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# ACES Symposium 2014

## Presenter Abstract by Discipline

### **Using E-learning Tools to Help Scaffold the Problem Solving Process to Solve Stoichiometry Problems**

Presenter: Kenneth Abayan, Chemistry Graduate

3:40 PM, Pedernales

Mentor(s): Kevin A. Schug

#### **Abstract:**

One of the topics in general chemistry that has often given students problems is stoichiometry. Stoichiometry is the branch of chemistry that attempts to quantify the measured relationships or ratios between two or more items. The importance of stoichiometry is not lost among those who practice it, mostly chemists or chemical engineers. For the novice learner it is difficult to see what is beyond the numerous techniques and explanations of how to solve a simple stoichiometry question. These students are beginning to learn to “problem solve”. In this study, we’ve created an e-learning tool to help scaffold the problem solving process necessary to help students (N=394) solve stoichiometry problems. Therein we’ve investigated any possible predictors for success on a stoichiometry based examination student’s conceptual understanding of solving stoichiometry problems and explanation of reasoning. We found that the way the student answered (i.e. whether the student used dimensional analysis, operational method or any other process) a given stoichiometry question was not statistically important ( $p=0.05$ ). More importantly, if the students were able to describe their thought process clearly, these students scored significantly (avg. 84,  $p<0.05$ ) higher on stoichiometry examination. This has a major implication in the teaching of the topic as lecturers tend to stress and focus on the method rather than the process on how to solve stoichiometry problems.

*This work was supported in part by the National Science Foundation*

### **Petrography, Stratigraphic Framework and Depositional Environment of the Wolfcampian Carbonate Deposits on the Northwest Shelf and Midland Basin**

Presenter: Toyly Abdullayev, Geology Graduate

Poster board: 1

Mentor(s): Merlynd Nestell

#### **Abstract:**

The Wolfcampian name was first proposed for lowermost Permian strata by Cheney et al. (1945) and strata of this age has been an important target for oil exploration in West Texas. Exploration cores have been taken in a number of wells in the northern part of Northwest Shelf and northwestern margin of the Midland Basin in the 1960's and 1970's that have not been studied until recently. They have been stored at the Midland Core Research Center of Bureau of Economic Geology and in the core repository of The University of Texas of the Permian Basin. Currently, efforts are underway to describe the petrography of the carbonate parts of several of these cores and to build a modern depositional and sequence stratigraphic framework for the northwestern part of Permian Basin. The purpose of this research is to study Wolfcampian cores from five exploratory wells located on the Northwest Shelf and in southeastern New Mexico. The information obtained can then be applied in exploration for petroleum and provide valuable data for companies that are interested in exploring Wolfcampian carbonate deposits. Over ninety percent of the core is limestone, and only some zones are dolomitized. Despite karst diagenetic overprints, two types of cycles have been recognized from core examination. One type of cycle is a mud-dominated to grain-dominated skeletal capped packstone. Main skeletal grains in this cycle are fusulinids, broken fragments of crinoids, trilobites, brachiopods, and other unidentifiable skeletal fragments. Most of intraparticle porosity of the fusulinids has been filled with calcite cement and does not show good reservoir quality, and is less porous and permeable. However, heavy oil bits have been noted in some strata of the lower zones of this cycle. The other type of cycle is dominated by a peloidal, skeletal grain packstone, and is relatively porous and permeable. The data presented in this abstract is based on a preliminary examination of over two hundred feet of core and work is in progress. Further detailed examination of these cores, preparation of thin sections, and a detailed analysis of these cores should lead to a better understanding of Wolfcampian carbonate rocks in the study area.

Presenter Abstract by Discipline

**Sample sequencing of 40 squamate reptile genomes reveals extensive evolutionary dynamics of genomic repeat element landscapes.**

Presenter: Richard Adams, Biology Graduate Student

**3:40 PM, Palo Pinto**

Mentor(s): Todd A. Castoe

Group members: D.C. Card, J. Reyes-Velasco, L.C. Drzich T.A. Castoe and D.R. Schield

**Abstract:**

Once commonly dismissed as unimportant “junk DNA”, genomic repetitive elements are now acknowledged to play important roles in diverse genomic processes, including recombination, regulation of gene expression, and regional genomic chromatin state. Recent sequencing of several squamate genomes has revealed extensive variation in the genome repeat content of squamate species, despite overall genome size remaining relatively consistent throughout the order. This remarkable variation contradicts the accepted view that the greatest variation in genomic repeat content exists between major amniote clades (e.g., between mammals and birds), and not within any one lineage. In this study, we expanded taxonomic sampling and gathered preliminary data on the repeat landscape of 41 squamate species. Our results indicate unprecedented divergence in repetitive content, structure, and abundance within a major amniote lineage, with certain squamate species exhibiting a repeat content of ~50% (similar to mammals), while other species having a repeat fraction of <30% (being more similar to birds). Our results indicate that both transposable elements and simple sequence repeats (microsatellites) contribute to high repeat landscape variation among species, and further show that certain transposable elements previously identified to be associated with microsatellite expansion and venom gene duplication appear to be greatly expanded in venomous lineages of snakes.

**Development of metal complexes for the activation of Nitrous oxide**

Presenter: Venkata Adiraju, Chemistry Graduate

**10:40 AM, Pedernales**

Mentor(s): H.V. Rasika Dias

**Abstract:**

Nitrous oxide, also known as laughing gas, is a major greenhouse gas as well as major ozone depleting substance. This work aims to use nitrous oxide, which is harmful to atmosphere, as a precursor in chemical reactions. We have designed and recently developed new molecule system for the activation of nitrous oxide. These new compounds were resulted from a chemical reaction under neat conditions, which do not need any solvent. A solid state lithium complex was obtained when our compound and lithium source were reacted. The lithium complex was found to be a very reactive species. For example, when the lithium complex was reacted with a copper or silver as metal source resulted in new copper and silver complexes. Copper and silver metals were found to be bonded by our compound by three and two chemical bonds respectively. Therefore these interesting structural features warrant further investigation of how our compound interacts with other metals for the activation of nitrous oxide.

**SURFACE FUNCTIONALIZATION OF  $\beta$ -SiC QUANTUM DOTS**

Presenter: Susana Aguirre-Medel, Chemistry Senior

Mentor(s): Peter Kroll

Group members: Munuve Mwanja

Poster board: 128

**Abstract:**

Quantum dots (QDs) are semiconductor materials with the size range of nanometers (nm). QDs exhibit unique optical and electronic properties. For instance, whereas bulk SiC has no usable optical activity, Silicon carbide (SiC) QDs reveal photoluminescence. Surface functionalization (introduction of chemical groups) of QDs will open up the potential to use these QDs for further applications. In this contribution, we demonstrate a strategy that yields functionalized SiC QDs in aqueous environment in just one day. We start with hydroxyl (-OH) terminated SiC QDs. In a first step, we introduce amine groups (-NH<sub>2</sub>) on SiC QDs in a two-phase process. In a second step, thiol groups (-SH) were attached to amine terminated SiC QDs. Successful amination is confirmed by a fluorescamine assay test. Fluorescamine is a compound that fluoresces only when it reacts with terminal amines. A negative fluorescamine assay confirmed replacement of the amine group by SH groups. Thiolation of SiC QDs was confirmed through Ellman's assay which consists of the reaction of Ellman's reagent with -SH to produce a yellow colored complex (measured through UV-vis). Positive fluorescamine and Ellman's test indicate successful functionalization. We also show that the thiolated SiC (SiC-SH) QDs can be connected to gold (Au) nanoparticles (NPs) by taking advantage of Au's affinity to sulfur. Photoluminescence measurements indicate an interaction between thiolated SiC QDs and Au NPs. These Au-SiC nanohybrids (NHs) may be used for photo-catalytic activity, energy harvesting as well as for environmental/analytical sensors.

**Synthesis, Characterization and Antitumor Activity of a Mixed Metal Ru(II)-Re(I) Complex**

Presenter: Pooja Ahuja, Chemistry Graduate

Mentor(s): Frederick M. MacDonnell

Group members: Kumail Ali

Poster board: 2

**Abstract:**

The development of new, safe, and effective drugs for treating cancer remains a priority as cancer remains one of the leading causes of death in today's society. One of the most successful anti-cancer drugs is the platinum compound cis-(NH<sub>3</sub>)<sub>2</sub>PtCl<sub>2</sub> or cisplatin, however despite its success, metal-based pharmaceuticals remain a novelty in the treatment of most cancers. Recent studies in our lab have shown that the two ruthenium(II) polypyridyl compounds (RPC's), [(phen)<sub>2</sub>Ru(tatpp)]<sup>2+</sup> ([MP]<sup>2+</sup>), (fig. 1a) and [phen)<sub>2</sub>Ru(tatpp)Ru(phen)<sub>2</sub>]<sup>4+</sup> ([P]<sup>4+</sup>), (fig. 1b) are promising anticancer drugs with low animal toxicity and demonstrable tumor regression in mouse tumor models.<sup>1</sup> Much of the anti-tumor activity by these drugs is presumed to be primarily due to the presence of an active unit tatpp (fig. 1c) that binds to DNA and is then reduced to a species that cleaves DNA. In this paper, we report the synthesis and characterization of a structurally similar mixed metal Ru(II)-Re(I) tatpp analogue containing the same active unit tatpp. Preliminary results reveal that the new Ru(II)-Re(I) tatpp analogue induces greater DNA cleavage compared to the parent drugs ([MP]<sup>2+</sup>) and ([P]<sup>4+</sup>) which may be beneficial therapeutically. Further studies are underway to determine the specificity of the new analogue towards targeting cancer cells vs normal cells.

### **The Subsidence Evolution of the Fort Worth Basin in North-Central Texas, U.S.A.**

Presenter: Ohood Bader al Salem, Geology Graduate

8:00 AM, Pedernales

Mentor(s): Majie Fan

Group members: Maje Fan; Dr. Xiangyang Xie; Beau Berend

#### **Abstract:**

The Fort Worth Basin in north-central Texas is one of the several foreland basins associated with the Marathon-Ouachita-Appalachian orogeny, which represents the mountain building process caused by the oblique collision of Laurentia and Gondwana continents 500-300 million years ago (Ma). Current studies on the Fort Worth Basin focus mainly on hydrocarbon exploration and production, however, the tectonic evolution of the basin remains poorly understood. In this study, we reconstruct the subsidence history of the Fort Worth Basin during 470-299 Ma, and constrain its dynamic relationship to the basin-bounding Ouachita fold-and-thrust belt by reconstructing one-dimensional tectonic subsidence curves and modeling two-dimensional flexure subsidence of the basin. Additionally, we conduct thermal maturation modeling to constrain the burial and exhumation histories during the last 307 Ma. Our results show an increase of subsidence rate at 323 Ma, suggesting the Fort Worth Basin experienced substantial amount of tectonic subsidence in response to the development of the Ouachita fold-and-thrust belt during 323-307 Ma. Our results also show that the mountain-bounding Ouachita belt was of 600 m high and 200 m wide during 323-307 Ma, which was smaller than the preserved current mountain size. Our thermal maturation modeling result shows that the basin experienced less than 4 km of subsidence and 2 km of erosion after 307 Ma, suggesting the flexural subsidence of the Fort Worth Basin continued after 307 Ma in response to the continued development of the Ouachita fold-and-thrust belt. Our study advances the understanding to the tectonic history of the Fort Worth Basin.

### **CuedR: A Novel Approach Towards Usability-Security Tension in User Authentication**

Presenter: Mahdi Nasrullah Al Ameen, Computer Science Engineering Graduate

8:40 AM, Red River

Mentor(s): Matthew Wright

#### **Abstract:**

Users often choose passwords that are easy to remember but also easy to guess. Passwords are also vulnerable to shoulder surfing and keystroke loggers. It remains an open research problem to design an authentication scheme that addresses these security issues while offering good memorability. We design, implement, and evaluate CuedR, a novel cued-recognition user authentication scheme that provides graphical, verbal, and spatial cues to assist in recognition of system-assigned keywords. Our scheme offers 28 bits of effective password space and provides resilience against attacks exploiting password reuse and predictable patterns. CuedR is also resilient against shoulder surfing and keystroke loggers. We evaluated the scheme with a multi-session in-lab user study; 100% of users remembered their passwords after one week. Users were highly satisfied with the usability and security of CuedR and interested to use the scheme for their online accounts.

### **Thermal Focusing and Separation of Selective Proteins on Microheater Platforms**

Presenter: Waqas Ali, Electrical Engineering Graduate

11:00 AM, Concho

Mentor(s): Samir M. Iqbal

Group members: Vivek Vishwakarma, Dr. Ankur Jain

#### **Abstract:**

Protein separation is important for purification. Many approaches have been developed to separate out (and study) proteins of interest from mixtures. These techniques use physiochemical properties such as size, solubility and charge etc. for isolation. Ultra-specific binding of proteins with novel probe molecules like aptamers and then thermal unbinding at very specific temperatures can be a simple and novel way for protein purification. We report experiments on temperature sensitivity of Epidermal Growth Factor Receptor (EGFR) binding and unbinding with an anti-EGFR RNA aptamer on microheater devices. It was observed that immobilized EGFR was selectively detached by thermal heating. At room temperature, maximum EGFR stayed stably attached to the surface, which kept decreasing as the temperature was raised. At 60 °C, only 25% EGFR was left on the surface. Microheater device was fabricated on a glass substrate with lithography and lift-off process followed by aptamer functionalization and EGFR capture using established protocols. EGFR was stained with Sypro ruby protein gel stain. Current was passed through the microheater and fluorescent intensity was measured at different temperatures to quantify the left over protein. This approach can have significant impacts in characterizing functions, structures and interactions of proteins of interest.

### **Prey-Switching in Response to Intraguild Predation Risk in Dragonfly Nymphs**

Presenter: Benjamin Allen, Biology Graduate

8:20 AM, San Saba

Mentor(s): Paul Chippindale

#### **Abstract:**

Intraguild predation is when one predator kills and eats its own competitors. This may lead to prey-switching--a risk-induced change in prey preferences--when one available prey item is less desirable to other predators, or when it reduces the risk of detection and interference by other predators. To test this, five species of aquatic dragonfly nymphs (*Anax junius*, *Erythemis simplicicollis*, *Libellula lydia*, *Pachydiplax longipennis*, and *Tamea lacerata*) were used in a caged predator experiment exposed to a negative control, *Tamea lacerata*, and *Anax junius*, with 15 replicates. Each individual was offered 10 each of *Gammarus sp* and *Daphnia pulex*. Foraging bouts were filmed for 10 minutes per individual. A prey preference score was used as a response variable in an ANCOVA by dragonfly species and predator treatment, with head width as a covariate. Species (df=4, F=4.824, P<.001), predator (df=2, F=8.488, P<.001), species-predator interaction (df=8, F=1.657, P=.032), and head-width (df=1, F=5.375, P=.009, Y=1.92x+2.658) were all significant and explained 34.7% of variation in prey preference. This indicates that dragonfly nymphs switch prey in response to perceived intraguild predation risk, and that the propensity to switch varies by species. Mechanistic models predict stability of intraguild predation only at intermediate productivity, which does not account for the ubiquity of intraguild predation observed in nature. Indirect effects such as prey-switching may account for this, by reducing the effect of both competition and predation, and permitting stability at a wider range of productivity.

## Presenter Abstract by Discipline

### **Mathematics Research - An Illustrative Example**

Presenter: Kelly Aman, Mathematics Graduate

Mentor(s): Minerva Cordero-Epperson

11:20 AM, Palo Pinto

#### **Abstract:**

What does it mean to do research in pure mathematics? Saying that I research "the algebraic properties of finite semifields" only makes sense if you know what a semifield is, and even the concept of mathematical research may be unfamiliar to you. There are, in fact, many similarities between research in pure mathematics and more experimental research. In this talk, I will highlight these similarities as I describe the methods I used to obtain one of my most important results.

The algebraic systems called "finite semifields" could be used to develop algorithms that will help increase the speed, security, and efficiency of Internet data, but first we need to have a better understanding of how they work. Existing research has focused on determining the algebraic properties of very specific finite semifields; the goal of my research is to build a strong set of mathematical tools that can be used to investigate the properties of *any* finite semifield. One such property is a set of functions known as the automorphism group of the semifield. Until now, there has not been a standard approach to determining this property. I will demonstrate how I was able to find a computational method for determining the automorphism group of any finite semifield.

*This research was partially supported by the National Science Foundation GK-12 Program under grant number 0841400.*

### **Effect of Fluctuating Temperature on Performance of Grease**

Presenter: Ami Shah, Material Science Engineering Graduate

Mentor(s): Pranesh B Aswath

Group members: Sujay D Bagi

8:40 AM, Concho

#### **Abstract:**

Friction has been one of the most common reasons for reduced efficiency of the machines. To improve efficiency, study of various lubrication systems and lubricants has been evolved. Grease, a common lubricant, contains various additives (chemicals) to enhance the friction and wear reduction. The traditional tests of evaluating grease are done in a machine called Tribometer and performed at uniform test conditions of 75°C, 1200 rpm & 40 kg load for 1 hour. To test the greases at more realistic conditions the temperatures were programmed to instead increase in a range of 50°C to 100°C. Highly tested, most commonly used extreme pressure additive like Molybdenumdisulphide (MoS<sub>2</sub>) and antiwear additive like Zincdialkyldithiophosphate (ZDDP) activated with Polytetrafluoroethylene (PTFE) were selected for performance testing. The wear surface was analysed using various imaging characterization techniques. Interaction between the additives was evaluated. Additives including ZDDP/PTFE showed activation at temperatures as low as 50°C with minimal temperature dependence on wear performance. Cyclic temperature tests on MoS<sub>2</sub> show improved wear performance in comparison to constant temperature tests. We see improved friction performance in cyclic temperature tests for all the blends. Specially, blends including ZDDP/PTFE show superior friction performance as compared to MoS<sub>2</sub>. This research is focussed on understanding the effect of cyclic temperature conditions on degradation of various additive chemistries that affect its wear and friction outcome. More realistic understanding shall help in effective application resulting in reduction of frictional losses and improving efficiency of the machines.

### **Changing node selection policy to improve performance in Tor network**

Presenter: Mehrdad Amirabadi, Computer Science Engineering Graduate

11:00 AM, Red River

Mentor(s): Matthew Wright

#### **Abstract:**

Tor is software and a network that provides anonymity for its users. Currently, there are more than five thousand computers (relays) in this network which has been distributed in all around the world. These relays have been configured to run Tor software in a way to redirect Tor users' traffic to their destination. By running this software, Tor users select three relays and using them to be connected to their destination. These relays conceal the users' identity and their destination from adversaries. One of the main problems of the Tor network is its performance. The current relay selection policy has some deficiencies which intensify this problem. In the current Tor design, relay selection is based on the relays' bandwidth and there is always a chance to select relays, which are in different directions in all around the world and it reduces the performance due to the latency in the network. In our new design we select relays not only based on their bandwidth, but also based on their location. By this method we just choose the high bandwidth relays located closed to the direct line between the user's location and her destination. To measure the performance of our new design, we have run our modified Tor on a Tor network simulator (Shadow). The results show improvement over the state of the art approaches.

### **EMPOWERING INNOVATIONS THROUGH DESIGN THINKING**

Presenter: Kharrolyn Amissah-Aidoo, Architecture Graduate

1:40 PM, San Saba

Mentor(s): Norma Figueroa

#### **Abstract:**

In the Design Thinking Lab, we identified user groups often overlooked in the design process, interviewed some of their members and, using their input, developed prototypes of innovations to empower, advance and include them as members of society with valid needs and wants.

Through interviews with active senior citizens, I identified that for them, even in a well-designed medium to large kitchen, food preparation can be exhausting. My solution, the Butt-res' Chair provides a relaxing middle ground between sitting and standing while cooking, as well as a tray on wheels to enable them move and perform better.

The Butt-Res' Chair, borrowing from technology used for toddlers high chairs, is a leaning chair that doubles as a cart. At the cooker, where the elderly would normally stand, an ergonomic leaning posture on the tilted seat puts them closer to the work top than sitting, keeping them at the right height while shifting their center of gravity to take strain off the feet.

Through interviews with nonprofits and the homeless, I identified my second target group, the Homeless in Transition and their basic need for respect, dignity and security while getting back on their feet.

My solution here was the H.I.T. (Homeless in Transition) kit, an executive-looking handbag aimed at giving a homeless woman a 'dressed' look to empower her psychologically to move forward, and at the same time safely secure her belongings. This bag converts into a pillow with attached sleeping bag for use at night.

### **Creating Black and Brown Female Disability: Historical Assumptions and Independent Realities**

Presenter: Lindsey Anderson, History Senior

8:40 AM, Guadalupe

Mentor(s): Ray Jordan

#### **Abstract:**

Although women of color with disabilities have the highest rate of disability in the United States-making up nearly 25 percent of all people with disabilities-women of color with disabilities remain virtually absent from mainstream American historical narratives. Except for the complex and contradictory case of Congresswoman Barbara Jordan, little is known about the history of women of color with disabilities, aside from the exploitation of non-normative black female bodies in freak shows and the ways in which doctors historically associated women of color with sickness and disease. Based on an ongoing oral history project with disabled Texas women of color, this presentation will offer some of the first grassroots histories of Texas women of color with disabilities. In so doing, this project will also challenge both traditional historical narratives of Texas, which emphasize whiteness, ableism, and male dominance, as well as standard disability studies assumptions about identity formation. Using an intersectional approach, this presentation will outline the varying and complex historical contexts under which Texas women of color with disabilities have established identities. Rather than fleeing from disability identities to escape other negative social assumptions about color or gender, these women have proudly claimed their status as –“disabled–” and have found independence, agency, and identity in working for organizations aimed at serving people with disabilities. For them, disability has become a key part of how they define community.

### **Obtaining Displacement Measures from Inertial Sensors to Quantify Human Steadiness/Tremor**

Presenter: Jonathan Armstrong, Electrical Engineering Graduate

Poster board: 3

Mentor(s): George Kondraske

#### **Abstract:**

Despite the prevalence of human tremor and decades of research, a standardized objective measure of human steadiness/tremor does not exist. Acceleration is the primary measure reported largely driven by the availability, sensitivity, and size of accelerometers. There has been growing support, however, to use displacement to reflect the "amount of tremor". Deriving displacement from acceleration involves a fairly complex signal processing chain requiring numerous parameter-dependent operations. In addition, tremor signals can have a range of characteristics. The challenge involves optimizing signal processing to obtain valid results over the range of tremor signals expected. Fast Fourier Transform (FFT)-based and integration approaches were developed in MATLAB. Both were evaluated using a set of simulated acceleration signals representative of tremor (pure fixed-amplitude sinusoids, amplitude modulated and frequency modulated sinusoids, and band-limited random signals). Key parameters (e.g., filter characteristics, sample rate, windowing) were varied. For the optimal settings determined, displacement accuracy ranged from 86.3% to 98.6% over all signal types, with the majority of cases greater than 90% accuracy. FFT-based approaches were better compared to the time-domain integration approach due to filtering influences. We conclude that what may be perceived as small differences in signal processing parameters can significantly impact the accuracy of acceleration-derived displacement measures. Careful attention makes it possible to obtain one set of parameters (e.g., "a standard") that produces reasonably accurate results for the range of tremor signals expected. This contributes to the quest for the standardized, objective quantification of steadiness/tremor for clinical and related purposes.

*This work was supported in part by the IEEE Instrumentation and Measurement Society.*

**XANES and Raman Analysis of Necrotic Trabecular Bone of the Femoral Head**

Presenter: Olumide Aruwajoye, Material Science Engineering Graduate

Mentor(s): Pranesh B Aswath

Poster board: 4

**Abstract:**

Ischemic osteonecrosis of the femoral head (IOFH) can lead to excessive resorption of the trabecular bone and collapse of the femoral head as a structure. The onset of the disease results from a lack of blood flow to the femoral head. However, very little is known about the chemical changes to the trabecular bone following ischemic osteonecrosis. We hypothesized that the chemical coordination of different elements vary in necrotic bone and possibly contribute to excessive resorption and structural collapse of the femoral head. The purpose of this study was to assess the chemical coordination of known elements in bone and isolate any differences between normal and necrotic bone. A piglet model of IOFH was used. Micro CT, backscattered scanning electron microscopy (bSEM), histology, X-ray absorbance near edge structure (XANES), and Raman spectroscopy were performed on femoral heads to characterize normal and necrotic trabecular bone. MicroCT, bSEM, and histology collectively showed gross deformity and active resorption of necrotic bone compared to normal. XANES and Raman spectroscopy obtained from actively resorbed necrotic bone and normal bone showed increased carbonate to phosphate content in the necrotic bone. While the significance of this finding is unclear, it is possible that local changes in the chemical structure due to carbonate substitution may play a role in the increased resorption of necrotic bone due to its increase in solubility. Indeed, a better understanding of the chemistry of necrotic bone could shed light on osteoclast activity and potentially improve therapeutic treatments that target excessive resorption of bone.

**Perceived Injustice is Associated with Psychosocial Distress and Sedatives Use in Chronic Disabling Occupational Musculoskeletal Disorder(CDOMD)Population**

Presenter: Sali Asih, Psychology Graduate

Mentor(s): Robert J. Gatchel

Group members: E. McKenna Bradford, Randy Neblett, Tom G. Mayer

1:20 PM, Neches

**Abstract:**

INTRODUCTION

Perceived injustice is defined as appraisal involving elements of the severity of loss as consequences of injury. Perceived injustice may serve as a risk factor of recovery. Higher perceived injustice is associated with more severe psychosocial distress. To date, perceived injustice in Chronic Disabling Occupational Musculoskeletal Disorder (CDOMD) in which occupational injury is the leading cause, has not been studied.

