in terms of style and coherence. Careful observation of the object in the Joslyn's vaults seems to indicate that the portrait has been assembled from several disparate pieces to form a pastiche, probably for the art market. Our poster details the trends and rise in popularity of fabricating restorations and pastiches to sell on the art market and we are thus able to explain the incongruities in style and several other difficulties raised by our initial examination of the object. The second portrait (JAM inv. 1952.33) portrays the head of an infant. Examinations of this object have led us to believe that it, unlike Portrait of a Roman Boy, is authentic, and most likely a funerary monument. Comparisons to other authentic, dated evidence support our hypothesis that the portrait was created during the Julio-Claudian period in the first half of the first century CE.

### 2. Boys, Not Girls, Are Negatively Affected on Cognitive Tasks by Lead Exposure: A Pilot Study

Khanna, Maya, Department of Psychology, Creighton University, Omaha, NE.

The study described in this article provides behavioral evidence that boys experience the deleterious cognitive effects of lead more than girls do. In fact, girls with elevated blood lead levels (BLLs  $\geq 10$   $\mu\text{g/dL}$ ) performed as well as girls without elevated BLLs on behavioral measures of cognition. This was shown by testing executive function and reading readiness skills of 40 young children (aged three to six years; 23 with elevated blood lead levels, 17 without) residing within a U.S. Environmental Protection Agency–designated lead Superfund site. The results also indicate that elevated BLLs are related to a more pronounced negative impact on executive function than on reading readiness. These findings support recent research on adults indicating that lead exposure is related to atrophy within the prefrontal cortex and other work suggesting that estrogen and estradiol may act as neuroprotectants against the negative impact of neurotoxins.

### 3. Cortical neuronal damage stimulates a microRNA and epigenetic-associated transition in activated microglia that enhances neuronal survival

Shibata, Annemarie, Alex Johnson, and Nick Mathy, Department of Biology, Creighton University, Omaha, NE.

Activated microglia, the resident immune phagocytic and secretory cells in the CNS, can trigger neurotoxic inflammatory responses or promote neurogenesis and neuronal survival. To study microglial release of secretory cues, we developed an in vitro model



system in which microglia are cultured upon transwell membranes suspended above mechanically damaged or undamaged primary neuronal cultures. This system allowed us to investigate the levels of select cytokines secreted by microglia in response to neuronal damage. Microglia responding to neuronal damage increase their secretion of MCP-1, and decrease expression of Ccl3, Ccl5, TNF, and Ifng. RTPCR is underway to verify ELISA data. Also, the presence of neurons alone significantly changes the levels of cytokine mRNA. We see significant decreases in Ccl3 and TNF ( $p < .01$ ). This may suggest an innate neuroprotective role of microglia.

Microglial-secreted cytokines enhance neurogenesis by regulating neuronal non-coding microRNA expression. We have shown that activated microglia enhance the timing of primary cortical neurons in vitro. Current RTPCR analysis demonstrates that this enhancement of neurogenesis is associated with time-dependent regulation of miR-9, miR-124, let-7c levels in differentiating neurons. Comparing neurons co-cultured in presence of microglia to those cultured without microglial presence, we observe increases in miR-9, miR-124, and let-7c levels quantified by RT-PCR in response to damage, all of which inhibit neural stem cell proliferation and promote neuronal lineage commitment.

We have also investigated the role of miRNAs in microglial regulation. We observed significant increases in miR-9, miR-124, and let-7 when compared to resting microglia, suggesting these microglia are functioning in a neurotrophic manner.

Understanding the mechanisms that drive neurotrophic processes may help develop immune therapies that promote these phenotypes over neurotoxic phenotypes during neurodegenerative diseases and traumatic brain injury.

#### 4. **Epictetus on Tragedy, Homeric Unheroes, and Stoic Heroism”**

Stephens, William, Krysta Larson, and Daniel Dean, Department of Philosophy and Classical & Near Eastern Studies, Creighton University, Omaha, NE.

This project has two parts. For the first part, my own research reconstructs and evaluates Epictetus’ Stoic critique of tragedy and heroism as represented by the mythic figures of Achilles, Agamemnon, Odysseus, and Heracles, and the historical figures of Diogenes the Cynic and Socrates. This paper will become one of eight chapters in my book manuscript *Stoic Lessons in Liberation: Epictetus as Educator*. For the second part, I collaborated with two students who took my Spring 2014 HRS 347: Stoics in Film and Literature course. Krysta Larson’s paper “Mother Knows Best? Evaluating the Roles of Stoic Parents in *Gladiator* (2000)” and Daniel Dean’s paper “‘A Good Dinner’—The Stoic Character of Heythorp’s Death in John Galsworthy’s *A Stoic*” are currently under review at undergraduate philosophy journals.