AIMS AND METHODS

This study aims to examine the utility of perceived injustice in a CDOMD population undergoing functional restoration program. There were 281 participants categorized into four groups based on the total score on the Injustice Experience Questionnaire (IEQ). The four groups were: low (n=19, scores: 0-9), average (n=35, scores: 10-17), moderate (n=84, scores: 18-29) and severe (n=143, scores: 30-48). The four groups were compared on demographic data, psychosocial measures (pain intensity, depressive symptoms, disability and insomnia) and medication (opioid, antidepressant and sedatives).

RESULTS AND CONCLUSION

The prevalence for low, average, moderate and high groups were 7%, 12%, 30% and 51%, respectively. High perceived injustice was associated with moderate-to-severe depressive symptoms, extreme disability, moderate clinical insomnia and sedative use ( $p$ s:0.000-0.040). No significant difference was found for opioid and antidepressants use. In conclusion, the majority of CDOMD sample experienced perceived injustice related to their condition. Further, the high perceived injustice group had similarly high levels of depressive symptoms, disability and insomnia. These findings may help clinicians tailor the treatment for those with high perceived injustice experience.

# ACES Symposium 2014

## Presenter Abstract by Discipline

### **Neuro-Adaptive Control of a Humanoid Robot for Walking**

Presenter: Ghassan Atmeh, Mechanical & Aerospace Engineering Graduate

1:40 PM, Red River

Mentor(s): Kamesh Subbarao

#### **Abstract:**

As part of an interdepartmental effort at the University of Texas at Arlington and the University of Texas at Arlington research institute a team was formed to compete in the Defense Advanced Research Project Agency (DARPA) robotics challenge competition. The work introduced in this abstract presents investigations and implementations by the author as part of that team. This abstract presents an overview of designing a system that allows a humanoid robot to walk in a stable manner. The work was based on a simulation model of the Atlas robot. Atlas is high mobility, humanoid robot designed to negotiate outdoor, rough terrain. It includes 28 hydraulically-actuated joints for two hands, arms, legs, feet, and a torso. Due to the complexity of the problem of controlling such a robot under the requirements of the competition, current interpretation of how the human brain works is used in the design process. Since humans rely on their brain to execute functions like walking, the hypothesis is that a control system can be designed to leverage a simplified model of how the core part of the brain (the neuron) works to execute a walking task. This model is referred to as artificial neural networks (ANN). The ANN is used to approximate the robot motion to allow for stable walking in simulation. Results show that it is possible to use such a system on a very complex platform, the Atlas, to execute the highly complex task of walking with two legs.

*This work was supported by the Defense Advanced Research Project Agency (DARPA)*

### **The Effect of Test-Order on the Sensory Organization Test**

Presenter: Rozha Azmar, Biology Senior

Poster board: 128

Mentor(s): Jacob Resch

Group members: Cadi Shurbet, Laila Khan, Mathew Schneider, Brandon Esianor

#### **Abstract:**

The Sensory Organization Test (SOT) is a clinical measure of postural stability following a sport related concussion (SRC). Despite its clinical use, the SOT has been shown to possess moderate sensitivity. The SOT consists of 18 trials, which may be administered in a random or serial order. Determining if there is a difference between random and serial may ultimately increase the sensitivity of the SOT to SRC. The objective of this study was to assess whether random or serial delivery of the SOT trials lead to significantly different composite scores. Participants consisted of 19 healthy college students (9 females and 10 males) aged  $21.16 \pm 2.12$  years with a mean height of  $167.80 \pm 18.07$  cm. Participants were randomly assigned into two groups. Groups were counter balanced and were administered on the SOT trials in a serial or randomized order. Participants then were seated for 15 minutes followed by the completion of the second SOT. The SOT equilibrium score and somatosensory, visual, vestibular, and visual conflict ratios were compared using paired t-tests to assess for differences between random and serial tests with a  $\alpha = .05$ . No significant differences ( $p > .05$ ) on any SOT composite score and/or ratios were observed. Overall, results suggest that test order has no effect on the SOT performance. However, future research should be conducted with a larger sample size in order to investigate this issue.

### **Adaptive robotic teacher for gesture imitation learning**

Presenter: Namrata Balakrishnan, Electrical Engineering Graduate

Mentor(s): Dan Popa

Group members: Isura Ranatunga

**Poster board: 5**

#### **Abstract:**

Autism is characterized by limitations in social interaction, speech, imitation and motor coordination. Recent studies suggest a link between imitation and Autism. In this paper, a system is developed to improve imitation learning in individuals with Autism. A system is proposed to gradually improve the imitation and social interaction of patients by adaptive training, which involves repetition of tasks close to the individual capacity limit and gradually increasing the capacity by improving the difficulty level. Here an ideal motion performed by a trainer is recorded using a Kinect sensor and is replayed on a small humanoid robot Zeno. The motion is encoded on the robot using the Dynamic Movement Primitives (DMP) architecture, which is a set of non-linear differential equations which can generalize a motion by just changing the time, beginning and end points of the trajectory. During teaching, the subject is asked to reproduce the gesture performed by the robot. A Kinect sensor is used to capture the subjects' motion. The robot adapts its motion to match that of the subject by analyzing the subjects' movements and changing the dynamics of the DMP. The intent of this approach is to gradually help the subject learn the ideal motion by adapting the teaching to the changing skill level of the subject. This system will help subjects of different capabilities learn in a consistent manner by adaptively adjusting to their progress.

### **Experimental Analysis of Patterned Growth of Micropores in Poly-Dimethylsiloxane (PDMS)**

Presenter: Arya Banait, Mechanical & Aerospace Engineering Senior

Mentor(s): Ankur Jain

Group members: Vivek Vishwakarma, Leila Choobineh, Ankur Jain

**1:20 PM, Guadalupe**

#### **Abstract:**

There is current interest in the field of microfluidics involving the soft polymer poly-dimethylsiloxane (PDMS) especially in biological systems. Flow across PDMS membranes requires controlled growth of micropores through thin PDMS layers. While micropore formation has been demonstrated previously using hydrophilic-hydrophobic interactions, a technique to grow micropores in a spatially controlled fashion has not been reported. This work demonstrates controlled growth of micropores along desired patterns in PDMS membranes using a microheater device fabricated on a glass slide. A coating of hydrophilic substance like Poly-Ethylene Oxide (PEO) is treated with uncured PDMS while an optimal electrical current is passed through the microheater device. The resultant heating causes local curing (solidification) of PDMS and PEO evaporates from the substrate. The evaporating PEO forms gas bubbles that migrate toward the microheater line (the hottest region on the device) and assemble in the shape of the line due to a phenomenon called thermocapillary effect. A set of experiments is conducted to determine optimal electro-thermal conditions for bubble formation. The variation of temperature, microheater line thickness and line shape is analyzed to study relationships between PDMS curing and bubble escape rates. Straight line and C-shaped micropore formations are demonstrated. The results of this work may have applications in PDMS-based membranes for filtration, separation and such other processes.

This work has been conducted at Microscale Thermophysics Laboratory, UT Arlington with Prof. Ankur Jain, Assistant Professor in the Department of Mechanical and Aerospace Engineering.

*Part of this work was supported by UT Arlington Honors College Undergraduate Research Assistantship (URA), now known as Undergraduate Research Fellowship.*

**Experimental determination of high velocity frictional behavior using a modified Torsional Kolsky Bar Apparatus**

Presenter: Monica Barbery, Geology Graduate

Mentor(s): W. Ashley Griffith

Poster board: 6

**Abstract:**

Knowledge of the frictional resistance along faults is fundamental to advancing our understanding of earthquake rupture mechanics as friction controls the stress drop, the mechanical work, and the heat generated during earthquakes. Earthquake ruptures typically propagate along preexisting faults at high slip velocities (m/s) under large normal stresses (50-125 MPa). Though often idealized as planar surfaces, faults in nature are irregular and it is theorized that high slip velocities during earthquake ruptures generates heat at connections between surface irregularities. The heat produced at these junctions does not have time to sufficiently diffuse, resulting in high, localized temperatures that degrade and melt the contacts, lubricating the fault and lowering the frictional resistance for a short period of time after initiation of slip in a process known as flash heating. Previous experimental work exploring the behavior of friction during rupture propagation has been conducted at low slip velocities (<1 mm/s) or under low normal stresses (<20 MPa). The focus of this work is to investigate the frictional behavior of rock at realistic slip velocities and normal stresses using a modified torsional Kolsky bar apparatus. In the experiments conducted thus far, a decrease in the coefficient of friction is noted, followed by an increase in the friction coefficient. The weakening is understood to be a result of flash heating, providing further support for the theory, and the strengthening results from increased contact area as surface irregularities are smoothed and hot, softened rock is cooled by neighboring, lower temperature rock.

*This work was supported in part by the National Science Foundation.*

**Cardiovascular Disease Risk Factors and Depression for African American Women who served in the Military and those that did not. Results from a National Longitudinal Survey**

Presenter: Tracey M. Barnett, Social Work Graduate

Mentor(s): Alexa Smith-Osborne

3:00 PM, San Saba

**Abstract:**

Background

Currently a gap exists in the literature that examines the relationship between African American Women (AAW) veterans, Cardiovascular Disease (CVD) risk factors, and depression. Research shows that AAW experience greater risk factors for CVD than any ethnic group. CVD can also trigger depression; consequently many AAW do not seek treatment for depression because it is viewed as a personal weakness.

Methods

Information was gathered from the 15th wave of data taken from the National Longitudinal Survey of Youth-97 which released figures for years 2011-2012. Selected variables included: sedentary activities, self-reported feelings of depression, and family history of diabetes for the most recent wave. A one way analysis of variance was used to examine the differences in sedentary activities, self-reported feelings of depression, and family history of diabetes for African American Women who served in the Military and those that did not.

Results

Results from the study provide evidence that African American women who served in the military experienced greater amounts of depression within the past four week period. For women that did not serve in the military, depression had a negative impact on their workplace performance. Those who served in the military spent more time during the week at a computer and those that did not serve spent more hours watching television. Lastly, siblings of those who served had a greater chance of being diagnosed with diabetes.

Significance of findings

Findings from the study provide policy and research implications for improved mental and physical health programs.

## ACES Symposium 2014

### Presenter Abstract by Discipline

#### **Teresa Mendoza, La Reina del Sur Controversial Rise to Popularity in Telenovelas**

Presenter: Mayra Barron, Modern Languages Senior

10:40 AM, Guadalupe

Mentor(s): Christopher Conway

#### **Abstract:**

Mexico has been fighting a drug war declared officially by President Felipe Calderon against all the drug cartels in 2006 with an estimated death toll of 60,000. These cartels have been dominating the illegal drug market in Mexico, causing rival cartels to fight over territory. Cartels are primarily male dominated organizations, with few women as leaders, such as Sandra Avila Beltrán, leader of the Sinaloa Cartel nicknamed "La Reina del Pacífico" (The Queen of the Pacific) by the media. The idea that women can be leaders of drug cartels has generated interest in popular Mexican culture. Los Tigres del Norte published a song in 2002 named La Reina del Sur, which speaks about a drug lord queen named Teresa Mendoza who dominates the drug scene in southern Spain. This song became a novel by Arturo Pérez-Reverte Gutiérrez, a Spanish novelist who made the bestseller list in Mexico. In 2011 Telemundo converted the book into a telenovela (a soap opera) bringing Teresa to life. Telenovelas have a long history in Latin-American television and largely influence the viewing population. My presentation argues how Teresa Mendoza has the ability to influence the Spanish viewing population accepting the drug war through a female character using sex appeal. I will carefully look at how Teresa has broken the traditional patriarchal role in a male dominated narco-culture and how her matriarchal role has influenced the viewers to accept a woman who refuses traditional family roles in a 2014 Spanish speaking society.

#### **Neutrinos and the Neutrino Experiment, an Effort to Understand the Universe**

Presenter: Amit Bashyal, Physics Senior

3:40 PM, San Jacinto

Mentor(s): Jaehoon Yu

Group members: Dr. Seongtae Park, Blake Watson

#### **Abstract:**

Neutrinos are almost massless, electrically neutral particles which are produced in nuclear reactors, the Sun, stars and huge cosmological events like Supernova explosions. Some of the unanswered questions about our universe is hoped to understand through the detailed studies of neutrinos. As a part of UTA high energy physics group member, I have been working on the simulation of the \$850M Long Baseline Neutrino Experiment at Fermi National Accelerator Laboratory. Although the experiment is still on the design phase, a series of simulation experiments altering the various components and the features of this experiment was carried out by our group. In this talk, I will give a brief introduction on neutrinos and their importance in understanding the fundamental nature of the universe. I will describe my work on the effect of the misalignment of one of the detectors and the proton beams, and the subsequent study of systematic uncertainties caused by the misalignment. The data were obtained by simulation done in the remotely connected FERMI Grid computing system. Careful statistical and physical analysis of these data was done to study the nature of neutrino flux, proton beams and the error distribution in this experiment. I will present the results of these studies with an explanation on the implication of these results on the future experiment itself.

## ACES Symposium 2014

### Presenter Abstract by Discipline

#### **Homosocial Bonds and the Female Experience in Contemporary American Literature**

Presenter: Tiler Bates, English Senior

9:20 AM, Guadalupe

Mentor(s): Desiree Henderson

#### **Abstract:**

For literary critics, depictions of gender and female voice are considered important for understanding how gender gets communicated and re-interpreted through literary texts. In my paper, I analyze three American novels that depict the experiences of girls attending college and their behavior around fellow women (*Daddy Long Legs* by Jean Webster, *Odd Girl Out* by Ann Bannon, and *The Wide, Wide World* by Susan Warner) by employing contemporary gender theory. I argue that although the main characters are in homosocial environments (referring to the fact that they either attend single sex universities or are involved heavily in groups that are single sex within their educational framework) their experiences are detrimental instead of beneficial to the women involved. Traditionally, feminist critics have viewed homosocial interaction between women as an alternative to women being used as an exchange commodity between men (such as "showing off a trophy wife"). Homosocial institutions are generally deemed beneficial in allowing women to extract themselves from patriarchal impositions. My argument differs in that I conclude that the female characters in these texts are essentially trained by the women around them in ways to behave in order to attract a marriageable, male partner. Instead of using the college environment and relationships for personal growth and liberation, the women are molded into the male-dominated system and pushed outside of their homosocial friend groups.

#### **Coral reefs under attack: Understanding how temperature is shifting the coral-microbe equilibrium in a major reef building coral**

Presenter: Joshua Beach-Letendre, Biology Graduate

9:20 AM, San Saba

Mentor(s): Laura Mydlarz

#### **Abstract:**

Invertebrate-microbe interactions within coral reef communities are rapidly shifting out of equilibrium throughout the globe. Higher temperatures are believed to be responsible for this destabilization. This study aimed to assess the production of potential virulence factors in previously isolated bacteria believed to contribute to disease symptoms in a major reef building coral, *Orbicella faveolata*. We hypothesize that an increase in temperature correlates with higher growth rates and biofilm (extracellular polysaccharide material) production in microbes associated with a destabilization in coral-microbe interactions. To test this hypothesis, the growth and respiration rates of potentially pathogenic bacteria (*Vibrio alginolyticus*, *Vibrio campbelli*, *Vibrio splendidus*, and *Aeromonas trota*) associated with Caribbean yellow band disease (CYBD) were measured across three different temperatures. At elevated temperatures bacterial growth and respiration rates increased significantly in all but *V. alginolyticus*. Biofilm production was assayed using a colorimetric method involving crystal violet. Secretion of biofilm was upregulated during slightly elevated temperatures but decreased at higher elevated temperatures. The data suggests that multiple virulence factors may be influenced by increasing temperature in bacterial communities and contributing to disease development in *O. faveolata*. Understanding these mechanisms is critical to creating methods for protective policy implementation for safe guarding the most diverse ecosystems on the planet.

Presenter Abstract by Discipline

**Analysis of Concrete Mixed with Carbon Nanomaterials**

Presenter: Md Motasim Bellah, Electrical Engineering Graduate

Mentor(s): Samir M. Iqbal

11:40 AM, Concho

**Abstract:**

We have studied concrete mixed with carbon nanotubes (CNTs) and carbon nanofibers (CNFs) designated together as carbon nano reinforcing materials (CNREMs). The effect of carbon nanomaterials dispersed in cementitious material changed macroscale properties due to nanoscale interactions. The data showed that both compressive and flexural strengths of the cement mortar mixed with 0.1% multi-wall CNTs (MWCNTs) were 54% and 14% higher than plain mortar paste (controls), respectively. Similarly, 0.1% CNF composites achieved 67% and 8% higher compressive and flexural strengths, as compared to control specimens. Flaws within cementitious composite exist at nanoscale. Utilization of CNREM may delay the nucleation and development of cracks at nano level and eventually hinder propagation of cracks to the micro level. The application of CNREM to reinforce cementitious composites can therefore enhance the reinforcing behavior at nano level instead of macro level. They can be distributed within the cement matrix at much more finer scale as compared to traditional reinforcing fibers. In addition, CNREM has the potential to act as filler around the cement grains, producing denser composites. Therefore, they may have the ability to produce significantly stronger and tougher cement composites in contrast to traditional reinforcing fibers. These enhanced structural properties may be attributed to the small sizes, very high surface to volume ratios, and very high mechanical strengths of CNREMs. This work may have some promises to find new structural composite materials with desirable properties.

**Professional or Personal? Examining the Agenda-Setting Surrounding Texas Senator Wendy Davis' Filibuster**

Presenter: Katherine Bennett, Communications Graduate

Mentor(s): Thomas Christie

Group members: Laura Kinch

Poster board: 7

**Abstract:**

Purpose: Women in politics are often viewed by feminine attributes that are different from male politicians. They are often described by their appearance, wife and mother status, and other personal attributes. This study uses content analysis to compare the attributes used to describe Senator Davis during the one month prior to and one month following her June 26, 2013, filibuster.

Methods: This study uses qualitative content analysis to study 84 newspaper articles from May 27-July 27, 2013, obtained through a Lexis-Nexis search using the terms "Wendy Davis" and "Texas." Fifty-three articles were in the Austin American Statesman and 31 from The New York Times. Editorials and letters were excluded. Two coders examined the articles based on three categories related to how Davis was covered in the media: personal attributes (appearance, education, personal background), professional attributes (political career, the filibuster, fundraising, political issues), and neutral/balanced.

Results: The majority of the articles had a professional tone, followed by personal and then neutral.

Coder 1

Coder 1

The Austin American-Statesman

The New York Times

Totals

Coder 2

Coder 2

The Austin American- Statesman

The New York Times

Totals

	Personal	Professional
Coder 1		
The Austin American-Statesman	5	36
The New York Times	8	21
Totals	13	57
Coder 2		
Coder 2		
The Austin American- Statesman	2	42
The New York Times	3	26
Totals	6	68

Conclusion: The findings show that the media used these attributes to portray Davis in a more professional tone instead of

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highlighting the more personal aspects of the senator and the filibuster.

**Geomechanical study of the formation, deformation, and internal structure of kilometer-scale sandstone injectites, Sheep Mountain Anticline, WY**

Presenter: Jennifer Beyer, Geology Graduate

8:40 AM, Pedernales

Mentor(s): W. Ashley Griffith

**Abstract:**

Clastic injectites are sedimentary structures formed by the forceful intrusion of liquefied sediments into surrounding low permeability rocks. Clastic injectites are present in sedimentary basins around the world; consequently an understanding of the geometry and internal structure of injectites is essential for predicting fluid flow in sedimentary petroleum reservoirs. Unfortunately, most injectites in petroleum reservoirs are difficult to image using geophysical techniques; therefore it is necessary to study them where they are exposed at the earth's surface. I have studied four large (up to 1 km in length) sandstone injectites which intrude in the Cretaceous Mowry Shale on the limbs of Sheep Mountain Anticline (Greybull, WY). I have characterized the 3D geometry, internal structure, and intrusion mechanics of these injectites using high precision GPS, outcrop-scale mapping, and structural analysis. My results indicate that the injectites were sourced by a sand in the overlying Cretaceous Frontier Formation. Sand intruded the underlying Mowry Formation along pre-existing joints prior to the development of Sheep Mountain Anticline. Clastic injectites are typically assumed to intrude upward toward areas of lower fluid pressure; however I argue that downward injection of the studied injectites is evidence of a highly stratified stress field resulting from the deposition, burial, and lithification history of the rocks in the area. Furthermore, the internal structure of the injectites is dominated by two sets of deformation bands with significant porosity loss. These injectites represent a significant potential fluid pathway for hydrocarbon migration, yet the deformation bands may act as fluid flow barriers.

*This work was supported by the American Chemistry Society through the Petroleum Research Fund.*

**Histone methyl-transferase EZH2 is transcriptionally regulated by estradiol and dysregulated by estrogenic endocrine disruptors**

Presenter: Arunoday Bhan, Chemistry Graduate

9:40 AM, Pedernales

Mentor(s): Subhrangsu Mandal

Group members: Paromita Deb, Imran Hussain, Khairul I. Ansari

**Abstract:**

EZH2, a histone 3 lysine 27 (H3K27) specific methyltransferase, is a critical player in gene silencing and is overexpressed in breast carcinomas. Our studies demonstrated that EZH2 is transcriptionally regulated by estradiol both in vitro and in vivo. EZH2 promoter contains functional estrogen-response elements. Estrogen-receptors (ERs) and ER-coregulators such as MLL-histone methylases (MLL2 and MLL3) bind to the promoter of EZH2 in the presence of estradiol and play essential role during estradiol induced EZH2 expression, in breast cancer cells. EZH2 is also transcriptionally activated upon exposure to estrogenic endocrine disrupting chemicals such as bisphenol-A (BPA) and diethylstilbestrol (DES), both in vitro and in vivo. Similar to estradiol, BPA and DES mediated EZH2 expression is also coordinated via involvement of ERs and MLLs. In summary, our study demonstrated that EZH2 is transcriptionally regulated by estradiol and its expression is potentially dysregulated upon exposure to estrogenic endocrine disrupting chemicals such as BPA and DES.

*Research in the Mandal laboratory is supported in part by grants from the National Institutes of Health (1R15 ES019129-01 and 2R15CA113747-02), the National Science Foundation (0821969), and the American Heart Association (0765160Y).*

**Large scale profiling of post translational lipid modified proteins by tandem mass spectrometry.**

Presenter: Ruchika P Bhawal, Chemistry Graduate

10:20 AM, Pedernales

Mentor(s): Saiful M Chowdhury

**Abstract:**

Protein prenylation is a type of post translational lipid modification where the covalent attachment of either 15 carbon farnesyl group or 20 carbon geranylgeranyl group to the cysteine residues of the proteins takes place. They play important roles in signal transduction pathways which are involved in cell growth, differentiation and other functions. Hence, the detection of the prenylated protein is important to understand the functions of lipid in these pathways. Recently developed methods utilized either radioactive labeling or in vitro tagging approaches for detection of prenylated proteins. There are no comprehensive mass spectrometric fragmentation studies were done on the prenylated proteins due to their hydrophobicity and poor ionization efficiency. We have developed a novel method to evaluate tandem mass spectrometry fragmentations of these prenylated peptides. This method involves the chemical oxidation of the prenylated peptides. Two prenylated peptides with farnesylated as well as geranylgeranylated lipid modifications were synthesized and oxidized. The mass analysis of all the prenylated peptides as well as oxidized ones were done using MALDI-IT-TOF. The CID fragmentation of the oxidized prenylated peptides result in the formation of a signature fragment with a constant mass loss from the prenyl group. This method can be globally applied to all prenylated peptides in a complex matrix as well as differentiate between the types of prenylation in less time.

**Investigating a new chemical space within Thiamin (Vitamin B1) Biosynthetic Pathway:  
The case of HMP Kinase**

Presenter: Sumit Bhawal, Chemistry Graduate

11:00 AM, Pedernales

Mentor(s): Frank W. Foss Jr.

Group members: Diego Lopez, Yannick Nkuni and Frank Foss Jr

**Abstract:**

The efficacy of current antibiotics has been compromised due to emergence of drug resistant pathogens. This has created the need to identify new targets as they may generate new class of compounds for which there is no preexisting drug inactivation mechanism. Thiamin (Vitamin B1) in its active form is an essential cofactor for all organisms but bacterial species has the necessary enzymes (not humans) to synthesize it. Therefore, enzymes of Thiamin biosynthetic pathway might be one largely untapped source of selective antibiotics targets. The chemical space of HMP kinase, an unexplored and important enzyme within Thiamin biosynthetic pathway, is investigated by synthesis of a rational library of small molecules and making subtle variation around the natural substrate 4- amino- 5-hydroxymethyl -2-methylpyrimidine(HMP). HMP kinase is responsible for catalyzing two sequential phosphorylation of HMP to HMP mono and di-phosphate within the same catalytic domain. Thus blocking either of these two transformations by suitable HMP analogous may lead to selective inhibition of bacterial thiamin biosynthesis, leading to its death. Various classes of HMP analogues were successfully synthesized, revealing convenient and divergent preparations of highly substituted pyrimidines. Luminescent kinase assays were utilized to investigate initial substrate scope and inhibitor pharmacophore with synthetic HMP analogues. The initial structure „Ä“activity relationship studies revealed interesting structural requirements for binding and inhibition and future studies are directed to improve it further.