#### 5. **Post-Pollination Development in *Ruppia maritima***

Taylor, McKenzie, Luke Aeilts, and Kristine Altrichter, Department of Biology, Creighton University, Omaha, NE.

**Purpose:** *Ruppia maritima* is an aquatic plant found in shallow lakes and coastal areas throughout the world. *R. maritima* exhibits hydrophily, a rare pollination mechanism in which pollen is transported via the water surface. The transition to hydrophily is known to be accompanied by modifications in pollen morphology, but the consequences of this

evolutionary transition for reproductive development are not well-understood. In this study, we characterized post-pollination pollen development in *R. maritima*. This is the first study to investigate pollen development in *R. maritima* and will yield valuable data for producing a comprehensive picture of reproductive development in water-pollinated plants.

**Methods:** Mature pollen characters were documented using light, scanning electron, and transmission electron microscopy. In order to investigate post-pollination pollen development, field collections were carried out and hand-pollinations were completed. Specimens were examined with light microscopy to determine the timing of developmental events, as well as rates of pollen germination and tube growth.

**Results:** We confirmed that mature grains exhibit a heteropolar exine with a reticulate proximal wall and smooth distal wall. Pollen is only deposited on stigmas in inflorescences with elongated peduncles. Pollen tubes emerge from apertures at the tips of the reniform grain, but only a small percentage of pollen successfully germinates. Germination occurred within five minutes after pollination and pollen tubes reached the ovule within one hour after pollination.

**Conclusion:** Rapid pollen germination and a short time to fertilization are likely adaptive for water-pollination. Understanding reproductive development in hydrophilous plants is key to answering questions regarding the evolution of flowering plant reproduction.

**Acknowledgement:** This project was funded by a 2014 Faculty Summer Research Fellowship to MLT, a Ferlic Summer Scholarship to LA, and the Clare Boothe Luce Program for Women in Science.

## 6. **CYBORG BEAST: AN OPEN SOURCE LOW-COST 3D-PRINTED PROSTHETIC LINE FOR CHILDREN WITH UPPER-LIMB DIFFERENCES**

Zuniga Ulloa, Jorge, A. Carson, D. Katsavelis Ph.D., M. Petrykowski, and L. Ploutz-Snyder, Ph.D., Department of Exercise Science and Pre-Health Professions, Creighton University, Omaha, NE.

**Purpose:** The aim of this preliminary investigation was to design a low-cost three-dimensional (3D)-printed prosthetic hand for children with upper-limb reductions and propose a prosthetic fitting methodology that can be performed at a distance. We hypothesized that anthropometric measurement of the upper limbs taken from photographs and processed by image editing software would not differ from anthropometric measurements taken directly on upper limbs. **Methods:** Nine children (two girls and seven boys, 3 to 16 years of age) with upper-limb reductions (one traumatic and eight congenital) were fitted with our low-cost 3D printed prosthetic hand. Seven separate two-way repeated measures ANOVAs [2 x 2; hand (affected versus non-affected) x fitting procedures (direct versus photographs)] were performed to analyze the data. A p-value of  $\leq 0.05$  was considered statistically significant for all comparisons. The results of the two-way repeated measures ANOVAs showed no significant mean difference between the anthropometric measures taken directly on the subject's upper limbs and those taken from the photographs. There were no significant two-way interactions for repeated measures ANOVAs performed for hand x fitting

procedures. There was a significant main effect, however, for hand (affected versus non-affected), with no significant main effect for fitting procedures (direct versus photographs). Discussion: This investigation describes a low-cost 3D-printed prosthetic hand for children and proposes a distance fitting procedure. The Cyborg Beast prosthetic hand and the proposed distance-fitting procedures represent a low-cost alternative for children in developing countries and those who have no access to health care providers. Further studies should examine the functionality, durability, benefits, and rejection rate of this type of low-cost 3D-printed prosthetic device.

## 7. **Low Cost 3D Printed Prosthetic Devices**

Zuniga Ulloa, Jorge, and Petrykowski, Marc, Department of Exercise Science, Creighton University, Omaha, NE.