**Catalytic Olefin Hydrosilylation Reactions: Synthesis Towards Cholesterol Reducing Agents**

Presenter: Apparao Bokka, Chemistry Graduate

Poster board: 8

Mentor(s): Junha Jeon

Group members: Yuanda Hua, Adam S Berlin, William R Scaggs

**Abstract:**

HMG-CoA reductase inhibitors (Statins) are a class of drugs used to lower cholesterol levels by inhibiting the enzyme HMG-CoA reductase, which plays a central role in the production of cholesterol in the liver. Statins contain a 1,3-diol moiety which is responsible for their biological activity. Synthesis of these 1,3-diols involves many hurdles such as low yields, purifications, and generation of harmful byproducts. We have designed an efficient, robust, and catalytic method to synthesize 1,3-diols. The advantage of this environmental friendly strategy will be two-fold; minimizing toxic waste and reducing operating costs associated with all the required processes. In our current study we demonstrated that the 1,3-diol skeleton was efficiently synthesized through olefin hydrosilylation by employing Grubbs' metathesis catalysts. We will provide the mechanistic details of this process and its synthetic applications.

*This work was supported by The University of Texas at Arlington start up fund.*

**From Photons to Electrons: Silicon Photomultipliers**

Presenter: Joshua Bolton, Engineering Junior

1:40 PM, Guadalupe

Mentor(s): Jaehoon Yu

Group members: Timothy Watson and Dr. Seongtae Park

**Abstract:**

Silicon Photon Multipliers (SiPMs) are made up of tiles of a silicon compound. They are used to change light, in the form of photons, into Electrons. If the photons have enough energy when they strike the silicon, they turn into an electron, which are usually known as photo-electrons. Electrons have a negative charge, and thus when they move, they create a current. An anode and a cathode are used to collect the current. This current can be used to tell the amount of photons that have hit the SiPM. A SiPM is only as good as the device that checks the current coming out of it. Our research is focusing on the best way to check the current coming out of a SiPM. If we can improve these SiPM detectors, we can use them to increase the accuracy in other experiments. There are many uses for These SiPMs. They can be used as detectors for radiation, medical imaging, and a similar product is used for solar panels.

Presenter Abstract by Discipline

**THE FEAR-AVOIDANCE COMPONENTS SCALE: A NEW MEASURE OF PAIN-RELATED FEAR-AVOIDANCE**

Presenter: Evan Bradford, Psychology Graduate

1:40 PM, Neches

Mentor(s): Robert J. Gatchel

Group members: Randy Neblett, Meredith Hartzell, Tom Mayer

**Abstract:**

**INTRODUCTION:** Pain and injury-related fear-avoidance (FA) is common in many individuals faced with acute and chronic pain and can lead to decreased physical activity, social interaction, and exaggeration of pain perception and pain behaviors. Although several self-report measures have been developed to measure specific components of FA, the Fear-Avoidance Components Scale (FACS) was created to provide a more comprehensive FA measure that demonstrates high reliability and validity. .

**AIMS AND METHODS:** The purpose of this study was to determine how reliable, valid and useful the FACS is in determining FA in both a patient and non-patient population. A total of 306 chronic disabling occupational musculoskeletal disorder (CDOMD) patients completed the FACS at an initial evaluation for a functional restoration program (FRP) and were used for factor and item analysis in a prospective cohort study. Of those, 294 were admitted to the FRP and completed a second FACS, and 131 completed the FACS within 5 days of initial evaluation and were used for test/re-test analysis. Additionally, 61 comparison subjects from a non-patient community sample also completed the FACS.

**RESULTS AND CONCLUSIONS:** The FACS was found to be highly reliable with a high Cronbach's alpha value and high test-retest reliability. Factor analysis supported three pre-determined factors: pain-related anxiety, avoidance, and victimization. The FACS successfully differentiated between the patient and non-patient comparison sample. These novel results indicate that the FACS is the first reliable measure that successfully differentiates among the three important components of FA in CDOMD patients.

**Dog behavioral patterns in dog parks**

Presenter: Brandon Butler, Anthropology Senior

8:00 AM, Guadalupe

Mentor(s): Shelley L. Smith

**Abstract:**

Domestication has enabled the dog to become integrated into human society by mediating the behavioral systems concerned with fear and aggression. Dogs are able to interpret human communicative social cues and communicate with humans within their phylogenetic constraints. Given that most studies examine dogs' abilities to communicate with both members of their own species and members of the human species, few have taken serious consideration into how dogs navigate a dynamic social environment where both species would frequent in large numbers outside of the context of walking, namely a dog park. This study uses behavioral observation methods (focal follow and ad libitum sampling) to elucidate how dogs behave differently to other dogs and to humans (owners and non-owners) in a dog park setting on the basis of four behavioral categories: agonistic behavior, play behavior, attention behavior, and stress behavior. It also reviews the literature surrounding dog behavior and the role domestication may have played in its evolutionary change. The results indicate that dogs are more likely to utilize play and attentive behaviors toward other dogs, depending on the activity or inactivity of the humans involved. Agonistic behavior accounts for only a certain percentage of total observed behaviors but when they occur they usually involve other dogs not people usually.

**Comparative Sustainability analysis of Bioreactor landfills: Aerobic Bioreactor landfill vs. anaerobic bioreactor landfill**

Presenter: Reza Broun, Civil Engineering Graduate

3:20 PM, Concho

Mentor(s): Melanie Sattler

**Abstract:**

Municipal solid waste (MSW) management is an important part of urban infrastructure ensuring protection of the environment and human health. The main reason for a special look in MSWM is increasing rate of MSW generation in many urban areas. Subsequently, Texas as a result of accelerated urban population growth and increasing economic activities and resource consumption is exposed to growing rate in generation of municipal solid waste. As the amount of municipal solid waste raises, a sustainable method to manage MSW is gaining more importance to overcome the probable troubles arisen from disposing MSW.

The purpose of this paper is to compare sustainability analysis of municipal Solid waste disposal in Texas. Therefore, two types of bioreactor landfills have been assessed using environmental, economic indicators based on a life cycle approach. The existing situation of aerobic bioreactor landfill in Texas was compared with that of an anaerobic bioreactor landfill. The results revealed the extent to which aerobic bioreactor landfill could contribute to reducing environmental impacts such as reduction of methane emission (global warming potential), within an anaerobic bioreactor landfill if methane gas is not collected properly, it might be resulting in increase of landfill gas emission. In addition, assessment of life cycle cost showed results in support of anaerobic bioreactor landfill due lack of cost associated with air injection in cells and economic benefits from energy production. The results can be interesting for landfill owners in order to utilize the appropriate type of bioreactor landfill to achieve the sustainability goals.

**Information Packaging with Hashtags: Repair on Twitter**

Presenter: Darcey Browning, Linguistics Graduate

8:20 AM, Neches

Mentor(s): Laurel Stvan

**Abstract:**

Hashtags may have been originally created as a search tool, but this combination of symbol and text is now a pragmatic device conveying information that is not explicitly given in the text.

In examining noun phrases, Clark and Marshall (1981) suggested that mutual knowledge is essential for communicating successfully; they found that hashtags serve as a tool for repair involving cultural, linguistic, indirect, and physical co-presence.

Using opportunistically gathered tweets combined with those from *Illocution Inc* (2013), 337 tweets with 427 hashtags were analyzed; from those, 25

(1) [Ö] if Amazon Prime doesn't have what I wantÖ go into mass confusion  
and slight panic #Firstworldproblems

(2) Her outfit omg give me #newgirl

(3) [Ö] tomorrow I get to go pick up Spencer!! #puppylove

(4) Yup somebody just got flashed. #windy #woops

In the examples for (1-4), a subset of the meaning of each tweet would be unclear without the hashtag. While repair is not the only job of hashtags, the linguistic categories of Clark and Marshall (1981) illustrate how well they perform this task.

**Suicidality and Health Risk Behaviors among Youth in Juvenile Detention**

Presenter: Dante' Bryant MPsy, MTS, MSSW, PhD student, Social Work Graduate

3:40 PM, San Saba

Mentor(s): Schnavia Hatcher

Group members: Hyejung Oh, MSW; Schnavia Smith Hatcher, Ph.D.; Dione King, MSW and Brian Bride, Ph.D.

**Abstract:**

Research Cluster: Adolescent and Youth Development

Adolescent Violence/Delinquency Health

Title: Suicidality and Health Risk Behaviors among Youth in Juvenile Detention

Suicide is the third leading cause of death among youth between the ages 15 to 24. The number of reported suicidal behaviors increases substantially when attention is turned toward incarcerated female youth. Female youth account for more than 20% of the juvenile population. Despite their growing presence there has been little effort to examine the prevalence of suicidal activity and associated health risks behaviors among this population. The purpose of the study was 1) to examine the prevalence of suicide ideation and attempts and health risk behaviors in incarcerated female adolescents and 2) to determine whether associations existed with suicidal ideations and attempts and health risk behaviors.

Data suggest that both suicidal ideations (40%) and attempts (54%) were highly prevalent among female juvenile detainees. Number of sexual partners (1.33 (CI=1.01, 1.27) and physical fights (CI=1.01, 1.27), were included in the final model ( $X^2=9.69$ ,  $df=2$ ,  $p=.008$ ). Both outcomes suggest a positive relationship with suicidal ideation.

This research was conducted to aid in the identification and prescription of a growing social concern effecting an often overlooked population. The fi

Acknowledgements

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**Flower Micro-channel Device for Cancer Cell Migration Study**

Presenter: Loan Bui, Biomedical Engineering Graduate

9:40 AM, Palo Pinto

Mentor(s): Young-Tae Kim

Group members: Bailey Sayles, Oguz Yetkin

**Abstract:**

Microfluidics is the study of small volumes of liquid in confined spaces. This is important in the field of cancer research because it allows researchers to follow specific cells and monitor their behavior as they move through micro-channels. Here, we present a novel microfluidic design that we refer to as the "Flower device" because the device, made of a polymer, features one central reservoir where cells are cultured, surrounded by six 'satellite' reservoirs. The devices either have identical micro-channels connecting the central reservoir to all six satellites (tapered version) or various dimension (20, 15, 10, 8, 5, 3 $\mu$ m width) micro-channels (multi version). The device design accomplishes multiple aims: 1) improve the limitations of time consuming experiments 2) reduce the large standard deviation, an intrinsic drawback of many microfluidic systems, and 3) target different aspects of tumor cell migration processes such as various migration modes, extracellular adhesion, etc. Our first aim was to determine an optimal cell seeding volume for both of the devices; 50 $\mu$ l was found to sufficiently enable high and uniform cell distribution. Next, multi-flower devices allowed us to simultaneously visualize different modes of brain cancer cell migration in the 6 different dimensions of micro-channels. These were amoeboid mode via the confined (3 and 5 $\mu$ m) micro-channels and mesenchymal mode via the wide (15 and 20 $\mu$ m) micro-channels. Another application was to compare migrating ability of different genetically modified mouse astrocytes; the cells with more cancer-related genetic modifications such as the triple mutant *P53*<sup>-/-</sup> *Pten*<sup>-/-</sup> *Braf* showed closer cancerous migratory behaviors.

ACES Symposium 2014  
Presenter Abstract by Discipline

## ACES Symposium 2014

### Presenter Abstract by Discipline

#### **A Review of the Theoretical Frameworks Within the Journal of the Society of Social Work and Research**

Presenter: Jacqueline Burse, Social Work Graduate

**Poster board: 9**

Mentor(s): Alexa Smith-Osborne

Group members: Abdullah Asmari, Alicia Barker

#### **Abstract:**

Within the social work profession, theories are applied to gain a better understanding of people, organizations, policies, and systems. Social work journals provide the primary knowledge base of the profession and give credibility to the research process. We evaluated 52 journal articles within the Journal of the Society of Social Work and Research in order to assess the number of articles that utilized a theoretical orientation. Results show that 43% of the articles reported a theoretical model within the research but may not have utilized the theory throughout the research process, which indicates a gap in linking theory and research. This study illustrates the need for the future social work scholars and practitioners to practice, engage in, understand, and have advanced knowledge of research with a theoretical context.

#### **The fight and struggle to survive**

Presenter: Jennifer Caballero, Modern Languages Junior

**Poster board: 125**

Mentor(s): Christopher Conway

#### **Abstract:**

La bestia is the name given to the train that runs from Guatemala to Mexico transporting goods and the dreams and hopes of countless undocumented immigrants. Women are part of the mass of immigrants migrating daily to Mexico using the bestia. Their goal is to reach the United States and make a new life for themselves. What these women do not know is that in the journey to accomplish their dream, their life is in danger. Their dream is also a nightmare as they run the risk of being kidnapped into sexual slavery, raped or murdered. My presentation will focus on the journey of these women and their struggle to survive. I also examine the kind of help and treatment these woman receive from the Mexican government and other non-profit organizations. Clearly, these women are not being protected enough. Using the horrors of their journey, and data documenting it, my presentation makes various proposals about how women making this journey can be protected and helped.

**A Phenomenological Study on International Doctoral Students' Acculturation Experiences at a U.S. University**

Presenter: Throy A. Campbell, Leadership Graduate

11:20 AM, San Saba

Mentor(s): Barbara Tobolowsky

**Abstract:**

A phenomenological method was used to analyze 10 international doctoral students' description of their lived experiences at a United States (U.S.) university. The analysis was based on the theoretical premise of how migrant students' acculturate to their new educational settings (Berry et al., 2006; Vedder & Horenczyk, 2006). Three broad overlapping themes emerged: (1) participants' past experiences that influenced their desire to study in the U.S.; (2) participants' interactions within academic and non-academic settings; and (3) the role of family relationships during their studies. The study revealed that the students: were optimistic about the societal opportunities from studying in the U.S., were appreciative of their interaction with instructors, had inadequate relationship with supervising professors, participated in limited social activity outside of academic settings, and made adjustment to family relationships.

These empirical evidences serve for further research and inform university administrators and policy makers. In the context of doctoral programs, academic departments should make faculty advisors aware of students' cultural differences, provide mentoring opportunities, and facilitate the formation of supportive student organizations. These initiatives will help to orient the students on the demands of doctoral studies, expose them to scholarly research, and provide opportunities to collaborate in academic projects.

**Assessing the cooling effect of Joe Pool Lake towards the Urban Heat Island (UHI) phenomenon in the North-Central Texas region over the period of November 2012 - November 2013.**

Presenter: Nguyen Cao, Geology Senior

10:20 AM, San Jacinto

Mentor(s): Arne Winguth

**Abstract:**

This study assesses the cooling effect of Joe Pool Lake (JPL) towards the urban heat island phenomenon (UHI) in North-Central Texas region from November 2012 to November 2013. The UHI refers to the urban area exhibiting a higher temperature than its adjacent rural site. Joe Pool Lake, located in the rural area of the study, is conjectured to have a cooling effect towards it, possibly aggrandizing the temperature difference between the two sites. The cooling effect means the lake's heat budget yields a positive value, which is equal to the gained heat of the lake and the heat loss of the surrounding area. Building the heat budget requires a thorough calculation of the lake's surface heat fluxes-sensible heat flux, latent heat flux, insolation flux, infrared flux, and advective heat flux. Weekly meteorological data sets regarding wind speed, wind direction, air temperature, surface temperature, humidity, and dew point are obtained directly from JPL. Missing data sets due to bad weather conditions and other relevant data sets which cannot be obtained from the lake such as insolation are inputted from the Texas Commission for Environmental Quality (TCEQ) and National Oceanic and Atmospheric Administration (NOAA) websites. Subsequently, the aforementioned fluxes are computed based on the recorded measurements. As predicted, the heat budget yields a positive value. Therefore, the lake is concluded to have a cooling effect towards the rural area in this UHI study. The data sets also provide an important database for future analysis of climate events and lake hydrodynamics.

**Genome-wide evidence of evolution in the invasive Florida python population**

Presenter: Daren Card, Biology Graduate

1:00 PM, Palo Pinto

Mentor(s): Todd A. Castoe

Group members: Drew R. Schield, Margaret Hunter, Todd A. Castoe

**Abstract:**

Analyzing how natural selection exerts its effects on a genomic scale is difficult because substantial evolutionary changes often happen over long time periods in most species. Invasive species, however, represent a promising model for analyzing the processes of evolution and adaptation on timescales that are tractable for study, and have been shown to demonstrate rapid evolutionary responses over short or 'ecological' timescales. Such recent invasive introductions often demonstrate rapid responses to this shift in environmental conditions and habitat (from native to introduced), and present ready opportunity to test the genome-wide effects of natural selection. The Burmese python (*Python molurus bivittatus*) is ideal for this work due to its recent establishment in Florida, a location with climatic conditions much different from those in the species' native range of Southeast Asia. A 2010 freeze event in Florida led to a large (>50%) die-off of snakes in the Florida python population (FPP), and represents a selective event that likely catalyzed selection-driven evolution in the FPP. We used discrete population-level sampling of the FPP before (2007) and after (2013) the freeze event and genome-wide marker sequencing (RADseq) to test the hypothesis that large fluctuations in allele frequencies (i.e., evolution) have occurred in the FPP as a result of the freeze event. We found multiple regions of the genome that appear to show major fluctuations in heterozygosity, indicating *in situ* evolution in the FPP, and we used the Burmese python genome to identify genes and associated functions linked to these putatively selected loci.

*This work was supported by startup funding to Todd Castoe from the University of Texas at Arlington.*

**Time-Lapsed Study of Groundwater Quality in Areas of Hydraulic Fracturing and Natural Gas Extraction**

Presenter: Doug Carlton, Jr., Chemistry Graduate

11:20 AM, Pedernales

Mentor(s): Kevin A. Schug

Group members: Zacariah L. Hildenbrand; Brian E. Fontenot; Jayme L. Walton; Kevin A. Schug

**Abstract:**

The volume of extractable natural gas across America has proliferated due to advances in unconventional extraction techniques, including hydraulic fracturing. Many of these techniques are relatively new in the world of hydrocarbon extraction, therefore, a sound understanding of their effects beyond increased production is absent. Adequately surveying extraction regions with environmental and analytical measurements has not been possible because of rapid expansion of newly available gas reserves. This study has taken the opportunity to collect approximately 60 water samples from two properties (totaling approximately 7000 acres) within the Cline Shale of the Permian Basin in Texas where hydraulic fracturing and natural gas extraction are present. These samples were collected less than six months before any drilling activity was scheduled to take place in an effort to obtain baseline data. These data were then compared with data from subsequent sampling events during production and after completion of the gas wells. Each time-point sample was subjected to a comprehensive suite of analytical techniques for fracturing fluid ingredients, specific metals utilized for drilling and fracturing, and carbon and nitrogen content measurements. Data acquired pre-fracking indicates the water to be of good quality. Selected metal measurements reveal a consistent concentration of arsenic in the water, but a decrease in selenium along the time points. Other measurements from this work in progress will also be discussed. Our study possessing thorough baseline data by the same protocols can be the most decisive case study for understanding impacts of hydraulic fracturing.

## ACES Symposium 2014

### Presenter Abstract by Discipline

#### **A theoretical model of coinfection dynamics: Modeling competition dynamics between *Borrelia burgdorferi* and *Anaplasma phagocytophilum* within a human host.**

Presenter: Ashley Carter, Biology Senior

8:40 AM, San Jacinto

Mentor(s): James P. Grover

Group members: Aileen Toja, Joana Gonzalez, Omomayowa Olawoyin, Dr. James Grover, Dr. Hristo Kojouharov, Dr. Christopher Kribs-Zaleta

#### **Abstract:**

Though many mathematical models have been used in the field of epidemiology, few models aim to predict the outcome of competitive coinfection dynamics within humans. This study used a theoretical model to analyze the competition between two infectious bacteria, such as *Borrelia burgdorferi* and *Anaplasma phagocytophilum*, which often coinfect human hosts. Interactions between coinfecting species in the human body are complex, since both microorganisms are competing for the same resource, which in this study is iron, and elicit different rates of innate immune responses from neutrophils and macrophages. The goal of this study was to identify whether resource limitation or immune responses are more efficient in clearing a coinfection. Literature values were used to parameterize the interactions for numerical simulations. Results showed that a 10% decrease in iron availability below baseline parameters would clear the coinfection, while an 8% increase in neutrophils would produce the same results. Through these simulations it was concluded that both, decreasing the iron availability and increasing the neutrophil concentration in this system, were equally efficient at clearing the coinfection. The results showed that these changes have the potential to be artificially induced in humans as an alternative treatment method for coinfections.

*This work was supported in part by the National Science Foundation through NSF Award #DUE-0827136, with additional support from The University of Texas at Arlington.*

#### **Determination of Nicotine Residue in Fish with QuEChERS Sample Preparation Method**

Presenter: Yun-Wei Chang, Chemistry Graduate

Poster board: 10

Mentor(s): Kevin A. Schug

Group members: Hien P. Nguyen, Mike Chang

#### **Abstract:**

Nicotine is used as a botanical insecticide on crops in the US, Canada, and other parts of the world. As with many pesticides, there is a concern that overuse can result in contamination of the environment. Nicotine is ultimately poisonous to organisms and the accumulation of it in aquatic animals is a concern. The quantitative determination of nicotine and its major metabolites (cotinine, anabasine) in fish tissue was evaluated using liquid chromatography coupled with tandem mass spectrometry. Marine and freshwater fish were purchased from local grocery stores and were prepared based on a well-known QuEChERS (quick, easy, cheap, effective, rugged, safe) sample preparation protocol. To determine the highly polar compound, cotinine, hydrophilic interaction liquid chromatography (HILIC) was also introduced. There were significant suppressions on measured nicotine signals (10%) due to the matrix effects from marine fish but no obvious effects on freshwater fish signals. Method validation was incorporated with internal standards and carried out with matrix-matched calibration. The detection limits for nicotine, cotinine, and anabasine were 9.4, 3.0, 1.5 ng/g in fish, respectively. The precision was higher than 89% for all three compounds and the accuracy was satisfactory on anabasine and nicotine at middle and high concentrations. Acceptable extraction recoveries (70 ñ 120%) of all three compounds were achieved except anabasine at low concentration (61%). This developed method offers a fast, easy, and sensitive way to evaluate nicotine and its metabolites residue in fish tissues.

Presenter Abstract by Discipline

**A Historiography of Rock Crystal Funerary Art in Early Buddhism**

Presenter: Morgan Chivers, Art Graduate

Mentor(s): Melia Belli

9:00 AM, Neches

**Abstract:**

This paper examines the historiography of rock crystal in Buddhist funerary art; despite the frequency with which clear macro-crystalline quartz objects were found in auspicious circumstances, art historians have traditionally paid these objects remarkably little attention. By combing through the archives of archaeological papers discussing *stupa* excavations, and by following any mention of these unearthed relics throughout the published literature, I have discovered that the majority of relevant authors merely mentioned the existence of a crystal object, with little to no attempt to elucidate their significance. It is not within the purview of this paper to specify the significance of rock crystal to early Buddhist practitioners and *stupa* builders, though the paper does take the first steps towards understanding what significance the material may have held in those communities by establishing that the material seems to have occupied a special place within the cosmology of certain sects of early Buddhists, and by detailing the extent to which this issue has been largely overlooked by modern scholars and art historians.

**Using digital media to foster cultural interaction of Canadian-Born Chinese**

Presenter: Gladys Chow, Art Graduate

Mentor(s): Robert Hower

8:40 AM, Neches

**Abstract:**

Using digital media to foster cultural interaction of Canadian-Born Chinese

The purpose of this research project and creative activity is to create an interactive eBook story that introduces Canadian-Born Chinese (CBC) children to cultural experiences in the Cantonese and English languages. This digital story hopes to encourage understanding of Chinese and Canadian culture and traditions, stimulate language practice of Cantonese and English, and potentially bridge the communication gap between younger and older generation audiences.

A first draft of an interactive eBook story regarding the Mid-Autumn Festival Chinese holiday was designed and presented to CBC children and their parents on the Apple iPad. By observation, research data was collected from CBC children concerning their responses to cultural symbols, graphics, language and content of the bilingual story. While the parents read the story to the child, observations were documented regarding the particular illustrations the child touched on the screen, sounds the child repeated, the language learning ability of Cantonese and English vocabulary, and their reactions to interactive components in the story. An online survey was also sent to participants to gather feedback on their reading experience.

Some of the initial observations suggested that certain visuals and audio from the story related to the reader's level of engagement and educational involvement. The data gathered was significant in understanding the design and narrative improvements needed in the digital story to inspire cultural interaction and language exchange between generational audiences.

*This work was supported in part by the Festival of Ideas Global Research Fellowship.*

**An Examination of Transient Affective States and Religious Experiences at a Zen Meditation Retreat: A Pilot Study**

Presenter: Thomas Christian, Social Work Graduate

Mentor(s): Jan Finch

Group members: Weldon Wright, M.D.

Poster board: 11

**Abstract:**

The purpose of this pilot study is to examine affective states related to religious exercise and religious experience. For this study we set out to observe and annotate affective/feeling states, as subjectively experienced by 6 participants during a 3-day Zen meditation retreat. We developed a push-button device, designed for the investigative effort, which allowed for both the electrical recording of participants' feelings, and the quantitative analysis of these perceived feelings.

Participants were instructed to press buttons designated for 3 principal feeling states as they became aware of such states; namely, suffering, joy, and "no self"--a phrase correlated in the Zen tradition with western notions of "religious experience." Prior to the retreat the participants were educated respecting common definitions for each button. What is more, at the conclusion to the retreat we asked participants to manually record in a writing tablet their insights related to their personal experiences apropos of affective states during the retreat.

Our main research question centered upon the possible relationship of perceived suffering and perceived joy vis-à-vis participants' "no self" experiences.