One to two percent of newborns are born with congenital defects, and 10% of them have congenital differences of the upper extremity. Amniotic Band Syndrome is the term applied to a wide range of congenital anomalies, most typically limb and digital amputations and constriction rings that occur intrauterine in association with fibrous bands. It is estimated that in the USA, more than 32,500 children suffer from major pediatric amputation. Children's prosthetic needs are complex due to their small size, as well as their physical and psychosocial development. The family's financial resources play a crucial role in the prescription of prosthetics for their children, especially when private insurance and public funding are insufficient. The current cost for a myoelectric prosthetic hand ranges from \$30,000 to \$100,000. The cost of a body powered prosthetic hand, however, ranges from \$5,000 to \$11,000. Due to the complexity and high cost of these prosthetic hands they are not accessible for children of low income or uninsured families. Three-dimensional (3D) printing is a process of making a 3D solid object of virtually any shape from a digital 3D model. Advancements in 3D printing technology offer the possibility of designing and printing plastic mechanical hands at a very low cost. Body-powered voluntary closing prostheses, such as the present mechanical hand require significant wrist strength for best performance. Individuals with unilateral upper limb reductions suffer from a significant amount of muscle atrophy in the affected limb. It is unknown if the use of body-powered voluntary closing prostheses, such as our low-cost 3D printed mechanical hand improves muscle atrophy, muscle function, and overall functionality. Thus, the purpose of the current study is to examine strength, muscle morphology, and functionality of a low-cost 3D printed mechanical hand for children and adults with upper limb differences.

## HADDIX RESEARCH SCHOLAR ABSTRACTS

### 1. **A FRAGMENTED PAST: (RE)CONSTRUCTING ANTIQUITY THROUGH 3D MODELING**

Averett, Erin, Department of Fine and Performing Arts, Creighton University, Omaha, NE.

In summer 2014 I initiated a pilot project that utilized structured light scanning to produce 3D models of Archaic-Roman votive offerings dedicated in the rural sanctuary at Athienou-Malloura Cyprus. This project was a collaboration of archaeologists, art historians, and computer scientists from Creighton University, University of Wisconsin-Milwaukee, and the University of Kentucky's Center for Visualization and Virtual Environments. Visual documentation is at the core of archaeological practice and imaging has played a critical role in archiving and interpreting material culture. Although archaeologists have embraced technology for this purpose since the discipline's inception, recently there has been a proliferation in digital imaging technologies and the use of computerized applications. The utilization of imaging technologies presents many practical advantages, from research analysis to virtual presentation, in an international field that rarely permits archaeological finds to be removed from their country of origin.

This poster presents the results of our pilot season implementing an accurate and cost-effective process to create high-resolution 3D data sets. A close-range projection structured light scanning system with customized hardware and software packages was developed by the Center for Visualization. In addition to developing protocols and a set of best practices for the scanning process, we were able to generate an accurate and sample corpus of 3D models. The metadata (which records the geometry and shape of the object, as well as its appearance) has already proven to be a powerful tool; for example, final models can be measured with a digital ruler to .5 mm accuracy across any part of the object. Subsequent phases of this project will experiment with developing a predictive data processing algorithm that will use geometric dimensions, surface texture, and break patterns to propose potential joins among our thousands of terracotta and limestone fragments and use the 3D models to ask further research questions regarding manufacture techniques and surface treatments.

### 2. **THE MATERIAL SCIENCE OF DENTAL RESTORATION MATERIALS: BUILDING BRIDGES BETWEEN TWO COLLEGES**

Baruth, Andrew Nick Fischer, Rachel Pham, Roselyn Cerutis, Ph.D., Wayne Barkmeier, DDS, Department of Physics, Creighton University, Omaha, NE.

Evidence-based dentistry bridges the gap between research and dental practice, which allows dentists to stay up to date on the latest procedures for patients to receive improved treatment. Such practices require the judicious integration of systematic assessments of clinically relevant scientific evidence. In this study, we incorporate the material science expertise from the Creighton University Physics Department in the College of Arts and Sciences with material restoration and oral biology studies occurring in the School of Dentistry. In particular, dental restorative materials are a class of fabricated materials specifically designed for restoring tooth form and function. Several key issues exist, primarily in the areas of biocompatibility and physical wear, which must be fully addressed to evaluate their efficacy in a clinical setting. This project focuses on the nanoscale imaging of specimens relevant to these key issues utilizing atomic force microscopy and optical profilometry. First, the design and construction of a liquid imaging environment with temperature control has furthered our ability to image human gingival fibroblast cells at the nanoscale, potentially while living, providing 3-dimensional characterization of how these essential players in successful implantation adhere to relevant surfaces. Next, we have performed a comparative study of surface roughness using atomic force microscopy, a nanoscopic imaging technique, and optical profilometry, a common dental imaging technique with

microscopic lateral resolution, of enamel surfaces following the use of four commercial etching products. By collecting and merging the two disparate imaging techniques, the correlation between roughness values obtained from the two techniques can be rectified. Finally, this collaborative materials research model is enhancing the study of dental materials and has provided a meaningful experience for undergraduate students interested in pre-professional programming.