The data indicates four items of note: 1) It emphasizes the cyclical nature of perceived affective states during long-term meditation--joy, suffering, joy, etc.; 2) Attention upon affects during long-term meditation increases meditators' sensitivity to affective quality; 3) Participants maintain that "suffering" is a type, or form, of "joy;" 4) There may be some type of entrainment activity among meditators; that is, the meditators seem to experience similar affective states at similar times.

*i.N.N.N.i.*

**The Development of a Hybrid Energy Storage Module (HESM) Using Commercial Off the Shelf Technology**

Presenter: Isaac Cohen, Electrical Engineering Graduate

Mentor(s): David Wetz

Poster board: 12

**Abstract:**

There is a considerable need for a compact prime power supply for a host of applications including directed energy and electrical grid backup among others. The need for both high energy and high power makes the implementation of such a system a non-trivial task. While lithium-ion batteries (LIBs) are available, which possess these properties, operation at high power reduces their cycle life which increases the cost of the system with frequent replacements. One method proposed involves combining high energy LIBs with high power electric double layer capacitors (EDLCs) using power electronics to regulate the power to and from each respective device. At UTA, a high rate HESM has been constructed to evaluate its performance under various load conditions. It has been constructed using commercial off the shelf (COTS) power electronic converters, lead-acid batteries, and EDLCs. The results have shown that this scheme is capable of not only maximizing the LIBs cycle life and delivering power to the load at all times, but is also capable of increasing the instantaneous power capabilities of the system. This is accomplished by limiting the current flow through the batteries and allowing the EDLCs to handle all transient demands through intelligent control of the power converters. Utilizing this system has the benefits of reducing long-term system cost, reducing size and footprint requirements of existing systems through HESM augmentation, and most importantly, reducing the hazardous material waste of battery replacement. A discussion about the setup at UTA and results obtained thus far will be presented here.

*This material is based upon work supported by US Office of Naval Research (ONR) under contract number N00014-11-1-0659 and N00014-13-1-0441.*

**Role of Reverse Transcriptase Domain 0 in Non-LTR Retrotransposons**

Presenter: Jeremy Cortez, Biology Junior

Mentor(s): Shawn Christensen

Poster board: 128

**Abstract:**

Transposable elements (TEs) are genomic parasites (mobile DNA) with the ability to replicate within most organisms' genomes. "Target primed TEs" are an important class of TEs that are responsible for making up over 34% of the human genome. Target primed TEs have an RNA genome that is copied then pasted into DNA at a site of insertion; a process termed target primed reverse transcription. Target primed TEs, therefore, must encode a protein that is able to bind their element RNA and copy it into the host DNA. Reverse transcriptase, an important enzyme attached to target primed TEs, have a coding region (domain 0) not present in other TEs. It is hypothesized that domain 0 of the reverse transcriptase may be involved in recognizing and binding to element RNA. I generated a point mutation within domain 0 of the target primed TE from *Bombyx mori* (R2Bm) in order to test for loss of RNA binding function. The mutant protein was purified and put through in vitro based DNA and RNA binding reactions that mimic target primed TE activity in cells. Electrophoretic mobility shift assays and denaturing gel electrophoresis indicated that the point mutant was not deleterious enough to show demonstrable loss of function. Although this particular mutation did not show loss of function, domain 0 is highly conserved and is still likely to be involved in RNA binding or integration. Additional single and double mutants are currently being generated in domain 0 to test for loss of function.

*This work was supported by NSF and the McNair Scholars Program.*

**Dynamics of Bison and Prairie Grass**

Presenter: Brittney Cox, Biology Junior

Mentor(s): James P. Grover

Group members: Oladipo Oyediran, Christy Nguyen, Hristo Kojouharov

Poster board: 128

**Abstract:**

The purpose of this project was to observe the dynamics of bison and prairie grass populations when subjected to changes in growth factors. In a simplified system, short prairie grass grows into tall prairie grass at a constant rate unless it comes in contact with bison feces. This contact increases the growth rate of the prairie grass from a non-edible to an edible status as far as bison feeding is concerned. As the bison feed on prairie grass of this edible height, their population in turn becomes a food source for wolves living in the same environment. Understanding these dynamics of the bison and prairie grass could shed light on actions needed to ensure the preservation of both populations. It would help especially with prairie grass since they presumably have multiple predators in this and other similar environments. A continuous time model was devised to model the growth of bison and the conversion of short prairie grass into tall prairie grass. Based on three differential equations, a simulation was developed through Matlab, which produced results that conveyed insight on this biological situation. Likewise, the manipulation of initial and parameter values resulted in significant changes to the populations of short and tall prairie grass but not the bison population. This suggests that the bison population grows at a small rate, regardless of the nature of the environment inhabited, while the growth of the prairie grass grew at a slightly faster rate when in contact with the feces.

Presenter Abstract by Discipline

**A Lyrical Desperation: Exploring “Alas, and did my Savior bleed...” and “Don’t Let the Sun (Go Down on Me)” in *A Visitation of Spirits***

Presenter: JennahRose Shakespeare English, English Senior

9:40 AM, Guadalupe

Mentor(s): Barbara Chiarello

**Abstract:**

In recent decades, the realm of literary scholarship has become inundated with critical theory, effectively rendering literary study as virtually inaccessible to the average layman, while also establishing an absence of agency within its own community, leaving little space for unique thought and novel enterprise or interpretation, further separating the author and his masterpiece from the audience. Randal Kenan's *A Visitation of Spirits* ardently challenges this reliance upon critical theory, drawing the reader into a deep relationship with the text through the use of commonplace art—song lyrics. The depth and sincerity of struggle as related through that which is included leaves little room for the intrusion of outside, accepted means of interpretation. Kenan's novel is an illustrative force of living art, whereas critical theory remains cold, sterile, and out of touch with art's intended consequences—to move, to inspire thought, to incite change. When analyzed from within, the text has a way of fulfilling and justifying itself, leaving an impression upon its reader of the depth of human experience. This study boldly challenges the unfeeling, too scientific practice of laboring over critical theory before actively and wholly engaging the art itself.

**An Investigation Into The Rate-Determining Step Of Cysteine Dioxygenase**

Presenter: Joshua Crowell, Chemistry Graduate

Poster board: 13

Mentor(s): Brad Pierce

**Abstract:**

Cysteine dioxygenase (CDO) is a non-heme mononuclear iron enzyme that catalyzes the first step in the catabolic dissimilation of L-cysteine (Cys) to produce cysteine sulfinic acid (CSA). In mammals, the study of enzymes involved in mammalian sulfur metabolism have been of considerable medical interest due to the observation that patients suffering from neurological disorders such as autism and Down syndrome have significantly lower plasma concentration of transsulfuration pathway and methionine cycle products [cysteine (Cys), homocysteine (HCY), glutathione (GSH), and S-adenosylmethionine (SAM)]. In this work, we investigate we investigate the kinetic mechanism of CDO by determining the rate of product release as a function of solvent viscosity. As this process is postulated to be the rate-determining step for the enzymatic reaction, this value sets an upper speed limit on the rate of single turnover. Moreover, these results help to validate proton inventory experiments in which a single protonation event can be observed in the rate-determining step (i.e. product release).

**Analyzing Differences in Scientist and Science Perceptions, Self-Efficacy, and Science Enjoyment between Fourth Grade English Speaking and Hispanic ELL Students**

Presenter: Kristina Toth, Education and Curriculum Instruction Senior

Poster board: 100

Mentor(s): Ann Cavallo

**Abstract:**

Changing demographics of classrooms in the United States are marked by a significant influx of Hispanic English Language Learners (ELLs). The language and cultural dichotomies that now exist among school children demands that educators gain information for promoting academic success among all students, which includes perceptions of scientists and science, as well as self-efficacy and enjoyment of science. Therefore, the purpose of this research was to analyze possible patterns and differences between fourth grade Hispanic ELL and English-speaking students' views of scientists, understandings of the nature of science (NOS), self-efficacy toward learning science, and their overall enjoyment of science. This study consisted of 176 students (97 English-speaking and 78 ELL) with 36.3 % of those students designated as "at-risk." Questionnaires were administered to students at the beginning of the school year to measure students' views of scientists, understandings of NOS, self-efficacy, and science enjoyment. Results revealed a significant difference between ELL and English-speaking students' views of scientists, with ELLs holding a "broader" view of scientists. There was no significant difference among the two groups in understanding of NOS. Hispanic ELLs were shown to have lower self-efficacy toward learning science compared to English-speaking students. Both groups indicated an equally high enjoyment of science. This study informs educators of the views and beliefs students hold that may impact their learning and academic success in science.

**Structure and Thermochemistry of Hafnium-Silicate Glasses**

Presenter: Atreyi Dasmahapatra, Chemistry Graduate

Poster board: 14

Mentor(s): Peter Kroll

**Abstract:**

Mixtures of hafnia ( $\text{HfO}_2$ ) and silica ( $\text{SiO}_2$ ), hafnium silicate ( $\text{HfO}_2\text{-SiO}_2$ ) glasses, are materials for next generation transistors. They have higher dielectric constants than pure silica and consequently allow fabrication of thinner layers in transistors enabling production at the 14 nm scale. To understand the relation between structure and property, a microscopic insight into these compounds is necessary. In this study, we investigate  $\text{HfO}_2\text{-SiO}_2$  glasses using computational modeling. We analyze the materials' properties and study their change as a function of  $\text{HfO}_2$  content. We find that silicon (Si) is always tetrahedrally connected to oxygen (O). At low hafnia ( $\text{HfO}_2$ ) concentration, Hf prefers a four-fold connection to oxygen, but favors higher coordination as the  $\text{HfO}_2$ -content increases. Accurate quantum chemical calculations indicate large values for the enthalpy of mixing. This indicates low solubility of  $\text{HfO}_2$  into  $\text{SiO}_2$ , setting a limit to the thermodynamically stable composition.

Additionally, we compute the vibrational properties of the material. Our results agree well with the available experimental data. We observe that adding small amounts  $\text{HfO}_2$  to  $\text{SiO}_2$  results in a depletion of low-frequency vibrational modes. As a consequence, thermodynamic properties that depend on the vibrational modes, for example, heat capacity at constant volume show a non-linear behavior.

**Anomaly detection in big data; A Cloud based machine learning solution**

Presenter: Prathibha Datta Kumar, Computer Science Engineering Graduate

10:20 AM, Red River

Mentor(s): David Levine

Group members: Giacomo Ghidini, Stephen P. Emmons

**Abstract:**

In the current "Internet-of-Things", thermostats, weather sensors, home security, patient monitoring and a myriad of devices are all connected to the network, producing terabytes of raw data. While most function as expected, occasional malfunctions can wreak havoc on a network wasting resources and money. To detect these malfunctions we are faced with two significant problems: firstly, there are millions of such devices and millions of messages per hour and secondly, malfunctions may be unique. We are looking for a needle in gigantic haystacks, but we don't know what needles look like. To process millions of messages per hour, in real time, would require million dollar computer clusters, and we still don't know what anomalies look like. Our effort leverages parallel computing on the cloud where we can use hundreds of computers for a few dollars and machine learning to detect unusual sequence of events that may indicate anomalies. We apply the cluster analysis technique which segregates the devices with unusual behavior. One case study identifies a few hundred devices out of about half a million. This behavior was later analyzed to be connected to a known recent activity on the network. With this information, we can make beneficial predictions. Another case study recognizes about 20% of a set of devices that possibly ran into futile communication and needed assistance to function normally. In this way, our solution extracts actionable information that helps understand the network and also allows predictions. All this is achieved in a cost-effective and time-saving fashion.

**Mechanism of transcriptional regulation of EZH2 (H3K27 methyltransferase) by 17 $\beta$ -estradiol and estrogenic endocrine disrupting chemicals**

Presenter: Paromita Deb, Chemistry Graduate

Poster board: 15

Mentor(s): Subhrangsu Mandal

**Abstract:**

**Introduction:** It is a member of polycomb group of proteins. EZH2, a histone 3 lysine 27 specific methyltransferase, acts as a gene silencer and is also overexpressed in prostate and breast carcinomas. It is a component of polycomb repressive complex 2 (PRC2). PRC2 is involved in transient gene silencing by causing H3K27 tri-methyl marks in the promoter regions of various genes. Overexpression of EZH2 leads to augmented tumorigenesis in mice and oncogenic phenotype, while knockdown via RNAi leads to decreased cell proliferation, cellular invasiveness and metastasis. In this study, we investigated the mechanism of transcriptional regulation of EZH2 by estradiol and other estrogenic endocrine disrupting chemicals, BPA and DES. **Methods:** MCF7 (human adenocarcinoma mammary, ER-positive) cells were treated with estradiol, bisphenol-A (BPA) and diethylstilbesterol (DES), RNA and protein were analyzed by qPCR and western blot, respectively. ChIP analyses on estradiol/BPA/DES treated and control cells were performed with appropriate antibodies.

**Results:** Our studies demonstrated that EZH2 is transcriptionally up regulated by estradiol, BPA and DES both in vitro and in vivo. EZH2 promoter contains functional estrogen-response elements (EREs), identified via luciferase assay. Estrogen-receptors (ER $\alpha$  and ER $\beta$ ) and ER-coregulators such as MLL-histone methylases (MLL2 and MLL3) bind to the promoter of EZH2 in the presence of estradiol, BPA and DES. Thus aiding in estradiol, BPA and DES mediated up regulation of EZH2, in vitro.

**Conclusion:** EZH2 is transcriptionally regulated by estradiol and EDCs such as BPA and DES via recruitment of ER $\alpha$  and ER $\beta$  to the functional EREs along with ER-coregulators such as MLL2 and MLL3 and modify the chromatin, leading to the recruitment of RNA polymerase II to the promoter region of EZH2. Thus, up regulating the expression of EZH2

**Modeling the Effectiveness of Integrated Pest Management in Discrete Time**

Presenter: Michael DeBellevue, Music Freshman

Poster board: 127

Mentor(s): Hristo Kojouharov

Group members: Dianna Nguyen, Zengxing Pang, Van Nguyen, James Grover

**Abstract:**

Pests impose substantial harm to agriculture and industry. Crop losses strain an already overburdened food supply, contributing to the threat of global malnutrition. Integrated pest management (IPM) is a strategy of pest control that combines a number of control methods. These techniques usually consist of traditional pesticides and biological control methods, especially predators of the pests. In order to evaluate the impact of integrated pest management, a mathematical model of the pest and control populations was constructed. Studies of the efficacy of IPM have primarily used continuous-time models, which are not always representative of the seasonal life cycle of common pests. In this project a discrete model accounting for seasonality was used. The model included a measure of the pesticide's effect on the control populations. The simulations demonstrated that using both strategies was superior if and only if the pesticide affected the pest more than the control. These findings indicate that biological control methods should be used alongside pesticides only when the pesticide's effects are primarily exclusive to the pest population.

*This work was supported in part by the National Science Foundation*

**Network Mapping the Development and Expansion of Anti-Slavery Thought: Applying Social Network Analysis Theory into 19th Century Abolitionism.**

Presenter: Michael Deliz, History Graduate

10:20 AM, Neches

Mentor(s): John Garrigus

**Abstract:**

This study examines how the course of human civilization turned in the 19th century away from its 5,000 year-long tradition of human bondage to create the modern ethos wherein slavery is deemed unnatural and morally wrong. Though slavery and abolition remain subjects of historical inquiry, such treatments are more often than not focused narrowly within the boundaries of the historical nation state. Using a transatlantic perspective, this study re-frames abolitionism within a transatlantic framework which clusters the many societies of the Atlantic basin as a single space for action. Then, drawing from such national histories, this study identifies the points wherein these become congruent and conversant to delineate a common timeline for transatlantic anti-slavery thought. The initial effort yielded the identification of a key event thoroughly ignored by scholars; the 1867 Paris Anti-Slavery Conference. This two-day event represents the only comprehensive meeting of anti-slavery activists from the United States, Britain, France, Spain, Brazil, Cuba, West Africa and other parts of the Atlantic basin. Through textual analysis of the proceedings of the conference, organizational records, and personal papers, the 1867 Anti-Slavery Conference thus provided a comprehensive snapshot of an Atlantic-wide movement. This one-time occurrence made it possible to reconstruct a before-and-after image of the movement. Using Social Network Analysis, a sociological approach to evaluating social interactions, it became possible to visually map anti-slavery thought across the Atlantic basin and its changes over the course of the 19th Century, as a single movement.

Presenter Abstract by Discipline

**Study of function of two young nuclear transport retrogenes (*Dntf-2r* and *Ran-like*)**

Presenter: Susana Domingues, Biology Graduate

8:00 AM, San Saba

Mentor(s): Esther Betrán

Group members: Erica Eckstrand

**Abstract:**

*Ntf-2* and *Ran* are housekeeping nuclear transport genes. They physically interact and play a central role in the transport of proteins from the cytoplasm of the cell to the nucleus. In the lab, we showed that both genes have convergently retroduplicated in different *Drosophila* lineages and show testis-biased expression. These data supports a high turnover of these gene functions in testes. *Ntf-2r* and *Ran-like* are two retrogenes duplicated from *Ntf-2* and *Ran* and present in *D. melanogaster*. They have a strong testis biased expression and are evolving under positive selection. In this project we want to understand the function of these new genes in *D. melanogaster* and try to elucidate the evolutionary pressures that lead to the high turnover of these gene functions in testes.

We have performed *in situ* hybridization studies on parental genes and retrogenes. We have tagged *Dntf-2r* with EGFP and *Ran-like* with DsRed.T4 using their native regulatory regions and have studied co-localization with other known spermatogenesis proteins. A series of RNAi knockdowns have been performed for both retrogenes and parental genes in testis followed by qRT-PCRs and dissections with staining for different cellular structures. Additionally, we have knockout mutants for *Ran*, *Dntf-2* and *Dntf-2r* and we are in the process of obtaining a *Ran-like* mutant. The data collected to the moment supports an important role of these retrogene in male spermatogenesis but the reasons for the high evolutionary rate of these genes and gene functions remains elusive at this point.

**Flow Rate and Inlet Temperature Considerations for Direct Immersion of a Single Server in Mineral Oil**

Presenter: Richard Eiland, Mechanical & Aerospace Engineering Graduate

3:00 PM, Red River

Mentor(s): Dereje Agonafer

Group members: John Fernandes, Marianna Vallejo

**Abstract:**

Complete immersion of servers in electrically nonconductive mineral oil has recently become a promising technique for minimizing cooling energy consumption in data centers. Liquid cooling in general offers significant advantages over traditional air cooling approaches due to the higher heat capacities of fluids. However, a lack of sufficient published data and long term reliability documentation of oil immersion cooling makes most data center operators hesitant to apply these approaches to their mission critical facilities. In this study, a single server was fully submerged horizontally in mineral oil. Experiments were conducted to observe the effects of varying the volumetric flow rate and oil inlet temperature on thermal performance and power consumption of the server. Specifically, temperature measurements of the CPUs, motherboard components, and bulk fluid were recorded at steady state conditions. Comparing with results from baseline tests performed with traditional air cooling show promise for mineral oil as a viable cooling alternative for data centers. Overall, the oil cooling loop was able to achieve partial power usage effectiveness (pPUECooling) values as low as 1.027. This server level study provides a preview of possible facility energy savings by utilizing high temperature, low flow rate oil for cooling. A discussion on additional opportunities for optimization of IT hardware and implementation of oil cooling is also included.

*This work was supported in part by Dr. Veerendra Mulay, industry mentor from Facebook, Inc.*

**Effects of Shale Natural Discontinuities on Stress Perturbations and Related Hazards in Underground Coal Mines**

Presenter: Ciel Elizalde, Geology Graduate

Poster board: 16

Mentor(s): W. Ashley Griffith

**Abstract:**

Oil shales form the roof and floor rocks of many coal mines in the Appalachian Basin. These mines offer outstanding 3D exposures of fresh rocks, otherwise only accessible via boreholes or heavily weathered surface outcrops, and present an excellent opportunity to directly observe natural fracturing of shales under pristine in situ conditions. Pre-mining thrust faults are well-exposed inside a coal mine in Carroll County, Ohio, and these thrust faults appeared to develop in areas where gradients of the coal-shale contact are steepest, leading to a larger propensity for roof failure in those areas. I hypothesized that the spatial distribution of thrust faults mapped in the roof rock is controlled by sedimentary contact geometry. These sloping contacts serve as natural displacement discontinuities which augment the local stress state, causing localized secondary fault development. I simulated this process with the boundary element method program Poly3D, using borehole and mine survey data to constrain the geometry of the coal-shale contact, and the distribution of thrust faults throughout the mine. Preliminary results suggests that rocks are brought closer to failure near sloping contacts where thrust faults are found, even when the bedding contacts dip only a few degrees. Understanding the relationship between subsurface stress perturbations caused by bedding plane slip and the formation of secondary fractures as constrained by the integrated field and modeling approach taken in this study will lead to better understanding of natural fracture distributions in oil shales, and, at the same time, improve our predictive capabilities of underground structural hazards.

**Madness, Art, and Pilgrimage in Medieval Europe**

Presenter: Trevor Engel, History Junior

8:20 AM, Guadalupe

Mentor(s): Sarah Rose

**Abstract:**

Medieval Europe brimmed with pilgrims traveling to different holy sites in order to pray to different saints or martyrs. One of the many purposes of these pilgrimage sites was to offer a place to seek miraculous cures of ailments from saints. Moreover, the subjects of these cures and their treatments were often immortalized in collections of pilgrimage stories or in stained glass windows such as those at Canterbury Cathedral, the resting place of Saint Thomas Beckett. This paper focuses on those pilgrimage stories and representations of persons deemed to be "mad." By examining these documents and works of art I was able to construct a better understanding of the social position of people labeled as mad during this time: which was among the lowest social orders possible. Artistic representations also reflected stereotypes about how "mad" people looked, such as having "flame hair," being bald, or simply being poor. I also argue that because pilgrimage stories and artistic representations emphasized the necessity of beating or forcing "mad" people to submit to pilgrimages against their will, these representations encouraged poor treatment of them. In short, my research shows that widely recognized Medieval artistic and literary works of the time influenced how mad persons, or even people that appeared mad, were to be treated for the next few centuries.

### **The Effect of Caffeine on Neurocognitive Testing using ImPACT**

Presenter: Brandon Esianor, Kinesiology Senior

Mentor(s): Jacob Resch

Group members: C Munro Cullum, Damond Bluit

**Poster board: 128**

#### **Abstract:**

The ImPACT is commonly used to assess cognition following sports related concussion (SRC). One extraneous variable, which may influence computerized cognitive performance, is caffeine. The purpose of this study was to examine the influence of caffeine on ImPACT performance. A repeated measures counter-balanced design was used to assess (n=26) healthy college participants (5 males and 21 females) aged  $18.5 \pm .76$  years. Participants completed the Green's Word Memory Test (WMT), used to assess effort, and ImPACT on Days 1, 7, and 14. Participants scoring less than 82.5% on the WMT at any time point were excluded. Participants were randomly assigned into two counterbalanced groups, which received 100 mg of caffeine or a 100 mg placebo capsule at time points 2 and 3. ImPACT forms 1, 2 and 3 were administered to each participant. Paired t-tests were used to assess ImPACT Visual and Verbal Memory, Visual Motor Speed, Reaction Time, and Total Symptom Scores. No significant differences were observed between groups for any ImPACT composite score ( $p > .05$ ). Despite participants meeting inclusion criteria for both ImPACT and the WMT, eight (31%) participants were misclassified on Day 7 and nine (35%) participants on Day 14 by ImPACT. Our results suggest 100 mg caffeine, equivalent to a cup of coffee or several popular energy drinks, does not influence ImPACT performance. Future research is needed to determine if increased amounts of caffeine influence performance on ImPACT or other computerized neurocognitive tests.

### **Can prostate cancer be useful in detecting breast Cancer?**

Presenter: Rasool Fakoor, Computer Science Engineering Graduate

Mentor(s): Manfred Huber

Group members: Faisal Ladhak, Azade Nazi

**9:20 AM, Red River**

#### **Abstract:**

Studying the correlation between gene expression profiles and disease states or stages of cells plays an important role in biological and clinical applications. By comparing the genes expressed in normal tissue with the ones in diseased tissue, one can obtain better insight into the disease pathology. One of the challenges that has been addressed in this way is to determine the difference between cancerous gene expression in tumor cells and the gene expression in normal, non-cancerous tissues. To address this, quite a number of machine learning classification techniques have been used to classify tissue into cancerous and normal. However, due to the high dimensionality of gene expression data and the availability of only a few hundred samples for a given tumor, this application requires a number of specific considerations to deal with these data. In this research, we show that how unsupervised feature learning can be used for cancer detection and cancer type analysis from gene expression data. The main advantage of the proposed method over previous cancer detection approaches is the possibility of applying data from various types of cancer to automatically form features which help to enhance the detection and diagnosis of a specific one. Applying this method to cancer data and comparing it to baseline algorithms, our method not only shows that it can be used to improve the accuracy in cancer classification problems, but also demonstrates that it provides a more general and scalable approach to deal with gene expression data across different cancer types.

**Probing in vitro antioxidant mechanism of flavonoids: Reactive oxygen species induced oxidative degradation of quercetin and catechin in a continuous stirred tank reactor**

Presenter: Hui Fan, Chemistry Graduate

2:20 PM, Pedernales

Mentor(s): Kevin A. Schug

Group members: Veronica Waybright

**Abstract:**

Reactive oxygen species (ROS) play important roles in biological systems. Excessive ROS induce oxidative stress, which is involved in cancer development. As a class of plant secondary metabolites, flavonoids, such as quercetin and catechin, are suggested to have antioxidant properties. Yet, their antioxidant mechanism at molecular level remains unclear. Electrospray mass spectrometry (ESI-MS) is a powerful analytical tool for studying a variety of natural products and their metabolites. It provides high sensitivity and allows simultaneous observations of multiple degradation products. Continuous stirred tank reactor (CSTR) is a continuous flow device used in many applications at many different scales. An in-house made milliliter-volume CSTR was coupled with ESI-MS to investigate in vitro antioxidant mechanism of quercetin and catechin. Hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>), a naturally occurred ROS in the body, was used to study ROS-induced oxidative degradation. A small amount of quercetin was introduced into CSTR to create a gradient concentration profile as reference. Then, same amount of quercetin was introduced into CSTR and admixed with H<sub>2</sub>O<sub>2</sub>, which was held at constant concentration by direct infusion. A time-resolved concentration profile of quercetin and its degradation products were generated, and compared to the reference concentration profile. Same experiment was carried out with catechin and quercetin/catechin mixture, to study combined antioxidant behavior of quercetin and catechin. Experimental data was extracted and analyzed in Microsoft<sup>®</sup> Excel. Degradation reaction rates were determined. From these data a new method was used to efficiently obtain new information about a biologically important system.

**The Role of Social Dominance Orientation in the Management of Existential Threat**

Presenter: Jeremy Farrow, Psychology Senior

Poster board: 124

Mentor(s): Jared Kenworthy

Group members: Lauren Coursey

**Abstract:**

The increased worldview defense following mortality salience is a robust finding in terror management theory research. In some cases, this defense can take the form of ingroup favoritism, outgroup bias, and prejudice. Social dominance orientation is a personality trait that predicts political and social attitudes, and is considered to be a consistent predictor of negative outgroup attitudes. We examined the impact of social dominance orientation on the relationship between mortality salience and outgroup attitudes. Social dominance orientation was assessed in a separate online prescreen. 242 participants were randomly assigned to a mortality salience or a dental-pain control topic prior to receiving a measure of attitudes toward four outgroups (Muslims, Jews, homosexuals, and the homeless). Social dominance orientation negatively predicted outgroup attitudes. A significant interaction emerged between social dominance orientation and experimental condition. At mean and high levels of social dominance orientation mortality salience had no effect on outgroup attitudes. At low levels of social dominance orientation, attitudes towards outgroups were more negative in the mortality salience condition compared to the control condition. Our current study extends terror management theory and provides the first conservative test of the relationship between between social dominance orientation, mortality salience, and outgroup attitudes. High social dominance orientation may not represent a heightened susceptibility to existential anxiety, but instead, a worldview that negatively portrays outgroups and is chronically accessible.

**The impact of pre-entry factors on veteran's success in a Compensated Work Therapy program**

Presenter: Brandi Felderhoff, Social Work Graduate

Poster board: 17

Mentor(s): Alexa Smith-Osborne

**Abstract:**

Compensated Work Therapy (CWT), a type of vocational rehabilitation, exists throughout the Veteran's Administration (VA). This study aimed to determine "pre-entry" factors (PEFs) that might contribute to veterans' unsuccessful discharge from the CWT program due to the prevalence of irregular discharges.

Utilizing existing data from the CWT program, and drawing on systems theory, positive and negative PEFs were selected, that according to the literature, impact the success of veterans in the program. Hypothesized positive PEFs include: 1) current support system; 2) structured environment; 3) stable work history; and 4) formal substance abuse rehabilitation. Hypothesized negative PEFs include: 1) lack of income; 2) pre-existing medical conditions; 3) felony conviction; 4) identification problems; 5) substance abuse history; 6) mental health diagnosis.

This single-group cross-sectional design study utilized retrospective chart review, identifying existence of PEFs for 30 veterans irregularly discharged. Regarding negative PEFs, 5 of 6 were present at least 57% of the time. Less than 30% of veterans had an identifiable support system; only 10% had a work history. Data suggest that the existence of negative PEFs could impact a veteran's success in CWT. In this sample prior substance abuse treatment, and a structured environment prior to admission, did not have a positive impact on the veteran's completion of CWT.

The effectiveness of vocational rehabilitation programs is imperative to prepare veterans for success. Evaluation of factors that could pre-determine

***In Vitro* Activity of Paired Antibiotic Combinations against *Clostridium difficile***

Presenter: Emmanuel Fordjour, Biology Senior

9:00 AM, San Jacinto

Mentor(s): Julian G. Hurdle

Group members: Kieu Doan

**Abstract:**

The emergence of the epidemic BI/NAP1/027 *Clostridium difficile* has increased the severity and recurrence of hospital-acquired diarrhea. Antibiotic monotherapy for *C. difficile*-associated diarrhea (CDAD) often fails, prompting the idea that multi-drug therapy could be a better treatment approach. This project investigates whether paired combinations of current and in development narrow spectrum antibiotics could have synergistic or antagonistic effects against *C. difficile in vitro*. The minimum inhibitory concentrations (MICs) of nine antibiotics were assessed singly and in paired combinations against ten *C. difficile* clinical isolates. Based on these MICs, we determined fractional inhibitory concentrations (FICs) and consequently, the synergistic or antagonistic properties of these antibiotic combinations. The fusidic acid-rifaximin combination was particularly effective, exhibiting 55% additive to fully synergistic activity, 45% indifference and no antagonism in tests performed. The ramoplanin-daptomycin combination was particularly ineffective, showing 25% antagonistic activity, 15% additive synergy and 60% indifference in tests performed. Of fundamental interest in this study are the *in vitro* interactions of antibiotic combinations. Antagonistic combinations reduce the efficacy of multi-drug therapy. However, synergistic combinations enhance the antibacterial activity of either antibiotic and could reduce drug dosage and its concomitant toxicity to *C. difficile*-infected patients. Synergistic combinations which employ different modes of antibacterial action could also mitigate resistance emergence during therapy. Therefore, future studies will examine the activity of synergistic combinations against antibiotic resistance in *C. difficile*. Ultimately, insights from this study could improve antibiotic choice and clinical treatment of patients with CDAD.

*EF acknowledges the support of the UT System LSAMP program funded by the National Science Foundation grant number HRD-1202008.*

# ACES Symposium 2014

## Presenter Abstract by Discipline

### **Effects of Population Density on the Spread of Disease**

Presenter: Samuel Frickle, Biology Junior

Mentor(s): Kribs Zaleta

Group members: Hasan Sumdani, Matthew Le, Martin Tran

**1:40 PM, San Jacinto**

#### **Abstract:**

Middle East respiratory syndrome coronavirus (MERS-CoV) had its first reported case in June 2012. Although human-to-human transfer has been confirmed, with comparison to the 2003 SARS outbreak, it has spread less due to the need for a prolonged contact period. It is believed that population density would have an effect on the spread of a disease where prolonged contact period is necessary for transfer. Our epidemiological model, using a system of nonlinear differential equations, shows the effects of population density on the spread of a disease like MERS-CoV. The novel feature of our model is that an individual's lifestyle affects the number of contacts with other individuals in the system. Their lifestyle may be affected by population density based on their home, transportation, and work environments. Model analysis evaluates the disease's ability to persist as a function of population density. In regions of high population density the disease persists at an endemic level for any proportion of the populace with a density-dependent number of contacts. However, for low population density areas, the persistence of the disease depends on density-independent contacts. These results suggest ways to target preventative measures in case of an outbreak.

*The UTTER program and this project were funded by the National Science Foundation*

### **Seasonal and annual variation in immune response of the hard coral *Acropora palmata***

Presenter: Lauren Fuess, Biology Graduate

Mentor(s): Laura Mydlarz

Group members: Erinn Muller, Jorge Pinzon, Kim Ritchie, Caroline Rogers, Laura Mydlarz

**10:20 AM, San Saba**

#### **Abstract:**

Coral reefs are one of the most diverse ecosystems on the planet, however in recent years rising temperatures have led to increases in coral disease, resulting in declines of coral coverage. *Acropora palmata*, a major reef building coral in the Caribbean, has experienced declines in abundance and coverage due to disease. This study followed sixteen colonies of *A. palmata* from the US Virgin Islands over a two year period to determine their disease susceptibility, as well as the presence of pathogens and host immunity. Corals were sampled in cooler spring temperatures (March) and warmer summer temperatures (September) of 2012 and 2013. Disease status (healthy or infected) was recorded at the time of collection. Pyrosequencing was used to quantify the percent bacterial load of a pathogen, *Serratia marcescens*. Host coral immune responses were determined using biochemical assays for antioxidant production and the melanin synthesis pathway. Preliminary data suggests significant seasonal and annual variance in coral immune function. Antioxidant abundance increased over the two year sample period, possibly due to annual variation in environmental conditions. In contrast the melanin synthesis pathway showed seasonal variation, decreasing during the summer when disease is prevalent. Seasonal differences in temperature and other environmental conditions may contribute to variance in immune functioning in corals. Furthermore, abundance of *S. marcescens* was negatively correlated with levels of a melanin synthesis component in host corals. This suggests that corals with low levels of basal immunity, particularly in the melanin synthesis pathway, may be more susceptible to infection by *S. marcescens*.

*This work was funded in part by the Mote Marine Laboratory Postdoctoral Fellowship.*

**Associative Memory in the Dorsolateral Prefrontal Cortex**

Presenter: Kellen Gandy, Psychology Graduate

Mentor(s): Keeyeong Park

Group members: James D. Schaeffer, Amarnath S. Yennu, Fenghua Tian, Hanli Liu, & Heekyeong Park

Poster board: 18

**Abstract:**

Associative memory involves recalling items in association with one another (i.e. salt & pepper are often associated together). This study focused on investigating associative recognition with functional near infrared spectroscopy (fNIRS) using an item-item association memory paradigm. During study, participants were shown a list of word pairs and asked to make a judgment on whether one of the words in the pair could fit into the other. During test, participants were presented with intact word pairs (word pairs were presented exactly as studied), rearranged word pairs (words had been previously studied, but paired differently), and new word pairs (unstudied words). Participants were asked to make memory judgments of the test word pairs by responding "intact", "rearranged", or "new".

We observed an increase in oxygenated hemoglobin in the dorsolateral prefrontal cortex (Brodmann's areas 46/9) when participants made accurate associative memory judgments (i.e. intact pairs were correctly judged as "intact"). Additionally, we compared associative encoding to associative retrieval and observed a bilateral increase in the dorsal prefrontal cortex during retrieval. These findings coincide with previous functional magnetic resonance imaging (fMRI) studies which have demonstrated lateral prefrontal involvement in associative memory. These finds are important because they provide converging evidence for the importance of the dorsolateral prefrontal cortex in the retrieval of item-item associations. Further, this study demonstrates that fNIRS can be used for investigating complex cognitive processes such as episodic memory.

**Processes and mechanism of Laramide deformation: constraints from 2D flexural subsidence modeling of intermontane basins**

Presenter: Min Gao, Geology Graduate

Mentor(s): Majie Fan

8:20 AM, Pedernales

**Abstract:**

Laramide deformation is the geologic process that formed the intervening high mountains and low basins in the central Rocky Mountains during ~80-45 million years ago. Although it is generally agreed that the deformation was caused by the flat subduction of the Farallon oceanic plate underneath western U.S.A., the exact mechanism of the deformation remains controversial. We apply 2D flexural subsidence modeling to constrain the elevation gain of the mountains and the change of lithosphere flexural rigidity (D) in order to better understand how the flat-slab subduction caused the surface deformation. The principle of our modeling is that the basin-bounding mountain causes flexural subsidence of the basin, and the mountain's height and lithosphere flexural rigidity can be determined by modeling the subsidence history of the basin. We studied the Powder River, Wind River, and Green River basins located along a southwest-northeast transect. Our results show that the mountains bounding those basins gained high elevation during the Laramide deformation, and the D values range from  $10^{21}$  Nm in southwest Wyoming to  $10^{23}$  Nm in northeast Wyoming, which are lower than the D value ( $10^{24}$ - $10^{25}$  Nm) of the area before the deformation. These results seem to support the geodynamic models that propose the Laramide deformation was caused by the thermal and isostatic uplift induced by flat slab removal and associated mantle upwelling. The lower D value in southwest Wyoming may imply that the flat slab was removed underneath southwest Wyoming during the Laramide deformation.

**Red, White and, Blue: The Creation of the Syrian Nation-state in the Atlantic World, 1890s-1930s**

Presenter: Bryan Garrett, History Graduate

9:40 AM, Neches

Mentor(s): Kenyon Zimmer

**Abstract:**

My paper examines how nationals of the "Syrian space" constructed a shared sense of national identity. They did so through dialogues that spanned empires and emerging states during the period of the late nineteenth century to the early twentieth century. During this period, individuals and groups from what is modern-day Syria, Lebanon, Palestine, Jordan, and Iraq constructed inclusive (and exclusive) national identities. These "imagined communities" were created by gatherings of migrants and stationary families, from areas as diverse as Argentina, the United States, and throughout the globe as "Syrian" or "Lebanese." Additionally, imperial authorities fabricated and projected racial and national identities for these variegated groups from outside their communities. Evidence drawn from research at the Diplomatic Archives at Nantes, France, underpins the arguments proposed in this paper. Specifically, official communications between French administrative agents and their representatives in Central and South America, as well as the Middle East, directly confronted the issues surrounding fluid notions of Syrian and Lebanese nationality and citizenship. My study builds on the notion that nation-states develop within a discursive frame as imagined communities by suggesting the same qualities for how imperial regimes created new constituencies. Nation-states are not the natural product of progressive history, nor are they consequent emanations of empires. Nation-states and empires existed, and continue to exist, within the same spaces. By categorizing identity with documentation that subsequently could control movement, imperial regimes helped define national communities throughout and across empires.

*Global Research Fellowship*

**Parent mental health status and child temperament and externalizing behavior problems: A preliminary investigation.**

Presenter: Afsoon Gazor, Psychology Senior

Poster board: 112

Mentor(s): Jeffrey R. Gagne

Group members: Jerry C. Prater, Haolei Fang

**Abstract:**

The TEXAS Family Study examines early childhood temperament and behavior problems in the family context. Previous findings from this project have found a significant relationship between parental depressive symptoms and ratings of their children's temperament on multiple dimensions (Gagne, Spann, & Prater, 2013). The present investigation examines parental depression and anxiety symptoms as well as parent- and observer-rated child temperament and externalizing behavior problems. Participants included 201 preschool-aged children and their parents. Parent mental health symptoms were assessed via self-report using the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977) and the State-Trait Anxiety Inventory (STAI; Spielberger et al., 1970). Parents rated child temperament with the Toddler Behavior Assessment Questionnaire (TBAQ; Goldsmith, 1996) and child behavior problems with the Child Behavior Checklist (CBCL; Achenbach, 2001). Trained independent observers rated child temperament and behavior problems following a two-hour laboratory assessment. Temperament and externalizing problems were significantly correlated for both parent and observer ratings, and there was modest agreement between parent and observer ratings on these variables. Parent depression and anxiety scores were significantly associated with parental ratings of child temperament and externalizing behaviors. However, there were no significant relations between parental mental health symptoms and observer-rated child temperament or externalizing problems. Although results are preliminary, findings indicate a possible rater bias present in parents experiencing depression and/or anxiety symptoms, whereby they perceive their children to be more difficult. Future analyses will compare these parent variables to standardized laboratory assessments of child temperament.

## ACES Symposium 2014

### Presenter Abstract by Discipline

#### **SMIRFF: Smart, Maintenance, Inspection, and Repair Free-Flyer**

Presenter: Ameya Godbole, Mechanical & Aerospace Engineering Graduate

Mentor(s): Kamesh Subbarao

2:00 PM, Red River

#### **Abstract:**

Future space exploration missions will require longer flight times. NASA is moving towards having a crew-tended outpost orbiting the Moon within the next two decades. This outpost will be the destination for multiple robotic and crewed missions from and to Earth among other locations such as Mars or asteroids. Such an outpost faces many challenges. One that stands out is the need to routinely inspect and repair external components, and the nature of the radiation environment beyond low earth orbit (LEO) adds unnecessary risk to conducting multiple space walks. These issues can be addressed with a tele-operated free-flying inspection robot. A design concept for the Smart, Maintenance, Inspection, and Repair Free-Flyer (SMIRFF) is presented to satisfy such requirements. SMIRFF is a compact, intelligent robotic free-flyer that possesses capabilities which allow operators to inspect, maintain, and minimally repair external components of space systems. Of cubic shape and using a cold-gas thruster based propulsion system, SMIRFF is capable of maneuvering in any direction and at any orientation to arrive at a required location. Due to the complexity of space structures and the need to interact with such structures for inspection and maintenance, SMIRFF possesses two robotic arms with a novel moving-base concept. These manipulators provide the operator with the ability to interact with the environment. The current work is geared towards a more detailed design of this concept in hope of competing in this year's Revolutionary Aerospace Systems Concepts-Academic Linkage competition managed by NASA and the National Institute of Aerospace.

#### **British Petroleum Gulf Deep-water Oil Spill: When a Business Becomes Unethical**

Presenter: Victor Gonzalez Hernandez, Business Administration Senior

Mentor(s): James Campbell Quick

2:00 PM, San Jacinto

#### **Abstract:**

This research study analyzes the British Petroleum (BP) deep-water gulf oil spill as a case study in order to answer the question: when does a business become unethical-- before, during, or after and action? It reviews 12 data cases occurring before the oil spill, 29 articles published during the spill, and 8 articles published in the aftermath of the oil spill. The study judges the culture and history of British Petroleum through Immanuel Kant's categorical and practical imperatives, determining when BP violated Kant's universal laws, hence making BP unethical. Evidence suggests that the root cause of ethical or unethical actions is the people within the company, specifically, the leaders that direct the business as a whole. Before the oil spill CEO John Browne set the course for what would become BP's business standard, valuing profits above obligations. Tony Hayward, who later replaced Browne, intended to focus BP on safety, people, and performance; however, he failed to renew BP's cultural mentality. During the oil spill BP faced transitional moments: leadership shifted to Bob Dudley, board members were replaced, and BP focused on purpose instead of profit. After the oil spill, Dudley's leadership demonstrates a clearer sense of compliance to BP's universal obligations. This study suggests that leadership is a determining factor of a business's ethical actions.

**Improving the Life of PMTs by Reducing Ion Feedback with Powered Grids**

Presenter: Jace Grandinetti, Physics Junior

Mentor(s): Andrew Brandt

Group members: Ryan Hall, Jordan Williams

Poster board: 126

**Abstract:**

Photomultiplier tubes (PMTs) use a photocathode to convert photons to electrical signals. Our project requires the use of a specialized PMT to precisely measure the time of flight of scattered protons as part of a new sub-detector for the ATLAS experiment at the Large Hadron Collider (LHC) in Geneva, Switzerland. Existing PMTs have relatively low lifetimes due to damage to the photocathode from recoiling positive ions. A powered grid was added inside the standard PMT to repulse the positive ions to limit the damage to the PMTs. The detector is planned to be installed in 2015 at the LHC, and with the use of powered grid PMTs we could lower operating costs by reducing the number of replacement tubes needed over the course of the experiment. I present methods that we developed to measure the amount of positive ions and present data to evaluate the hypothesis that increasing the grid voltage will reduce the amount of ions. We then infer the effect this will have on the PMT lifetime.

**Investigating differences between urban and rural populations of the native Texas prairie grass Little Bluestem (*Schizachyrium scoparium*)**

Presenter: Michelle Green, Biology Graduate

Mentor(s): Laura Gough

Group members: Rachel Carmickle, Dr. Laura Gough

9:00 AM, San Saba

**Abstract:**

Human activities in urban areas have resulted in dramatic land use changes, elevated temperatures, and increased levels of carbon dioxide, nitrogen, and other pollutants in the atmosphere. These conditions have the potential to affect the way that native plants grow and reproduce. Selection by the urban environment for different plant characteristics within a species could eventually lead to the development of genetically distinct populations known as "ecotypes." In order to investigate the impacts of the urban environment on the native prairie grass Little Bluestem, four North Texas remnant prairie sites with differing degrees of urban proximity were selected for study. Measurements of Little Bluestem height and abundance revealed differences among the sites in plant growth. To investigate whether these differences could be attributed to genetic adaptation, individual Little Bluestem plants were also collected from each of the sites and grown together outdoors in a common garden experiment. Plant characteristics such as the number of tillers (leaves), biomass, and flowering stalks were measured from June to November 2013. Preliminary results indicate significant differences in the characteristics of the grasses originating from the four sites, supporting the idea that urban ecotypes of Little Bluestem exist. Results from this study will be important in informing urban planning, conservation, and restoration efforts, particularly as the world population grows and urban centers expand.

*This work was supported in part by the UTA I-Engage Mentoring Program and the 2013 Native Plant Society of Texas Graduate Research Grant.*

**Woman's Repression and Rupture In The House of Bernarda Alba by Federico García Lorca**

Presenter: Rosalinda Guerra, Modern Languages Senior  
Mentor(s): Christopher Conway

**10:20 AM, Guadalupe**

**Abstract:**

Liberty and submission are so contradictory yet so finely intertwined. When desire and reality do not coincide, when suffocating passion makes a living hell where is it that you turn? Federico García Lorca (1898 ñ1936) was a member of the Generation of 1927, a group of important, Avant Garde writers in Spain. His plays and poetry are among the most popular and critically acclaimed works of 20th century Spanish literature. His final play, The House of Bernarda Alba (1936), is a powerful criticism of the Spanish cultural norms that subordinated women to men. García Lorca presents a positive vision of rupture or resistance to cultural norms and how that can interact with rigid enforcement. From a feminist perspective, García Lorca demonstrates how women are victimized and limited in early 20th century Spanish society. However, despite all the submission involved in the lives of the characters in the play a rupture is seen coming from the start. In this presentation I will argue how society and social norms can ultimately play a huge part in women's behavior. My analysis is based on the examination of symbolism, colors and themes. Specifically, I will demonstrate, with the use of existing criticism, the absurd power behind social images and rigid expectations.

**An Overview Of Self-Efficacy Related To Physical Activity In Children With Developmental Coordination Disorder**

Presenter: Sarasvati Guzman, Kinesiology Senior  
Mentor(s): Priscila CaÁola  
Group members: Michael Romero

**Poster board: 111**

**Abstract:**

Studies have indicated that children with Developmental Coordination Disorder (DCD) have lower self-efficacy toward physical activity than typically developing children. No known studies have analyzed age as a factor in this occurrence. The purpose of this study was to determine self-efficacy in children with DCD and compare the results by age. There were 11 participants with DCD. Participants completed two questionnaires, the Children's Self-Perception of Adequacy in, and Predilection for Physical Activity (CSAPPA) and the Children's Assessment of Participation and Enjoyment (CAPE). Participants were divided into a "younger" group between 7 to 9 years and an "older" group aged between 10 to 13. Independent t-tests were run to compare the groups for all the scales. A correlation analysis looked at possible relationships between age and scores. The percentage of the maximum score for each category of each assessment was shown. The only significant difference was found for the CSAPPA total score. The younger group had a significantly higher percentage of self-efficacy for the total CSAPPA score than the older group (69% compared to 54%). A negative correlation was found between age and percentage values in two scales of the CSAPPA and of the CAPE, indicating that self-efficacy decreases as age increases (CSAPPA ñ total: -.54, active games: -.53, CAPE ñ diversity: -.41, enjoyment: -.53). These results support the preliminary notion that that self-efficacy in children with DCD decreases with age. This could be attributed to a child with DCD becoming more aware of their own difficulties with activities as their peer's abilities advance.

**Phylogeography of the Mojave Rattlesnake (*Crotalus scutulatus*) in the U.S. and Mexico**

Presenter: Nicole Hales, Biology Junior

Poster board: 117

Mentor(s): Todd A. Castoe

Group members: Drew Schield, Jacobo Reyes-Velasco, Carol L. Spencer

**Abstract:**

The Mojave Rattlesnake (*Crotalus scutulatus*) is a venomous snake native to the desert regions of the Southwestern United States and Mexico. This species possesses the most deadly venom of any rattlesnake, which includes the highly lethal Mojave Toxin. The species also exhibits considerable variation in morphology and venom composition across its range, and two subspecies are currently recognized. Despite interest in its medical relevance and considerable knowledge regarding their morphology, ecology, and natural history, no studies have examined genetic variation and genetic structure across the range of this species. We generated DNA sequences from a mitochondrial gene from *C. scutulatus* from throughout their range, including sampling from relict populations of *C. s. salvini* in Mexico. We used these sequences to perform analyses of species-wide genetic diversity, and to estimate phylogenetic relationships and divergence times among populations. Our results indicate a substantial amount of genetic structure within *Crotalus scutulatus*, provide a useful framework for further studies of Mojave Rattlesnake population genetics, and have implications for potential conservation concerns regarding populations at the extreme southern edge of its range in Mexico.

*1Department of Biology, University of Texas at Arlington, Arlington, TX 76019*

*2Museum of Vertebrate Zoology, University of California Berkeley, Berkeley, CA 94720*

**Microfluidic Device to Rapidly Generate Hollow Alginate Microfibers with Controlled Wall Thicknesses**

Presenter: Madiha Hanif, Biology Senior

9:20 AM, San Jacinto

Mentor(s): Samir M. Iqbal

Group members: Uyen H.T. Pham, Dr. Amit Asthana

**Abstract:**

Simple and controlled fabrication of hollow alginate fibers is critical for developing biodegradable and biocompatible scaffolds with excellent mechanical strength. Here we report an interesting strategy to make hollow fibers using a microfluidic device made in polydimethylsiloxane (PDMS) that contained a Y-shaped template with 3 inlets and 1 outlet. The two side inlets of the Y were sheath flow inlets where an alginate solution was inserted and the core inlet was equally spaced in the middle where a calcium chloride solution was pumped in. The fabricated fiber was collected at the outlet. The diameter of the hollow core and wall thickness of the fiber was found to solely depend on the flow rates of the sheath and core solutions, while the outer diameter of the fiber remained the same throughout these variations. As the core flow rate increased with a constant sheath flow rate, the inner diameter of the hollow core also increased and the wall thickness decreased. However, as the sheath flow rate increased with a constant core flow rate, the diameter of the hollow core decreased and the wall thickness increased. This data suggested that the dimensions of the fabricated fiber could be easily changed to fit certain needs. It is an effective and simple way to mass produce fibers at ease. This method does not require any special equipment, so it is cheap and accessible. There are many potential applications of hollow fibers for example in tissue engineering, drug delivery, and bioreactor systems.