### 3. **DEVELOPMENT OF ORAL DRUG DELIVERY SYSTEMS FOR POORLY SOLUBLE ANTICANCER DRUGS BASED ON DRUG-POLYMER INTERACTIONS**

Chauhan, Harsh Anne Trivino, Jonathan Bernick, Department of Pharmacy Sciences, Creighton University, Omaha, NE.

**Purpose:** Correlate the In-silico drug polymer interactions with poorly soluble drug precipitation inhibition and amorphous stabilization by various polymers for the development of oral delivery system.

**Methods:** The optimized geometries of the flutamide-polymer complexes were obtained using the B3LYP/6-31G\*\* calculations performed by the Jaguar (Schrodinger LLC, 2012) program. Intermolecular energy values  $E_{bind}$  and hydrogen bond lengths between drug and polymers functional groups were calculated. These calculations are determined to predict the most stable complexes and were correlated with precipitation inhibition efficiency of polymers. Biotek plate reader was used to monitor drug concentrations with time. Polymers mainly PVP K 90, HPMC, Eudragit EPO and PEG 8000 were used in the study. Amorphous solid dispersions of flutamide with these polymers were prepared. Solid dispersions were characterized using PXRD and MDSC. IR and Raman spectra were used to investigate the possibility of drug polymer interactions.

**Results:** The  $\Delta E$  intermolecular energies of -12.05, -10.2, -8.39, -6.69 kcal/mol were computed for flutamide complexed with monomers of PVP K90, Eudragit EPO, HPMC and PEG 8000. Further, intermolecular hydrogen bond distances between flutamide and monomers of Eudragit EPO, PVP K90, PEG 8000, and HPMC were found to be 2.054, 2.038, 1.896, and 1.870 respectively. These results show the stability of the complexed flutamide and the PVP monomer was greater than other polymers monomer units. PVP K 90 and PEG 8000 were found to be the most efficient flutamide precipitation inhibitors. In solid state, no melting endotherm was observed in flutamide-PVP and flutamide-PEG dispersions indicating formation of stable amorphous solid dispersions. IR and Raman confirmed the possible interactions of flutamide with PVP and PEG.

**Conclusion:** Good correlation between the In-silico drug polymer interactions and polymer's precipitation inhibition and amorphous stabilization efficiency was observed. Flutamide-PVP and Flutamide PEG has potential to be developed into oral delivery system.

### 4. **OBESITY DOES NOT ALTER URINARY CONCENTRATIONS OF MARKERS OF INTESTINAL BARRIER DYSFUNCTION**

Lambert<sup>1</sup>, G. Patrick Stephen J. Lanspa<sup>2</sup>, Geri A. Moore<sup>1</sup>, Jennifer C. Yee<sup>1</sup>, Department of Exercise Science and Pre-Health Professions<sup>1</sup>, and School of Medicine<sup>2</sup> Creighton University, Omaha, NE.

**Rationale/Purpose:** Previous studies have indicated obesity may be associated with intestinal barrier dysfunction (i.e., "leaky gut") and this may be related to inflammatory processes observed in diseases such as Type 2 diabetes. The intent of this investigation was to examine the effect of obesity and weight-loss on urinary concentrations of intestinal fatty acid binding protein (I-FABP) and claudin-3, markers of intestinal barrier dysfunction.

**Methods:** All procedures were approved by the Creighton University Institutional Review Board and all subjects provided written informed consent prior to participation. Nine individuals with obesity (BMI > 30 kg/m<sup>2</sup>; experimental group) and nine gender- and age-matched control subjects (not overweight; BMI < 25 kg/m<sup>2</sup>; control group) participated in the 12 week study. All subjects were pre-screened for cardiovascular, pulmonary, or metabolic risk factors, gastrointestinal (GI) disorders, and use of non-steroidal anti-inflammatory drugs (NSAIDs). Subjects were not allowed to participate if considered “high risk” in terms of cardiovascular, pulmonary or metabolic disorders, if experiencing GI symptoms, or if using NSAIDs. All subjects were invited to participate in a free exercise program (3 times per week) to promote weight loss or weight maintenance and were measured for total weight, waist and hip circumferences, waist-to-hip ratio, and BMI weekly. During weeks 1, 6, and 12, subjects provided a urine sample that was assayed for I-FABP and claudin-3.