**Patterned Electrical Neuromuscular Stimulation on Muscle Strength in Healthy Normals: A Pilot Study**

Presenter: Danielle Hansen, Kinesiology Graduate

Poster board: 20

Mentor(s): Cindy Trowbridge

Group members: Dr. Mark Ricard

**Abstract:**

Neuromuscular Electrical Stimulation (NMES) is commonly used in rehabilitation to improve muscle activation and strength. Patterned Electrical Nerve Stimulation (PENS) allows for activation of the muscles in patterns that mimic natural motion. Previous work has demonstrated significant training effects when PENS is used during active jumping exercise; however, little is known about the effects of passive PENS treatments on muscle function. The purpose was to investigate the effects of multiple passive PENS treatments on thigh musculature.

Two subjects participated (one sham, one experimental). The study spanned 4 weeks and included 13 visits to the lab. The first visit was a session to familiarize the subject with the various strength tests they would be performing. Days 1, 6, and 12 were testing days where the subject did a pretest, got their treatment, and then was post-tested. The testing included isometric knee extensions and isokinetic knee extensions at 90°/sec and at 180°/sec. The rest of the lab visits were treatments (15 minutes of PENS or sham NMES).

Peak torque (strength) data was collected for all tests. For the isokinetic knee extension tests, the PENS subject demonstrated positive percent change scores between day 12 post and day 1 pretest (ranges 2.7 to 8.4%). Whereas the sham subject demonstrated negative percent changes (ranges -1.8 to -4%). Therefore, the passive application of PENS for 12 treatments does result in improved muscle activation and strength changes in the thigh muscle. Future work will include collecting data on 5-10 subjects for each treatment type.

*All supplies were donated by Hangar Inc- Accelerated Care PlusÆ*

**Towards Applying Psychometric Theory in Measuring Usable Security Constructs**

Presenter: S M Taiabul Haque, Computer Science Engineering Graduate

8:20 AM, Red River

Mentor(s): Matthew Wright

Group members: Shannon Scielzo

**Abstract:**

Password entry on mobile handsets is a time-consuming and error-prone operation. Survey results show that users are not comfortable with entering passwords on mobile handsets given the existing keyboard choices, such as Blackberry-style physical keyboards and touchscreen keypads. This could undermine the security of mobile banking and other systems where using a strong password is important. Measuring user comfort and convenience during a password entry operation is not a straightforward task because comfort and convenience are subjective psychological concepts that are hard to measure. In this study, we apply psychometric theory (a branch of psychology that specializes in measuring various concepts that concern human feelings and performance) to investigate the issue of user comfort and convenience during password entry on mobile handsets. By using standard techniques from psychometric theory, we develop a questionnaire that measures users' comfort and convenience of constructing a strong password when using a particular mobile handset. We also assess the reliability and the validity of our questionnaire. We find that our questionnaire meets all of the requirements for reliability and validity for a psychometric questionnaire: it is consistent, complete, accurately focused, and capable of predicting certain real-world outcomes. These findings demonstrate that our questionnaire can be effectively used to measure user comfort and convenience during a password entry operation on a mobile handset.

**Co-delivery of anti-cancer drug with pH-sensitive and photoluminescent nanoparticle for prostate cancer**

Presenter: Prashant Hariharan, Biomedical Engineering Graduate

Poster board: 21

Mentor(s): Kytai T. Nguyen

Group members: Primana Punnakitikashem

**Abstract:**

Prostate cancer is the second leading cause of death in men after lung cancer. Although there are many successes in the treatment of early stage/localized prostate cancer (PCa), there is currently no effective therapy to treat patients with castration-resistant prostate cancer (CRPC), the PCa end stage. In addition, current treatments such as chemotherapy also produce many severe side effects as the drugs not only kill cancer cells but also cause damage to healthy tissues. The objective of this study is to develop biodegradable, photoluminescent and pH-sensitive nanoparticles using Biodegradable Photoluminescent Polymer (BPLP) with Carboxy Methyl Chitosan (CMC). These nanoparticles are also loaded with anti-cancer drugs such as Docetaxel for targeted delivery to cancer cells only. The photoluminescence will allow potential to track the location of the particle, whereas the pH-sensitivity of the particle will allow a burst drug release due to the difference in pH at the tumor site. Preliminary characterization studies showed particles with uniformly distributed sizes having diameters in the range of  $272 \pm 15\text{nm}$  and polydispersity of 0.27. The zeta potential of these particles was observed to be in the range -30 to -36mV, suggesting these nanoparticles were stable. Fluorescence intensity scan exhibited uniform results when dissolved in particles of different pH solutions confirming their photoluminescent properties. These results indicate that it is possible to synthesize photoluminescent and pH-sensitive nanoparticles that can be used as targeted drug delivery and sustained drug release vehicles. Future work will include toxicity, drug release, and *in vitro* cell studies.

**Differential Local Field Potential Activity in the Anterior Cingulate and Primary Somatosensory Cortices During Peripheral Nerve Stimulation**

Presenter: Amber Harris, Psychology Graduate

2:20 PM, Neches

Mentor(s): Yuan Bo Peng

Group members: Ai-Ling Li, Mayanja M. Kajumba, Yuan B Peng

**Abstract:**

Pain is the primary motive to seek physician care. Animal research is informative for investigating brain areas involved in pain including the Primary Somatosensory (S1) Cortex which processes a wide range of sensory input as well as the Anterior Cingulate Cortex (ACC) which is sensitive to high intensity input. Rodent studies implicate these areas using a variety of methods. However, information about the broad-range neural activity provided by local field potential (LFP) recording in real time has yet to be extensively investigated. Recording electrodes were implanted in the ACC and S1 of seventeen anesthetized rats. A stimulator was implanted at the L5 spinal nerve to deliver six progressive electrical stimulations while LFP activity was recorded. Results from repeated measures ANOVAs indicated that LFP in both areas was not significantly different during stimulation and rest,  $p > .05$ . However, ACC activity increased at higher intensities and persisted after stimulation. The conclusion is that progressive high intensity stimulation could lead to ACC sensitization. Results from repeated measures ANOVAs suggested that activity was significantly higher in the S1 than the ACC at delta (0-4Hz) and theta (4-8Hz) frequencies,  $p < .05$ . This is expected because the S1 has been closely linked to sensory processing. However, brain activity is highly influenced by cognitive factors such as attention. Therefore, future research will include freely moving animals. Future research will also address whether the stimulation incites pain. The ultimate significance of this line of research is furthering understanding of how the brain processes pain.

**Does the economy affect functional restoration outcomes for patients with chronic disabling occupational musculoskeletal disorders?**

Presenter: Meredith Hartzell, Psychology Graduate

3:40 PM, Neches

Mentor(s): Robert J. Gatchel

Group members: Tom G. Mayer, M.D.; Randy Neblett, M.A., LPC, BCB; Robert J. Gatchel, Ph.D., ABPP; Dennis J. Marquardt, M.S., Ph.D. Candidate

**Abstract:**

**INTRODUCTION:** Economic recession can significantly affect the patients with chronic disabling occupational musculoskeletal disorders (CDOMDs) by increasing the likelihood that they file for disability payments, because the difficulty of finding jobs post-rehabilitation is higher. However, few studies have been conducted on how the economy affects treatment success in an interdisciplinary functional restoration program (FRP).

**AIMS AND METHODS:** The purpose is to determine how the economy affects CDOMD patients completing a FRP during a good economy versus an economic downturn. A total of 969 patients with workers' compensation claims were admitted to the medically-supervised FRP, consisting of quantitatively-directed exercise progression and multi-modal disability management, in either a time of Good Economy (GE, n=532) or during a time of Poor Economy (PE, n=437). Patients were compared on demographic, psychosocial, and socioeconomic outcome data.

**RESULTS AND CONCLUSIONS:** Few significant demographic differences existed between GE and PE patients. GE patients reported more depressive symptoms and disability at admission, but also demonstrated significant decrease in depressive symptoms, and increase in self-reported quality of life, compared to the PE group. PE patients had lower work return and work retention rates one year after discharge, and lower follow-up provider visits post-discharge ( $p < .001$ ). Economy type was found to be a significant predictor of work return and retention, even after controlling for other factors such as length of disability or admission work status that might influence outcomes. This study demonstrates that a poor economy can be an additional barrier to work outcomes in CDOMD patients.

**Fabrication of Integrated Microscale Ion Exchange Membrane Suppressor ñ Conductivity Detector**

Presenter: Mohammad Hasan, Electrical Engineering Graduate

4:00 PM, Concho

Mentor(s): Samir M. Iqbal

Group members: P. K. Dasgupta, S. M. Iqbal

**Abstract:**

Ion chromatography is a technique to separate different ions in a sample and quantify them. High concentration of background ions need to be suppressed to detect low concentration ions. Ion suppressor is used for that. We have developed a microscale ion suppressor, coupled with a detection module to improve the sensitivity of a portable chromatography system. The ion suppressor exchanged the cations for H<sup>+</sup> and converted the analyte anions to the corresponding acid. This increased the overall signal to noise ratio (SNR) of the system. The device was comprised of a circular conduit, a cation-exchange membrane and a conductivity measurement unit. The circular conduit was fabricated inside a polydimethylsiloxane (PDMS) slab using soft lithography. A 15 µm diameter tungsten wire, affixed on a flat surface was used as the mold. A set of interdigitated electrodes (Cr/Pt) was fabricated on a glass substrate using lift-off process. The interspacing and thickness of the electrode was 50 µm and 80 nm respectively. A cavity of 1 cm x 1 cm x 125 µm was created in the glass substrate to keep the exchange membrane with a small reservoir beneath it for the regenerant solution. The glass was silanized and etched with an O<sub>2</sub>-plasma for bonding to the PDMS. Then the PDMS slab was pressure bonded to the glass substrate with the exchange membrane in place and the channel passing over the active area of the electrode. This simple and compact device is suitable for ion chromatography based portable system for water analysis.

**Comparative theoretical perspectives: Intimate partner violence through the lens of feminist and empowerment theories**

Presenter: Alicia Hawley Barker, Social Work Graduate

Poster board: 22

Mentor(s): Beverly Black

**Abstract:**

Intimate partner violence (IPV) is a widespread challenge within today's society resulting in more than 1 in 3 women experiencing some form of physical or sexual assault and/or stalking by an intimate partner in their lifetime (Black, Basile, Breiding, Smith, Walters, Merrick, Chen, & Stevens, 2011). In order to better understand the nature of IPV, this paper looks at two distinct theoretical frameworks in relation to IPV. Both feminist theory and empowerment theory have been utilized to explore the dynamics of IPV further. By analyzing feminist theory, the author examines the relationship between IPV and gender roles within society. Empowerment theory is utilized many times with victims to help them to gain more self-control and power within their lives. As issues surrounding gender and sexuality and power and self-worth continue to grow and change within society, feminist and empowerment theories will continue to need to be explored and analyzed. Both theories provide a large, relevant amount of multi-level research opportunities in addition to the work that exists presently. Understanding feminist and empowerment theories to the fullest extent can help advocates to better understand issues surrounding IPV and ultimately to assist victims more effectively.

**Zero-Energy Responsive Metallic Facade System**

Presenter: Adam Heisserer, Architecture Graduate

1:00 PM, San Saba

Mentor(s): Brad Bell

Group members: Alexei Dukov, Khang Nguyen, Tenaj Pinder

**Abstract:**

The building envelope must consolidate a number of contradictory performance criteria, such as heat gain, visibility, and natural light. Traditionally, these issues have been met with static facade systems because moving parts are prone to mechanical failure and require additional energy to operate. These challenges can be overcome through the integration of thermostatic bi-metal; a metal that bends when exposed to heat. Through a cycle of fabrication, physical testing, and refinement of full scale prototypes, we developed a zero-energy, dynamic facade system composed of thermally activated bi-metal surfaces.

We found that by embedding an array of bi-metal panels within two layers of insulated glass, the system maximized solar heat gain when subjected to colder temperatures, and minimized solar heat gain when subjected to warmer temperatures. Results indicated that the system could regulate temperatures while maintaining visual transparency at all times. By using a thermally responsive material, there are no moving joints prone to mechanical failure.

Because more than 40 percent of all US energy consumption is used by buildings, and the majority of that energy is allocated to the building envelope, this zero-energy system would lessen the environmental impact of traditional facade systems while consolidating a wide range of performance criteria.

*Sponsored in part by the Digital Fabrication Consortium at UTA.*

**Gene Flow Within the Central Texas *Eurycea* of the Eastern Blepsimolge and Typhlomolge Clades**

Presenter: Philip Hejduk, Biology Graduate

3:00 PM, Palo Pinto

Mentor(s): Paul Chippindale

Group members: Todd Castoe; Daren Card; Drew Schield

**Abstract:**

Salamanders of the genus *Eurycea* inhabit numerous streams and caves throughout the southeastern Edward's Plateau region of Central Texas. These organisms primarily consist of two main groups (one stream-dwelling and one cave-dwelling) that have been isolated for millions of years, yet due to apparently occupying the same area, there is evidence that gene flow is occurring between species. Gene flow within this group has been hypothesized as being primarily from hybridization, given the very complex pattern of mitochondrial DNA (mtDNA) inheritance from previous studies. Another possibility is that androgenesis could account for the unusual mtDNA inheritance pattern. Androgenesis is a phenomenon in which male, diploid sperm parasitizes an egg of another species. This study applies next generation sequencing to these species in an attempt to resolve questions regarding the type, presence, amount, and direction of gene flow. Using an application of next generation sequencing allows one to develop a random sample of DNA markers from throughout an organism's genome. The four main species under study (2 stream-dwelling and 2 cave-dwelling) occur in highly vulnerable habitats in a growing metropolitan area, and all are Federally listed as Threatened or Endangered. Thus, this work is of critical and urgent importance with respect to conservation of the salamanders themselves, and the fragile aquifer habitats in which they live.

**Why Sex is Important: Radically Different Lifespan of Genetically Identical Individuals**

Presenter: Alissa Hendricks, Biomedical Engineering Junior

2:00 PM, Guadalupe

Mentor(s): John W. Fondon III

Group members: Manish Parihar, Andr#233; Pires da Silva

**Abstract:**

The present study is an attempt to determine environmental factors influencing lifespan. Nematodes are well-established experimental model animals with a short lifespan (~2 weeks) and a simple body plan. In this work, we used the nematode *Rhabditis* sp. SB347, a species that produces males, females, and self-fertilizing hermaphrodites, to investigate sex-dependent responses to physiological stresses. Previous studies have shown that hermaphrodites live 30% longer than females at 20°C, despite being genetically identical. The goal of this experiment was to test if the difference in lifespan remains in other environmental conditions. To test this, females and hermaphrodites were heat-shocked at 35°C for two hours as young adults, and cultured at 20°C. We found under these conditions females lived 50% longer than the hermaphrodites. This trend was the reverse of the organisms at 20°C, at which females lived shorter lives than hermaphrodites. We conclude that the genetically identical females and hermaphrodites have different response to temperatures, perhaps indicating that they respond differently to stress. These results, although interesting, are not completely conclusive yet because these nematodes encounter more stressors besides high temperature; they could also face changes in humidity, different salinity of the soil, and chemical imbalances of the surrounding.

**Effects of Predator Cues on *Daphnia* Life History Traits across Multiple Generations**

Presenter: Kelsey Biles, Biology Junior

Poster board: 106

Mentor(s): Matthew Walsh

**Abstract:**

It is becoming increasingly clear that environmental changes due to such factors as invasive species, rising temperatures, and habitat loss, pose significant threats to biodiversity. Much research has evaluated the mechanisms that allow organisms to adapt to environmental change. This research has focused on the ability of organisms to modify the expression of traits in response to a change in environmental conditions. For instance, many species of freshwater zooplankton (*Daphnia*) respond to the presence of predators by producing structural defenses (head and tail spines) and altering life history traits such as growth and reproduction. Yet, accumulating evidence indicates that the environment has the ability to induce responses that span multiple generations. Here our goal was to determine if predators can cause changes in the traits of *Daphnia* that span multiple generations. We reared over 25 different lineages of *Daphnia* from multiple lakes in Connecticut in a common garden setting (an experiment designed to eliminate extraneous variables) for two generations. We then performed an experiment that manipulated the duration of exposure to fish predator cues. Our results show that *Daphnia* reared in the presence of predator cues developed faster and produced larger clutches of offspring than *Daphnia* reared in the absence of predator chemical cues; although such an influence of predator on prey depends upon the number of generations that *Daphnia* were exposed to predators. On a broader scale, our results demonstrate that prey can adaptively respond to the threat of predation by modifying the expression of traits across generations.

**Analysis of several factors contributing to increased fertility rates in India: Religion as compared to Education and Wealth**

Presenter: Victoria Highland, Social Work Graduate

Poster board: 23

Mentor(s): Vijayan K. Pillai

Group members: Dr. Randall Basham, Yvonne Butler

**Abstract:**

Since 1952 India has worked to decrease overall population growth through family planning initiatives; yet India's population growth remains unsustainable. Previous research indicates fertility rates vary between religious groups, but theological differences are an insufficient explanation for difference. These studies theorize that structural factors, such as education and wealth, exert stronger influence on fertility rates than religion (Chamie, 1981; Yadava, 1999; Jeffery & Jeffery, 2000; Brookins & Brookins, 2012; Kulkarni & Alagarajan, 2005).

This thesis examined differences in fertility rates between Muslim and Hindu women in India, and the impact of education and wealth on fertility rates. According to Chamie (1981), differences in fertility rates of Muslim and Hindu women are to be expected, but that differences in structural factors between religions may explain differences. This study hypothesized Muslim fertility rates would be higher than Hindu fertility rates, and both education and wealth would exert a greater influence than religion on fertility rates.

India's 2005-2006 National Family Health Survey-3 [NFHS-3] provided secondary data for this study and represents the most current data available. The sample size was  $N=124,385$ . Multiple regression demonstrated significantly different fertility rates for Muslim and Hindu women (Muslim  $\beta=0.011$  and Hindu  $\beta=-0.309$ ). For every unit increase in education, fertility rates decreased ( $\beta=-0.777$  units of children); wealth decreased fertility rates ( $\beta=-0.131$  units of children). Education influenced fertility rates significantly more than religion ( $R^2$  change =  $-0.811 > -0.304$ ).

One social implication is that promotion of education could decrease Indian and global fertility rates, thus increasing female self-determination and economic resources.

### **Independent Segmentation and Specification Processes in Spine Development of Domestic Dogs**

Presenter: Treyce Hodges, Biology Junior

Poster board: 128

Mentor(s): John W. Fondon III

Group members: Michael Chau, Eldon Prince, Andr#233; Pires da Silva, & John W. Fondon III

#### **Abstract:**

Despite centuries of study and recent advances in technology, the early developmental processes through which mammalian body plans take shape from unpatterned cell masses are still poorly understood. The patterning of the spine occurs through the combined action of two processes: segmentation, the organization of tissues into a reticulate series of non-descript blocks that will become the vertebrae, and specification, the process by which individual segments acquire distinctive identities and shapes, such as lumbar or sacral. A long-standing question in developmental biology is how these dynamic processes are coordinated to consistently yield the characteristic vertebral patterns of different species. Experimental manipulations in chicken embryos indicated that these two processes are directly coupled, causing specification to homeostatically compensate for disturbances in segmentation, ensuring consistent developmental outcomes in the face of perturbations. This coupling hypothesis has become widely accepted, despite the relatively limited direct supporting evidence. Here we test the applicability of this model to mammals using analyses of naturally occurring vertebral variation in domestic dogs. Our results show that the widely held model that vertebral identities are coupled to segmentation does not hold for dogs. In contrast, segmentation and specification appear to be completely uncoupled, varying with fluid independence of one another, calling into question its validity for mammals in general. These findings beg reconsideration of the established view of this fundamental developmental processes, offering new ways to view vertebrate diversity and the approaches to prevention of a major class of birth defects.

### **Simulations of the ATLAS Forward Proton Detector.**

Presenter: Timothy Hoffman, Physics Senior

3:00 PM, San Jacinto

Mentor(s): Andrew Brandt

Group members: Lukas Dokoupil, Libor Nozka of Palacky University, Czech Republic

#### **Abstract:**

Our research group is a part of the ATLAS collaboration, which utilizes the Large Hadron Collider (LHC) in Geneva to understand the fundamental particles of the universe and the forces that govern their interactions. The high energy collision of protons centered in the ATLAS detector, which is analogous to a 5 story tall digital camera, has already led to a Nobel Prize for the prediction and discovery of the Higgs Boson, giving new insight into how particles acquire mass. The UTA group has been developing a new sub-detector to measure protons that are slightly scattered and emerge from the proton beam about an eighth of a mile downstream of the main ATLAS detector, providing access to a class of events that previously were invisible to ATLAS. Due to logistical issues integrating the detector in the LHC tunnel, it is necessary to design a more compact detector than originally conceived, while maintaining a high level of precision. My research has been centered on simulating the amount and timing of the light produced by the proton passing through the detector for several possible detector geometries. I will present results from these simulations that demonstrate that seemingly small changes in the geometry can have large effects, and show how the new design actually improves the detector performance while meeting the new space constraints, followed by a brief mention of plans to experimentally validate these conclusions.

**Trace Detection of Catechins in Human Blood Plasma using Trap-and-Elute Liquid Chromatography ñ Tandem Mass Spectrometry to Facilitate Kinesiology Study**

Presenter: Alonna Guerrero, Chemistry Senior

Poster board: 105

Mentor(s): Kevin A. Schug

Group members: Sarah Hughes, Hui Fan, Michelle Harrison

**Abstract:**

While it is recognized that determining levels of contaminants or analytes in any given mixture may be important, much thought may not be given to the process required to obtain this information. In our current method, we analyze trace quantities of an antioxidant, called catechins. Catechins, found in green tea, chocolate, wine, and other foods, have recently received attention in the medical community for their cholesterol-lowering powers, anti-obesity properties, and anti-cancer benefits. In collaboration with a group at UT Austin whose aim is to correlate consumption of catechins with physical performance, we are analyzing blood plasma for trace quantities of catechins at a level that has not been previously achieved. Previously reported detection limits for catechins determined using high performance liquid chromatography are around 100 ng/mL. We are developing a method that facilitates online extraction, in order to simplify sample preparation and achieve higher sensitivity. We are able to do this by using restricted access media, which traps the catechins injected into the instrument, while removing proteins and other salts in the plasma that can act as interferences. With this approach, we estimate our method can achieve closer to 100 pg/mL detection limits, which is multiple orders of magnitude more sensitive than literature reports. The method development process requires orchestrating many factors within the instrument and trap to exploit chemical interactions and extract the catechins. As consumers become more aware of chemicals in products, sensitive methods of chemical quantification will only become increasingly important.

**FaÁades that Mitigate Noise**

Presenter: Lucas Hoops, Architecture Graduate

2:00 PM, San Saba

Mentor(s): Brad Bell

Group members: Dardan Hoxha, Jacob Narvaez

**Abstract:**

From cars (100 Hz) to sirens (3000 Hz) noise pollution is a problem, and will only continue to increase with the densification of metropolitan centers around the world. Noise pollution can affect the quality of life in certain portions of a city. From land value to playing a role in segregation to the cause of stress and sleep loss, noise pollution is a growing epidemic in modern society. Our research looks at how sound can be mitigated in an exterior environment by configuring the material characteristics of porous concrete to absorb sound, while simultaneously configuring the diffusive geometric properties of a faÁade. By using a series of digital and physical testing scenarios we were able to establish a concrete panel that demonstrated the capacity for surface texture of concrete to function as an absorbent material while the calibrated geometries served as diffusive surfaces. This research resulted in the production of full-scale prototypes to demonstrate proof of concept and to effectively test innovative precast concrete mould making procedures. If deployed in at a large scale in an urban corridor, it would be possible to change some of the current patterns of urban development. Noise mitigation panels would allow integration of noise sources to be in closer proximity to the inhabitable urban environment. Trains, highways, airports, streets could be built closer to city centers, business districts, and residential complexes.

*Digital Fabrication Consortium at UTA*

**Cherokee in Hand: Using Mobile Devices to Teach Complex Real Language**

Presenter: Devin Hornick, Linguistics Junior

Mentor(s): Colleen Fitzgerald

Poster board: 114

**Abstract:**

Cherokee is a threatened Iroquoian Native American language spoken in parts of Oklahoma, the Great Smoky Mountains, and North Carolina. Cherokee verbs, known for their complexity, can make sentences by themselves. This is a challenge when learning the language. Mobile apps are available for language learning. However, Cherokee language apps typically focus on nouns and phrases. To address this, I developed an app prototype with a focus on verbs and sentences.

Apps often offer only dictionary forms. Cherokee verbs conjugate and build meanings using affixes, a process called polysynthesis. For example, the transitive verb 'give' conjugates based on whether the object given is living, flexible, long, liquid, or compact, and, with affixes, becomes "I am giving a long thing to him." Polysynthetic verbs cause learning challenges for English speakers. Using open source code by Ogoki Learning Systems, Inc. designed for the Native American language Ojibway, I combined audio of different verb conjugations with text written in the Cherokee syllabary, achieving a multisensory output teaching communicative units in Cherokee. Moreover, the app functions offline, providing full utility in rural or other areas with poor or no internet service.

The result of this work is the creation of an accessible tool adapted from freely available source code to work for an unrelated Native American language. This is important because it demonstrates the same code can benefit other endangered languages worldwide. A second implication is to present an audible picture of how Iroquoian verbs demonstrate the complex way human languages work.

**Cancer cell inhibitor with modified vitamin B2 structure**

Presenter: Mohammad Shawkat Hossain, Chemistry Graduate

Mentor(s): Frank W. Foss Jr.

Group members: Arunoday Bhan, Dr. Subhrangsu S. Mandal

2:00 PM, Pedernales

**Abstract:**

Vitamin B2, riboflavin, derived molecules catalyze important enzyme-mediated reactions in metabolism, including processes in plant photosynthesis, DNA-repair, and liver detoxification. Specifically, natural and synthetic riboflavin derivatives, generally termed 'flavins', catalyze oxidation reactions by the activation of molecular oxygen. Aberrant interactions between flavin catalysts and DNA may be a method for the oxidative destruction of cancer cells. Furthermore, disrupting normal flavin-dependent enzymes may initiate cell death. Using organic synthesis techniques, several new flavins were prepared, purified, and characterized. During our study, a new strategy for efficient flavin preparation was discovered. The flavin derivatives were analyzed as inhibitors against breast cancer cell line (MCF7) using the well-studied *cis*-platin inhibitor as a positive control. Some of the synthesized flavin analogs were found to be more active than *cis*-platin. Comparing the structure of new flavins to their relative anti-cancer activity, more potent flavin derivatives will be logically investigated and their mechanism of action can be investigated as a potential new method for cancer treatment.

**Parent Health Literacy and Communication with Diabetes Educators in a Pediatric Diabetes Clinic: A Mixed Methods Approach**

Presenter: Carol Howe, Nursing Graduate

11:40 AM, San Saba

Mentor(s): Judy LeFlore

**Abstract:**

Parents of children with type 1 diabetes rely on communication with diabetes educators to learn how to care for their child. Health literacy is the ability to obtain, process, and understand health information. Although the association between low health literacy and poor patient-provider communication has been established in adults, no pediatric data has been reported. This mixed methods study examined how parent health literacy affected communication with diabetes educators in a pediatric diabetes clinic.

Health literacy was measured with the Rapid Estimate of Adult Health Literacy in Medicine. Communication was assessed with 5 sub-scales of the Interpersonal Processes of Communication Survey (IPC) and interviews. A convenience sample of 162 parents attending Diabetes Clinic with their child completed the survey and a subsample of 24 parents participated in interviews.

One in five parents had low health literacy. Parents' report of poor communication ranged from 6-38% across the 5 IPC sub-scales. Health literacy was positively associated with General Clarity and negatively associated with Explanations of Care sub-scales. Content analysis of interviews found that parents with low health literacy were confused with diabetes jargon, and preferred information in simple language, broken down into key points, and repeated. Parents with adequate health literacy wanted comprehensive information at a parent-driven pace. While parents with low health literacy preferred hands-on learning, parents with adequate health literacy wanted an ongoing dialogue to learn problem solving. Diabetes educators should develop skills in clear communication, teaching strategies, use of problem-based curriculums, and tailoring education to individual learning needs.

*This work was supported by the Pediatric Endocrine Nursing Society, the American Association of Diabetes Educators, Sigma Theta Tau International, and the Kyba Fellowship.*

**Interception Ability and Tool Use in Children With or Without Developmental Coordination Disorder (DCD)**

Presenter: Melvin Ibana, Kinesiology Graduate

Poster board: 24

Mentor(s): Priscila CaÁola

**Abstract:**

Children with Developmental Coordination Disorder (DCD) often have difficulties with planning and generating a precise visuospatial representation of intended motor actions, however; little is known about their accuracy when planning motor actions with tools that extend reach space. This study examined the accuracy of children with DCD (n=9) when intercepting a moving target as compared to typically developing (TD) children (n=11) between 7-13 years of age. The experiment involved interception of a moving target via reach estimation from a first-person perspective under 5 conditions (hand, 10cm, 20cm, 30cm, 40cm). The target started close to the subject and travelled away along an orientation line (left, center, right) by increments of 500ms. Participants were instructed to imagine reaching out with their hand or tool and respond when they believed the target had arrived at their reach estimation. Overall, participants underestimated their reach ability, with DCD children underestimating an average of about 6cm more than TD children. On average, children with DCD underestimated 5.86cm, 7.74cm, and 6.86cm more than TD children at left, center, and right orientations respectively. The results showed that children with DCD underestimated reach distance, which became more apparent as tool length increased. Children with DCD may have problems with intercepting objects due to a lower ability to accurately estimate their reach with and without tools. These findings may lead to the creation of intervention protocols for children with DCD.

### **Improving Tor performance with smarter relay selection**

Presenter: Mohsen Imani, Computer Science Engineering Graduate

Poster board: 25

Mentor(s): Matthew Wright

#### **Abstract:**

Tor is an anonymity network that provides privacy for the Internet users by concealing their identity and activities on the Internet. Tor consists of several thousand voluntary computers (relays) which are distributed all over the world. Tor picks three relays and establishes a secure and encrypted connection (tunnel) between the user and its destination through these three relays. The user's traffic passes over this tunnel. One of main problems of Tor is performance. One way that we can improve the performance is to change the relay selection policy and take different criteria into account, such as different types of delays in the network. We focus on the delay in the established tunnel. We select relays based on the propagation delay and pick them based on their location. Relays that are close to the direct line between the user and the destination have higher chance to be selected. We build several tunnels through this way, and pick the tunnel with the lowest congestion. We also continue monitoring the congestion while we use that tunnel, if it is not satisfying, we stop using that and build another tunnel. Applying this policy endangers the anonymity of the user. In order to switch between anonymity and performance, we build in a tuning parameter that enables the user to choose the level of performance and anonymity. Through the experiment on the simulation by Shadow (Tor network simulator), we verify that this technique in the relay selection improves performance over the state of the art approaches.

### **The effects of bonding layer on ultrasound generation and sensing using PWAS**

Presenter: Md Islam, Mechanical & Aerospace Engineering Graduate

1:00 PM, Red River

Mentor(s): Haiying Huang

#### **Abstract:**

This paper presents an analytical simulation model to study the effects of bonding layer on ultrasound pitch-catch signals generated and acquired using bonded PWAS transducers. The PWAS transducers are assumed to deform in longitudinal mode1 while both the longitudinal and flexural vibrations of the structure are considered to account for the multi-mode nature of ultrasound pitch-catch signals. The governing equations of the PWAS transducer under these two different structural vibration modes are derived by coupling the deformation of the PWAS transducers to the structural deformation through the shear deformation of the bonding layer. The governing differential equations were solved by implementing appropriate boundary and continuity conditions as well as adopting the reverberation matrix method (RMM). Parametric analysis is carried out to study the unknown bonding layer parameters such as the shear modulus and shear reduction constant of bonding layer affects the ultrasound pitch-catch signals. The simulated pitch-catch signal will be matched with the experiment measurements by tuning the unknown bonding layer parameters.

**Mechanical Discrimination of Tumor Cells from Electrical Data Recorded in Microfluidic Channels**

Presenter: Muhymin Islam, Electrical Engineering Graduate

11:20 AM, Concho

Mentor(s): Samir M. Iqbal

**Abstract:**

Single microfluidic channel was used to detect and discriminate cancer cells based on translocation behavior. The approach provided rapid detection of metastatic renal cancer cells from their size and mechano-physical properties. The tumor cells showed characteristic electrical signals which easily distinguished them from blood cells. The microfluidic device consisted of single channel fabricated in polydimethylsiloxane (PDMS) using soft-lithography. The cross-section area and length of the channel were  $400 \mu\text{m}^2$  and  $5 \mu\text{m}$ , respectively. Dimension of the channel did not allow more than one cell inside at any given time. The ionic current across the channel was measured using Ag/AgCl electrodes which were connected to data acquisition system for voltage biasing and current measurements. The conductivity of the channel was seen to reduce due to physical blockage when cells translocated through. The translocation time and current drop for tumor cells were significantly different from blood cells. The average translocation time and current peak for tumor cells were  $149.09 \pm 50.12 \mu\text{s}$  and  $20.53 \pm 5.21 \mu\text{A}$ , respectively, where as those for blood cells were  $66 \pm 30.65 \mu\text{s}$  and  $2.23 \pm 1.53 \mu\text{A}$ , respectively. More than 80% cancer cells exhibited distinctive translocation profile compared to blood cells. This inexpensive device did not require preprocessing of the blood, surface functionalization, or fluorescent tagging but provided quantitative and objective detection of cancer cells.

**Stressors and Social Support Among African American Grandparents Raising Grandchildren**

Presenter: Dorothea Ivey, Social Work Graduate

Poster board: 26

Mentor(s): Anne Nordberg

**Abstract:**

Grandparent caregiving increased over the past three decades and occurs among all ethnicities. African American (AA) grandparent caregivers, however, experience the most stress; yet have the fewest resources as compared with other ethnicities. In addition, AA grandchildren are more likely to live with their grandparents than other ethnicities. This study qualitatively explores (1) the stressors and experiences of grandparent caregiving among AA grandparents, (2) the importance of social support and (3) the impact that grandparent caregiving has on relationships. A criterion sample of 16 AA grandparents (14 grandmothers and 2 grandfathers) was recruited from a human services agency in South Dallas County, TX. Data were collected through focus group discussions and previous studies. Grandparents who experienced the most stress were those that lack legal guardianship or custody of their grandchildren. Informal living arrangements made it difficult for grandparents to access social support while in financial strain. Patterns emerged among the grandparents relating to social isolation, health, and resilience among the grandmothers. Due to the high demands of the intergenerational household, grandmothers were less likely to participate in leisurely activities. Yet, the grandmothers prefer to continue raising their grandchildren than to release them to their parents or the child welfare system. Another finding was that AA grandmothers rely heavily on their church communities for support. These findings suggest the need for more rigorous assessment of stressors and available social support which could lead to the implementation of social support programs targeting grandparent caregivers in South Dallas County, TX.

*UTA School of Social Work's Charles Mendel Thesis Research Scholarship*

### **Impact of stress on sleep in cancer patients**

Presenter: Stephanie Jacob, Psychology Junior

Mentor(s): Angela Liegey Dougall

Poster board: 115

#### **Abstract:**

Everybody needs a good night of sleep in order to function properly, especially cancer patients dealing with tiring treatment. The current study examined stress and sleep quality in cancer patients and assessed the predictive power of stress at Time 1 on sleep problems at Time 2. It was hypothesized that patients would report more sleep problems and stress than healthy controls. Additionally, after controlling for age, education, gender, and religious beliefs, stress levels at Time 1 would predict sleep problems 3 months later. Patients (N=81) diagnosed with different types of cancers were enrolled. They completed questionnaires about stress 6 weeks after diagnosis, as well as about sleep quality, 3 months later. Patient sleep quality and stress levels were compared to normative data. As expected, patients reported worse daytime dysfunction, sleep efficiency, sleep duration and total sleep quality. Patients reported increased use of sleep medication, sleep disturbances, and sleep latency. Contrary to expectations, stress levels did not differ. Finally, as expected, stress predicted sleep latency ( $\beta = .38$ ), sleep efficiency ( $\beta = .04$ ), sleep disturbances ( $\beta = .02$ ), daytime dysfunction ( $\beta = .03$ ) and total sleep quality ( $\beta = .55$ ), but did not predict sleep duration, use of sleep medications, and subjective sleep quality. In conclusion, the stress patients experience while dealing with their cancer diagnoses and treatment may lead to sleep problems that further impair the body's ability to fight cancer. Therefore, intervention designed to decrease stress and help patients receive a good night's sleep are needed.

### **Querying Knowledge Graphs by Example Entity Tuples**

Presenter: Nandish Jayaram, Computer Science Engineering Graduate

Mentor(s): Chengkai Li

Group members: Dr. Ramez Elmasri

Poster board: 27

#### **Abstract:**

We witness an unprecedented proliferation of knowledge graphs that record millions of entities and their relationships. While knowledge graphs are structure-flexible and content-rich, they are difficult to use. The challenge lies in the gap between their overwhelming complexity and the limited database knowledge of non-professional users. If writing structured queries over "simple" tables is difficult, complex graphs are only harder to query. As an initial step toward improving the usability of knowledge graphs, we propose to query such data by example entity tuples, without requiring users to form complex graph queries. Our system, QQBE (Graph Query By Example), automatically derives a weighted hidden maximal query graph based on input query tuples, to capture a user's query intent. It efficiently finds and ranks the top approximate answer tuples. For fast query processing, QQBE only partially evaluates query graphs. We conducted experiments and user studies on the large Freebase and DBpedia knowledge graphs and observed appealing accuracy and efficiency. The results show that querying knowledge graphs by example tuples can effectively be used to search through complex, schema-less and large knowledge graphs. Our system provides a complementary approach to the existing keyword-based methods, facilitating user-friendly graph querying. Although the aforementioned approach is user-friendly, it is hard to convey the user intent for a complex query using it. QQBE not only lets users convey complex query intent, but also finds a ranked list of matching answer tuples efficiently.

*This work of Dr. Chengkai Li is partially supported by NSF IIS-1018865, CCF-1117369, 2011 and 2012 HP Labs Innovation Research Awards, and the National Natural Science Foundation of China Grant 61370019*

**The Use of Cheap Methane for Feedstock of Value-added Chemicals**

Presenter: Naleen Jayaratna, Chemistry Graduate

3:00 PM, Pedernales

Mentor(s): H.V. Rasika Dias

**Abstract:**

Methane, the simplest alkane is a well abundant raw material found in large amounts from both natural gas as well as biogas sources. Conversion of methane into a source of clean liquid fuel or utilize as a feedstock for value-added chemicals is a well-known challenge in which scientist looking for an favorable answer for decades. Yet the direct conversion of methane into useful products remains poorly responded. C-H bond activation is the main barrier for the conversion of methane into value-added products. Metal catalyzed C-H bond activation via carbene insertion has drawn a considerable attention over the past few years. It permits convenient incorporation of a variety of functionalities to alkanes but methane. Consequently our goal is to develop a catalyst which can activate not only convenient alkanes but also methane. Coinage metal ions supported by highly fluorinated ligands such as fluorinated tris(pyrazolyl)borates are excellent catalysts for this C-H bond activation chemistry and the activity of silver adducts are particularly noteworthy. Taking into account the importance and current interest of fluorinated tris(pyrazolyl)borates, two new tris(pyrazolyl)borates, [HB(4-Cl-3,5-(CF<sub>3</sub>)<sub>2</sub>Pz)<sub>3</sub>]- and [HB(4-(NO<sub>2</sub>)-3,5-(CF<sub>3</sub>)<sub>2</sub>Pz)<sub>3</sub>]- have been developed (Pz = pyrazolyl). We will discuss the successful synthesis of these ligands, their silver(I) cis-cyclooctene adducts, their properties and catalytic activity towards C-H bond activation.

*This work was supported in part by the National Science Foundation*

**Gender Differences in Crowding and Equipment Use in a University Fitness Center**

Presenter: Colin Jenney, Psychology Graduate

2:00 PM, Neches

Mentor(s): Angela Liegey Dougall

**Abstract:**

Introduction

As physical inactivity continues to be a detriment to health among Americans, gender differences in physical activity have become a growing area of research. Our previous research has shown marked gender differences in the use of the on-campus activity center and evidence that crowding may negatively affect gym use.

Methods

The current study characterized gender differences for experience and equipment use among undergraduates by surveying University fitness center users (n = 106) at the beginning of a Spring semester. This assessment measured demographics (gender), crowding, social physique anxiety, physical activity levels, equipment use and satisfaction.

Results/Conclusions

Against expectations, males perceived the free-weights area of the fitness center as more crowded than did females. Despite feelings of crowding, whereas males used resistance training equipment/area more than did females. These findings identify factors regarding gender differences in experience and equipment use. These results suggest that while males experience more crowding in the free-weights area, they may actually prefer such conditions, and that males and females may naturally segregate themselves within a gym environment. Additionally, these results suggest that individuals may avoid free-weights areas due to fear of social evaluation. These findings should be built upon by future research and should also be considered when designing gyms.

**Synthesis of flavin derived organic photocatalysts**

Presenter: Joe Johnson, Biology Senior

Mentor(s): Frank W. Foss Jr.

Group members: Mohammad Shawkat Hossain

**Poster board: 128**

**Abstract:**

Flavins are an important family of biological molecules and are a major component of many reactions in nature. They are most commonly involved in oxidation-reduction reactions where they transport electrons. In humans, flavins are present in cells as FAD(Flavin adenine dinucleotide) and FMN(Flavin mononucleotide) and are integral in a variety of metabolic reactions like cellular respiration. They are consumed by humans through their diet in the form of a derivative called riboflavin which is also known as Vitamin B2. The objective is to engineer an efficient photocatalytic system using bioinspired components. Flavins are employed as bioinspired catalysts to accelerate a photoreaction and to shuttle electrons to the substrate of the system. Thus, our reaction of interest is synthesizing derivatives of flavins to function as bioinspired mimics of catalyst for this system. The modification of linker groups on flavins affect their functions and this allows them to be used in diverse reactions. Synthesized flavins are available in two forms - iso-alloxazine and alloxazine. In our study, a new method was developed to synthesize iso-alloxazine with different linker groups at the N-3 position which could then be used to shuttle electrons from a metal oxide to the flavin.

**RADIO-FREQUENCY STIMULUS INDUCED NEUROMA PAIN**

Presenter: Benjamin Johnston, Biomedical Engineering Graduate

Mentor(s): Mario Romero-Ortega

Group members: Le, Matthew; Trinh, Shannon; Jones, Erick; Granja-Vazquez, Rafael; Romero-Ortega, Mario

**9:20 AM, Palo Pinto**

**Abstract:**

Idiopathic pain is a frustrating clinical challenge for many patients and physicians. Following a case report of a patient suffering from neuroma pain when exposed to radio-frequency (RF) stimulus, we developed an animal model in both Lewis and then Wistar rats to explore this unusual clinical finding. Without nerve injury, there are no reports of RF exposure leading to pain, and this result was confirmed in animal testing. However, RF stimulus delivers energy to living tissue like all electromagnetic radiation, and animals with neuromas demonstrated clear pain responses when exposed. To systematically confirm this observation, a blinded study with twenty Wistar rats was performed. Animals were separated into two experimental groups: four animals were given a sham surgery (no nerves were injured) serving as control subjects, and sixteen animals were operated on to induce a neuroma in the tibial nerve. After allowing the injury site to heal, animals were subjected to weekly RF exposure and observed for pain responses. Animals with neuromas demonstrated characteristic pain behavior while no responses were observed from the sham animals. This result was highly significant ( $p < 0.001$ ). To characterize the pain response to RF stimulus all animals were subjected to other common nociceptive assays. RF stimulus responses were more similar to thermal noxious stimuli than to mechanical palpation. This study is an important early characterization of a previously idiopathic pain diagnosis, and represents a breakthrough understanding of the interaction of nervous tissue with electromagnetic radiation.

*UT ARLINGTON & US DE GAANN FELLOWSHIP*

### **Green Energy Tapping from Building Doors**

Presenter: Sarthak Joshi, Mechanical & Aerospace Engineering Graduate

**2:20 PM, Red River**

Mentor(s): Ankur Jain

Group members: Sandeep Patil

#### **Abstract:**

With huge advancement leaps in the field of technology, medical sciences & engineering mankind has reached an era of peak advancement with energy being our prime asset. The depletion of natural sources & an exponential increase in the world pollution & global warming has dictated us to harness new sources of energy, design and develop more efficient systems & also implement energy recovery solutions in order to economize the use available energy. This project aims to implement a novel way to recover energy lost in opening doors in day to day life. The Door opening energy tapping project aims to tap and utilize the energy spent by a human being to open a door, in huge complexes, consisting of hundreds of doors, being opened every minute of the day. Although, a seemingly low amount of energy that is needed to open a door, it adds up to a gross amount when calculated considered a huge complex. A theoretical calculation approach, assuming a skyscraper consisting of forty floors with forty doors each floor, yielded an energy saving of 13 KW of electrical energy per day, which is a staggering 390KW of electrical energy per month. This source of green energy, if exploited would add up to our efforts as responsible engineers to control the energy crisis and help make the earth a better place.

### **Local Field Potentials Change in the Central Nucleus of the Amygdala (CeA) in Response to Noxious Stimulation**

Presenter: Mayanja M. Kajumba, Psychology Graduate

**Poster board: 28**

Mentor(s): Yuan Bo Peng

Group members: Ai-Ling Li; Amber L. Harris; Yuan B. Peng

#### **Abstract:**

The recording of the pain related activities in the brain involves use of various electrophysiological techniques. Local field potentials provide a unique set of data that can be used for long term brain recordings. This study examined the effects of formalin injection on pain-related responses in the CeA. Sprague-Dawley rats were used; one group under pentobarbital anesthesia (50 mg/kg) and another group of freely moving rats. Local field potentials were recorded with the aid of bipolar electrodes which were implanted into either the left or right CeA a week prior to the experiment. After recording baseline activity for 10 minutes, a 50µl formalin (3.0%) injection was administered to either the left or right hindpaw. Using a wireless module, local field potentials were recorded for a 45 minutes period after the injection. For the anesthetized animals there were significant decreases in Beta waves in the right CeA and in Delta and Gamma waves in the left CeA. For the freely moving animals there were significant increases in Delta, Theta, Alpha, Beta, and Gamma brain wave activities in both the left and right CeA during the first and second phases of the formalin test. Formalin-induced biphasic nociceptive responses were observed in the freely moving animals but there were no distinct formalin-induced phases for the anesthetized animals. In conclusion, our results indicate that (1) in freely moving animals both the right and left CeA respond to formalin-induced nociception and (2) the anesthesia (pentobarbital) attenuates formalin-induced nociceptive responses in the CeA.

### **Microwave-Based Navigation of Femtosatellites using On-Off Keying**

Presenter: Namrata Kamte, Mechanical & Aerospace Engineering Graduate

Poster board: 29

Mentor(s): Robert Harris

#### **Abstract:**

The objective of this research is to validate that the Pseudo Random Noise (PRN) code that modulates the weak GPS signal that enables the signal from a microchip-scale low-power femtosatellite to be tracked. A femtosatellite capitalizes on small-scale physics to perform maneuvers. Swarms of such femtosatellites can serve as environmental probes, interplanetary chemists or in-orbit inspectors of the parent spacecraft. In May 2011, NASA's Space Shuttle Mission STS-134 deployed femtosatellites called 'Sprites' but the ground stations on Earth failed to track their signal possibly due to the techniques used to modulate and encode the data. In our attempt to solve the signal-tracking problem, we have designed and built a prototype similar in size to the Sprite, containing a different microcontroller and transmitter. The transmitter emits the same 433 MHz radio frequency signal as the Sprite. Due to phase instability in small electronics, our signal is modulated with a PRN code using On-Off Keying unlike Phase Shift Keying in GPS satellites or Minimum Shift Keying in Sprites. Our ground station uses a Universal Software Radio Peripheral (USRP) with a custom-built microwave antenna. The USRP is driven by a software called GNU Radio that records the tracked signal into a binary file. Benchtop testing has demonstrated a reception sensitivity of up to 1 microsecond, which translates into a ranging capability similar to that of GPS satellites. Thus we have the capability to track a femtosatellite signal that is lower than ambient noise, just like the signals broadcast from GPS satellites.

### **Skeletal malformations in an invasive lizard species**

Presenter: Kelcy Steffen, Biology Senior

Poster board: 113

Mentor(s): John W. Fondon III

Group members: Hunter Rayner, Chad Watkins, Yoel Stuart, Andr#233; Pires da Silva

#### **Abstract:**

Vertebral patterns have been used to classify different species; however, variations of this vertebral pattern have been discovered within species as well. Previous investigations in the laboratory of axial skeletal variation revealed striking variation in number/identities of vertebrae in *Anolis sagrei* lizards sampled from the Mosquito Islands in Florida: over a third of individuals harboring supernumerary, missing, and/or transitional vertebrae. These anomalies were much more abundant than in native *Anolis carolinensis* lizards from the same locations (37% vs. 14%, respectively). This surprising finding raises important questions as to its causes and origins: Is this range of variation typical for *A. sagrei*, or is it particular to these specific populations? And secondly, might the observed variability be related to *A. sagrei*'s role as a successful invasive species? Are these malformations genetic in origin, or environmentally induced? To address these questions, we examined adult *A. sagrei* collected from their native range in the Bahamas and their offspring reared in standardized conditions. We found significantly less vertebral variation in *A. sagrei* sampled from their native range than observed in invasive Florida populations (2% vs. 37%, respectively). Analysis of captive-bred full-sibling and half-sibling cohorts also revealed significant clustering of variation within families, indicative of genetic causes. While additional studies will be required to determine the genetic mechanisms, the observed relationship between vertebral anomalies and status as a successful invasive species are consistent with similar relationships found for invasive plants.