**Results:** There were no differences between or within groups for I-FABP or claudin-3 at any time point.

**Conclusion:** These results indicate that urinary I-FABP and claudin-3 may not be sensitive markers of intestinal barrier dysfunction with obesity or that intestinal barrier function may not be compromised in relatively healthy individuals with obesity.

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## 5. CONGREGATIONAL HEALTH MINISTRIES IMPROVING HEALTH IN OMAHA

Roedlach, Alexander, Department of Sociology, Anthropology, and Social Work, Creighton University, Omaha, NE.

About 100 congregations are affiliated with the Omaha Faith Community Health Network, which is supported by CHI Health. Licensed nurses and other health ministers provide preventative health care and health education as well as other services related to public health within these congregations and the community in which the congregation is situated.

Long-term research during more than two years as well as a focused study since July 2014 using both qualitative and quantitative methods suggests that health ministry programs positively impact the health of those participating in activities and events organized by these programs. This impact has been conceptualized in terms of holistic health encompassing physical, emotional, social, intellectual, spiritual and environmental components of health.

The poster summarizes the main areas of health outcomes due to health ministry programs. The findings suggest that health ministries are suitable community partners for health care organizations that assist to keep individuals and groups healthy, help to reduce and minimize episodes of ill health and readmission to hospitals, and result in cost-savings for households and society. The poster also highlights shortcomings of health ministry programs and points at areas of friction between them and health care organizations that need to be addressed in order to foster collaboration.

## 6. USING BACTERIAL RNA SWITCHES AS SYNTHETIC GENETIC DEVICES

Soukup, Juliane, Daniel Poston, Audrey Netzel., Department of Chemistry, Creighton University, Omaha, NE.

Synthetic biology is an emerging field focused on engineering biochemical systems and cellular functions for a variety of applications, including therapies for the treatment of infectious diseases and cancer, as well as tactics for vaccine development, microbiome engineering, cell therapy, and regenerative medicine. Many of the advances so far have involved engineering synthetic

constructs for use in bacteria, but it is critical that synthetic biology tools be designed for use in mammalian systems. Riboswitches offer a unique set of “devices” for achieving synthetic gene regulation. Riboswitches bind to small molecules, which triggers a change in their structure in order to affect gene expression. We have built a synthetic genetic construct using the bacterial glmS riboswitch and the mammalian luciferase gene in a mammalian cell culture system. Preliminary results indicate that when the glmS natural ligand glucosamine-6-phosphate (GlcN6P) is added to the cell culture system there is a slight modification of gene expression, but that addition of an analog of GlcN6P, serinol, to the cell culture does result in down-regulation of luciferase gene expression. Further research will involve improved design and operation of these synthetic genetic devices, paving the way for future use of riboswitches to control mammalian genes.

## 7. **USING THE DECIDUOUS DENTITION TO DETERMINING AGE AND SEASON AT DEATH**

Hermesen, Kenneth and Vicki Wedel, PhD, Department of Anatomy and School of Dentistry, Creighton University, Omaha, NE.

Were you a parent whose child is abducted and whose skeletal remains are later found, you would want to know how your child died, how long ago s/he died, and if time passed between abduction and death. Only one method currently exists that allows forensic investigators to determine the age and season at death and has the potential to measure whether time passed between abduction and death. That method is called dental cementum increment analysis (DCIA), and in humans, it has only been demonstrated effective in permanent teeth. DCIA takes advantage of the differential mineralization of cementum collagen fibrils that bind with the periodontal ligament to hold the tooth in its socket. We hypothesize that deciduous teeth also exhibit cementum banding and that the percent completion of the outermost increment indicates how far into two broad seasons (April to September and October to March) the cementum was secreted.

We analyzed 32 deciduous teeth from children treated at Creighton University's School of Dentistry. The teeth were embedded, sectioned horizontally through the root, ground and polished to 100 microns. The thin sections of tooth root were examined under magnification and polarized light. A photomicrograph was taken and imported into Adobe Photoshop whose ruler function allowed us to mark and measure the widths of the cementum bands.

In this inaugural study of deciduous cementum, our observations support our hypothesis: deciduous cementum does band making DCIA applicable in deciduous teeth. Where we found challenges were with root resorption. DCIA typically uses sectioned “wafers” taken from the middle third of the root. Future work will be done to determine exactly how close to the cemento-enamel junction we can take a thin section and still achieve reliable results.

We are grateful for the Haddix Grant that funded this project and for the patients at Creighton University.