**Lingering effects of Multiple Concussions on ImPACT and Sensory Organization Test**

Presenter: Laila Khan, Biology Senior

Poster board: 128

Mentor(s): Jacob Resch

**Abstract:**

The effects of multiple sport related concussions (SRC) have been brought into question. The Immediate Postconcussion and Cognitive Testing battery (ImPACT) and Sensory Organization Test (SOT) are widely used measures to assess neurocognition and balance following a SRC. The purpose of our study was to examine the performance of athletes with history of two or more SRCs on the SOT and ImPACT compared to athletes with no history of SRC. For this retrospective cross-sectional study, database of 185 college athletes was analyzed. Eleven athletes (7 males and 4 females) with average age of  $19.7 \pm 1.90$  years, height  $69.5 \pm 3.69$  cm, weight  $72.0 \pm 11.2$  kg,  $12.9 \pm 1.37$  years of education (YOE), and two or more SRCs were matched to athletes with no history of SRC with average age of  $19.6 \pm 1.28$  years height  $19.7 \pm 1.90$  cm, weight  $162.3 \pm 23.5$  kg, and  $12.9 \pm 1.14$  YOE. Matching criteria included age, height, weight, YOE, sport and position. Participants completed ImPACT, SOT and symptom inventory. Homogeneity of variance was assessed via Levene's test. An ANOVA was used to assess group differences on ImPACT and SOT composite scores and demographic variables with  $\alpha = .05$ . No significant differences between groups ( $p > .05$ ) for ImPACT or SOT composite score were observed. Our results conflict with previous reports of multiple concussions resulting in decreased neurocognitive and balance performance. However, a small sample size may have influenced our findings. Further research is needed to better understand the cumulative effects of SRC on computerized neurocognitive and balance measures.

**Finite Element modeling of Descemet's Stripping Automated Endothelial Keratoplasty (DSAEK) surgery to improve surgical outcomes**

Presenter: Salman Khan, Mechanical & Aerospace Engineering Graduate

Poster board: 30

Mentor(s): P S Shiakolas

**Abstract:**

DSAEK surgery pertains to partial thickness keratoplasty procedures, wherein the diseased endothelial layer of the human cornea is replaced by a donor graft to improve visual acuity. DSAEK, a non-elective surgical procedure, is rapidly gaining acceptance and becoming the procedure of choice among surgeons. In the US alone 24,277 endothelial keratoplasty procedures were performed in 2012, showing a marked increase in percentage from previous years. The success of the DSAEK procedure depends on the manner in which the donor graft is handled and inserted inside the anterior chamber of the patient, where any undue stresses imparted to the donor graft result in endothelial cell death which in turn leads toward failure of the procedure. This research studies the effects of graft deformation during handling and insertion. Currently, this study focuses on estimating the stress levels on the graft due to deformation caused during the insertion process by developing high fidelity finite element (FE) models and correlating the stress levels to cell health. The results indicate regions of high stress levels which contribute to endothelial cell death/loss and reduced visual acuity. The predicted high stress regions and the quality of the developed model are verified since similar results with endothelial cell loss have been observed in clinical studies. The next step will include employing FE models to study and improve existing insertion techniques and develop novel devices to reduce stress trauma on the donor graft, hence decreasing the probability of endothelial cell loss and improve the success of DSAEK surgical procedure.

**Towards Understanding the Role of Tesmin/TSO1-like Protein in Stomate-Based Defense against Bacterial Infection in *Arabidopsis thaliana*.**

Presenter: Roshni Kharadi, Biology Junior

Poster board: 101

Mentor(s): Maeli Melotto

Group members: Dr. Maeli Melotto.

**Abstract:**

Stomata are pores present on the surface of plants and are primarily involved in transpiration. However, due to their abundance and their location on the surface of leaves, they become potential sites of entry for pathogens introduced on the plant surface. Stomata however, possess the innate ability to open and close in response to a pathogen. They can do this by recognizing molecules called pathogen associated molecular proteins (PAMPs) present on the surface of the pathogens. This constitutes the first line of defense for the plant. Our research is focused on examining the role of Tesmin/TSO1-like protein in stomatal immunity. The gene responsible for the production of this protein in *Arabidopsis thaliana* is At4g29000. We used homozygous T-DNA insertion mutants for our experiments (SALK\_020712C). Thermal imaging, which is used to monitor stomatal opening and closing, shows that stomatal pores in this mutant have small aperture width as indicated by a hotter leaf surface temperature two and four hours post inoculation. The mutant has also shown significantly lower levels of infection when inoculated with Pst DC3118 and Pst DC3000. The mutant also shows a significant decrease in the size of stomatal aperture two and four hours post inoculation when inoculated with the aforementioned bacteria. Further research and confirmation of the role of the Tesmin/TSO1-like protein in stomatal immunity can have potential applications in developing plant lines that have enhanced stomatal immunity, thus, reducing the amount of chemicals used for protecting crops against pathogens.

*This work was sponsored by the NIH.*

**The sex-linked gene TYRP1 is the primary color diversity locus in domestic pigeons**

Presenter: Shreyas Krishnan, Biology Graduate

Poster board: 31

Mentor(s): John W. Fondon III

**Abstract:**

While the wild rock pigeon is uniformly blue-gray with black bars on the wing and tail throughout its native range, domestic pigeons boast a stupendous array of colors in hundreds of diverse breeds derived from this wild progenitor. The "base" colors in these birds, encoded by the sex-linked B locus, occurs in three versions, including dominant ash red, wild-type blue, and recessive brown in descending order of dominance. We have used a candidate gene association approach in an across breed sample to identify the causative mutations underlying the B locus traits. Dominant ash red is the result of a single mutation event in the Z-linked TYRP1 gene resulting in an alanine to proline substitution at position 23 in the protein. Ash red heterozygotes develop reversionary "freckles" that are the color encoded by the recessive allele, either blue or brown. The recessive brown trait was found to be the result of a frame-shift mutation in the second exon the same gene. We have demonstrated the use of pigeons as a model system in which to examine the genetic basis of traits that also occur in humans, livestock and other domestic animals.

**Control of System PHEV Charging Stations**

Presenter: Asama Kulvanitchaiyanunt, Industrial Engineering Graduate

3:40 PM, Concho

Mentor(s): Jay Rosenberger

Group members: Wei-jen Lee, Piampoom Sarikprueck

**Abstract:**

The dynamic control of a system of plug-in hybrid electric vehicle (PHEV) charging stations for the DFW metroplex is studied. A finite horizon dynamic problem is presented. Following the timing of the electricity market, the system evolves in 15-minute time intervals. The objective function is to maximize the profit, which is the revenue benefit from selling back to the grid and serving the demands minus the cost of buying electricity from the grid. The state variables in each 15-minute time period consist of the total wind purchased by the system, solar power generation at each charging station, total demand at each station, and nodal market price at station locations. As an initial solution analysis, the mean value problem is formulated as a deterministic linear program and solved. Potential policies are presented to provide insight into the behavior of the system. It is suggested that the system takes advantage of the low market price in the morning, using battery storage, before peak demand occurs. Once the system has satisfied all demand for the day, the remaining stored electricity is sold back to the grid at the peak market price.

*This work was supported in part by the National Science Foundation Grant ECCS-1128871.*

**Integrated Decomposition of Perfluorooctanoic Acid by Palladium Doped Nanoscale Zerovalent Iron and Persulfate.**

Presenter: Wasuu Lawal, Geology Graduate

Poster board: 32

Mentor(s): Hyeok Choi

**Abstract:**

Perfluoroalkyl compounds (PFACs) are a group of compounds that have been widely used as water repellents in the paper and textile industries and in non-stick cookware. They are also used as fire retardants in firefighting foams. The issue with PFACs is that the properties that make them useful in the aforementioned examples also make them an environmental concern. They are thermally stable and non-biodegradable which makes them persistent in the environment and they have been implicated in a number of conditions such as pre eclampsia in pregnant women and even cancer. In this study, nanoscale zerovalent iron (nZVI) doped with palladium was found to decompose perfluorooctanoic acid (PFOA, one of the most commonly used PFACs) by up to 95% in just an hour. Further testing showed that PFOA decomposition was also achieved with even lower amounts of nZVI/Pd in the presence of persulfate, a commonly used oxidant. These results suggest a combination of reductive and oxidative pathways and further studies ongoing to determine the exact mechanism of decomposition.

**Direct cell-to-cell contact is an important mechanism in the impact of the toxic alga *Prymnesium parvum* on other species**

Presenter: Coridon Laws, Biology Graduate

4:00 PM, Palo Pinto

Mentor(s): James P. Grover

**Abstract:**

Toxins excreted into the water are thought to play major role in the population dynamics of several types of harmful algae, including *Prymnesium parvum*, a species often responsible for massive fish kills. Shortages of necessary nutrients such as phosphorus or nitrogen may trigger the release of dissolved toxins that inhibit or kill competing algal species, and incidentally kill fish. However, it remains debatable whether direct contact or dissolved toxins are responsible for lethality to competitors. To explore whether direct contact is required for effects on competitors, an experiment using *P. parvum* and *Rhodomonas salina* (target competitor species) was set up using a porous barrier to isolate the two species, but allow transmission of dissolved toxins released by *P. parvum*, if any were produced. Population densities of *R. salina* decreased more rapidly when in mixed cultures having direct contact with *P. parvum* than when *R. salina* was isolated from *P. parvum* due to the barrier. Because *R. salina* did not persist in direct contact with *P. parvum*, but did when separated, direct contact is likely to play a vital role in the mortality of this and probably other competitors of *P. parvum*. Additionally, it is likely that *P. parvum* ingests *R. salina* (or their remains) for nutritional benefit. Understanding how *P. parvum* interacts with other species will further elucidate the mechanisms of its population dynamics.

**Characterization of an Essential Methanogenic Enzyme: F420H2: NADP+ Oxidoreductase from *Archeoglobus fulgidus***

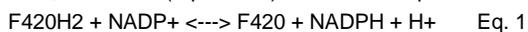
Presenter: Cuong Quang Le, Chemistry Graduate

Poster board: 33

Mentor(s): Kayunta Johnson-Winters

**Abstract:**

F420H2: NADP+ Oxidoreductase (Fno) is an enzyme that catalyzes the transfer a hydride (:H-) from the F420 Cofactor molecule, to NADP+ (equation 1). This reaction produces a biologically relevant molecule, known as NADPH.



F420 Cofactor is essential for methane producing and sulfate reducing microorganisms, such as methanogens. Methanogens play a critical role in carbon cycling, producing methane, which is a renewable energy source. We have created and purified three variants of Fno by converting an active site isoleucine (I135) amino acid into an alanine (I135A), glycine (I135G) and valine (I135V). Here, we will discuss the effects of these variants upon kinetics of Fno.

**LIMITING NEUROMA FORMATION AND NEUROPATHIC PAIN AFTER PERIPHERAL NERVE INJURY USING A MULTI-LUMINAL CONDUIT IMPLANT**

Presenter: Matthew Ie, Biology Senior

11:40 AM, San Jacinto

Mentor(s): Mario Romero-Ortega

Group members: Johnston, Benjamin; Trinh, Shannon; Granja-Vazquez, Rafael; Romero-Ortega, Mario

**Abstract:**

A neuroma is a disorganized, bulbous tumor of peripheral nervous tissue that forms following traumatic injury. Patients with amputated limbs will develop neuromas, and unfortunately, approximately 25% of patients will develop intense neuropathic pain at the neuroma site. To address the long-term complications of pain management for neuroma patients we developed a multi-luminal conduit to impede neuroma formation. We hypothesized that using a multi-luminal conduit to segregate nervous tissue would interrupt neuroma formation and limit pain experienced in injured animals. In our in vivo study, we used the Lewis Rat Tibial Neuroma model and divided seventeen animals into three treatment groups following nerve injury: no treatment, hollow conduit capping, and an advanced multi-luminal conduit capping. Weekly pain assays were performed after implementing the surgical treatment. Mechanical pain was assessed by direct palpation of the neuroma by Von Frey filament. After eight weeks of testing, we examined the morphology of the explanted tissue and found significant differences in neuroma formation between treatment groups. Further, the group with the multi-luminal conduit treatment had a significantly lower pain response. We hope that the study will lead to improved surgical treatment for neuroma patients.

**The role of rhizobial lipopolysaccharide (LPS) in the soybean-*Bradyrhizobium japonicum* symbiosis**

Presenter: Hae-In Lee, Biology Graduate

11:00 AM, San Saba

Mentor(s): Woo-Suk Chang

**Abstract:**

Nitrogen accounts for about 79% of the atmosphere and is an essential element for living organisms. Legumes such as soybeans are not able to directly utilize the atmospheric nitrogen, but require an interaction with soil bacteria, called rhizobia, to establish root nodules where the diatomic nitrogen is fixed into ammonia. The rhizobium, *Bradyrhizobium japonicum*, has a symbiotic relationship with soybean (*Glycine max*) by forming nitrogen-fixing nodules on the plant roots. It has been known that genes (e.g., *rfaF*, *rfaD*, and *galE*) involved in lipopolysaccharide (LPS) biosynthesis of *B. japonicum* play an important role in the symbiotic interaction between the two partners. Recently, *lpcC*, encoding a mannosyl transferase, was identified in *B. japonicum*, but its role in building an intact LPS structure has not been investigated. To examine its role in LPS biosynthesis and this symbiotic interaction, we constructed an *LpcC* deficient mutant. The mutant showed incomplete LPS structure and altered cell surface property (i.e., increased hydrophobicity) which eventually influenced the growth rate, motility, and biofilm formation. The most remarkable trait of the mutant was the deficiency in the ability to form root nodules, indicating that the intact LPS structure is required for the successful relationship between the symbiotic partners. Our findings would contribute to a better understanding of the mechanism by which *B. japonicum* establishes the symbiotic interaction with its host plant soybean.

**Expanding Analytical Capabilities in MALDI Mass Spectrometry using a 3-Hydroxycoumarin-Containing Binary Matrix**

Presenter: LI LI, Chemistry Graduate

Mentor(s): Kevin A. Schug

Poster board: 34

**Abstract:**

Matrix assisted laser desorption/ionization (MALDI) mass spectrometry is an analytical technique used to analyze proteins, polymers, and other small molecule compounds. Ionization in MALDI begins with a small organic molecule matrix absorbing the energy from a laser and then transferring the energy to analyte molecules to form ions. It is crucial to choose the right matrix for certain types of analytes to gain the best signal intensity and resolution. Combining different properties of matrices can allow fine tuning for different target analytes. In this experiment, we have used 3-hydroxycoumarin (3-HC; (matrix common to infrared laser MALDI) as an additive to 2,5-dihydroxybenzoic acid (DHB), sinapic acid (SA),  $\alpha$ -cyano-4-hydroxycinnamic acid (CHCA), and 3-hydroxypicolinic acid (3-HPA), which individually are common ultraviolet laser MALDI matrices. Some combinations with 3-HC has greatly enhanced either the peak shape or the intensity for various model test compounds. For labile compounds (like phosphatidylcholine), 3HC has greatly eliminated the fragmentation often found for "hot" matrices, such as CHCA, and produced a cleaner higher intensity signal. The use of this binary matrix thus enhances the performance of traditional matrices for ultraviolet laser-based MALDI.

**Influences of Structural Factors on Catalysis in Mouse Cysteine Dioxygenase**

Presenter: Wei LI, Chemistry Graduate

Mentor(s): Brad Pierce

Group members: Joshua Crowell, Bishnu Subedi, Andra Carter

Poster board: 35

**Abstract:**

In mammals, the study of enzymes involved in mammalian sulfur metabolism have been of considerable medical interest due to the observation that patients suffering from neurological disorders such as autism and Down syndrome have significantly lower plasma concentration of sulfur-bearing amino acid derivatives [cysteine (Cys), homocysteine (HCY), glutathione (GSH), and S-adenosylmethionine (SAM)]. In fact, imbalances in Cys metabolism have also been identified in a variety of other neurological disorders as well (motor neuron disease, Parkinson's, and Alzheimer's). These observations suggest a potential correlation between impaired sulfur metabolism, oxidative stress, and neurodegenerative disease. In this work we investigate the mechanism of a key enzyme in sulfur metabolism, Cysteine Dioxygenase (CDO). The active site of this enzyme contains a single iron atom which directly coordinates with its substrate L-Cysteine, (Cys) prior to O<sub>2</sub>-dependent formation of cysteine sulfinic acid (CSA). Herein we characterize the structural factors influencing substrate recognition at the CDO active site and how subtle alterations to this active site coordination geometry can result in oxidative stress due to the release of toxic reactive oxygen species (ROS) during catalysis. Therefore, this work confirms a direct link between impaired sulfur metabolism and oxidative stress.

*This work was supported in part by the NSF.*

**Microfluidics: An innovative way to assess cancer metastasis**

Presenter: Sylvia Loh, Biology Senior

Mentor(s): Jung-Chih Chiao

Group members: Dr. Smitha Rao; Dr. Victor Lin; Lyndon K. Lee; Steven R. Bean

**Poster board: 128**

**Abstract:**

The American Cancer Society estimated that during their lifetime, 1 in 6 men will be diagnosed with prostate cancer, while 1 in 8 women will be diagnosed with breast cancer. With our method of monitoring the movement of cancer cells, metastasis, or the spread of cancer, can be better understood. Metastasis of cancer is organ specific. It is known that prostate cancer metastasizes to the bone and lungs. Similarly breast cancer metastasizes to the bone. In this work, we assess the impact of conditioned media on cell migration as a model for metastasis of cancer. We have employed microfluidics to study individual cells and their response to specific chemoattractants. A microfluidic device with two chambers, connected by ten microchannels (20 $\mu$ m width, 10 $\mu$ m height, and 1000 $\mu$ m length), was used to study the migration characteristics of prostate cancer cells, PC-3, in the presence of media conditioned by osteosarcoma cells, SaOs-2. Using images taken at 24-hour intervals, the location of the leading cell in each channel was determined and average migration was calculated. It was observed that there was significantly higher response in PC-3 cells to media conditioned by SaOs-2 compared to standard media. The preferential migration of the cells has provided information regarding the behavior of cancer cells and development of cancer. Further research under microfluidic conditions can possibly bring insight and familiarity on the invasiveness and movement of metastatic cells.

**Vitamin B1 Pathway, A Distinct Source for Novel Antibacterial Development**

Presenter: Diego A. Lopez, Chemistry Graduate

Mentor(s): Frank W. Foss Jr.

Group members: Sumit Bhawal

**3:20 PM, Pedernales**

**Abstract:**

The current state of antibiotic development is dour. The rate decline from pharmaceutical industries to successfully develop novel therapeutics accompanied with the always-increasing bacterial resistance, have resulted in higher mortality indexes worldwide and an urgent need for new antibiotics. The vitamin B1 (thiamine) pathway represents an unexplored source for drug discovery. Its biosynthetic machinery is ubiquitous and specific for major infectious agents, resulting in a potential source of new enzyme targets. HMP kinase, a critical enzyme of the thiamine pathway, carries out two consecutive phosphorylations on 4-amino-5-hydroxymethyl-2-methylpyrimidine (HMP). We have prepared a series of synthetic analogues of HMP to determine substrate scope and identify a pharmacophore for lead inhibitors. Several analogs have shown in vitro activity either as substrate or inhibitor for HMP kinase. This work specifically displays and compares the analytical tools and in vivo assays used to enhance our understanding of the catalytic process of the enzyme; ultimately, leading to the investigation of HMP kinase as a target for antibacterial drug discovery.

**Differential gene expression underlying the extreme physiological remodeling of the Burmese python intestine upon feeding**

Presenter: Audra Andrew, Biology Graduate

2:00 PM, Palo Pinto

Mentor(s): Todd A. Castoe

Group members: Daren C. Card, Drew R. Schield, Elizabeth La, Stephen M. Secor

**Abstract:**

The Burmese python (*Python molurus bivittatus*) has emerged as a premier model for understanding physiological remodeling in vertebrates due to the massive changes in organ mass and physiological function observed in this species following feeding. Among these organ-specific responses, the small intestine experiences a doubling in mass, 6-fold fluctuations in microvillus length, and up to 10-fold increases in nutrient uptake within 48 hours of feeding. We tested the hypothesis that these dramatic fluctuations in small intestine form and function temporally correspond to major fluctuations in intestinal gene expression. We sampled python small intestines for each of the 6 time points before (fasted) and after feeding (6h, 12h, 24h, 96h, 10d), with 2-5 replicates per time point, using RNAseq to identify changes in gene expression associated with shifts in intestinal form and function. We identified genes that showed significant changes in expression across time points, as well as their magnitude and direction of change. We found a large number of genes that show significant differential expression with feeding, and multiple clusters of early and late-responsive genes. Our results indicate that there is a massive shift in gene expression that underlies large-scale rapid shifts in intestinal form and function upon feeding in the python, and that expression analyses have the potential to identify the molecular mechanisms and activated gene pathways that facilitate this shift in intestinal function.

**Model-Based Design and Analysis of a Reconfigurable Continuous-Culture Bioreactor (Work-in-Progress)**

Presenter: Luan Nguyen, Computer Science Engineering Ph.D Student

11:20 AM, Red River

Mentor(s): Taylor Johnson

Group members: Amol Vengurlekar, Ruoshi Zhang

**Abstract:**

Scientific research is increasingly dependent upon software-controlled experimental data acquisition and software-based data analysis. Unfortunately, writing bug-free code is incredibly difficult, even for expert programmers, as exemplified by recent product recalls and research retractions due to software defects (such as Toyota's recall of nearly a million 2010-2014 Priuses due to a software bug, retractions of recent papers in Nature and Science due to bugs in data analysis programs, etc.). In conjunction with biologists at UTSW, we are designing and building prototype laboratory equipment for experiment control and data acquisition in systems biology experiments. In particular, we present a model-based design and analysis of a new continuous culture bioreactor's high-level controller. The reconfigurable continuous culture bioreactor that we model and analyze may operate as: a chemostat, a turbidostat, or a morbidostat. Our analysis rigorously guarantees that our controller meets certain design requirements that an existing prototype system fails to meet. For example, one design requirement is that the volume in a beaker remains constant while adding and removing fluids using peristaltic pumps to control growth of microorganisms. Over long experimental periods, an existing prototype has resulted in beakers overflowing. Worse yet, these software-caused error scenarios reduce the confidence in the validity and reproducibility of results. Our redesigned prototype avoids these error scenarios and is being used to study a variety of important biological questions, such as how bacteria evolve to acquire antibiotic resistance, and how cyanobacteria may be evolved into efficient mechanisms for producing renewable fuels.

# ACES Symposium 2014

## Presenter Abstract by Discipline

### **Measured Noise Levels in the Hospital with Correlating Patient Perception**

Presenter: Rachel Lyle, Nursing Senior

Mentor(s): Deborah Behan

11:20 AM, Guadalupe

#### **Abstract:**

Patient satisfaction surveys in hospitals often return with poor ratings regarding quietness. The aim of this study was to determine what is causing the low satisfaction with noise. This was accomplished by obtaining 187 patients perceptions of noise levels in conjunction with a decibel meter recording of the current noise level in the hallway, at the nurse's station, and in the room both with the door open and closed. Occurring noise sources were recorded as well as directly asking patients what is the most disturbing sources to them in the hospital.

A significant negative correlation was found between patient perception of noise levels and decibels recorded in patient rooms with the door open, indicating patient satisfaction was most negatively affected by noises occurring outside the room; noises occurring outside the room were also the most often cited disturbing noise sources. Alarms, beeping noises, and staff talking in the hallway were cited most often. The morning time frame was found to be the noisiest and the time with the lowest patient satisfaction with noise levels, followed by nighttime and then late afternoon.

No prior research was found that correlated patient perceptions of noise levels with specific noise levels. This research begins to fill a gap in the knowledge and from it several recommendations can be made to improve patient satisfaction, including staff education and other ways to reduce noise levels on the floor, mainly those that occur outside the patient's room.

### **Healing Medieval Disability: Pilgrims and the Miracle Window of Canterbury Cathedral**

Presenter: Erin S. Lynch, History Senior

Mentor(s): Kathryn Beebe

9:00 AM, Guadalupe

#### **Abstract:**

Hundreds of thousands of pilgrims journeyed to Canterbury Cathedral during the Middle Ages, seeking the thaumaturgic powers of Saint Thomas Becket. The Miracle Window of the Trinity Chapel at Canterbury Cathedral, constructed during the early 13th century, features several scenes in which believers are healed by Saint Thomas Becket. The beautifully crafted stained glass depicts pilgrims receiving the healing waters of the saint, visiting his tomb, and being cured of their maladies through their faith and the saintly power of the martyr. The Miracle Window obviously serves as evidence for this belief in the healing powers of Thomas Becket. More than this, though, the window can act as evidence for medieval perceptions of impairment and disability. Yet what the window shows is just as telling as what the artists chose to leave out of the record, that is, blindness, deafness, and leprosy. By studying this sort of material culture, using the Miracle Window as a documentary record demonstrates how medieval populaces understood and sought to deal certain impairments.

**Organ-Specific Migratory Response of Cancer**

Presenter: Lyndon Lee, Biomedical Engineering Graduate

Mentor(s): Jung-Chih Chiao

Group members: Steven Bean, Sylvia Loh, Smitha Rao

9:00 AM, Palo Pinto

**Abstract:**

Metastasis is characterized by the entry of cancer cells into the circulatory system from the primary tumor and subsequent invasion at distant sites to form secondary tumors, and generally contributes to poor prognosis due to the lack of effective treatments options. Roughly 90% of all human cancer deaths involve metastasis. Previous reports suggest that cancer cells preferentially migrate to certain organs. It is therefore reasonable to believe that specific organs express or release soluble chemical factors that promote metastasis and secondary tumor formation. Here we analyze the migration potential of human prostate cells exposed to different rat organ extracts. Human prostate cancer cell line PC-3 and human prostate normal epithelium PZ-HPV-7 were employed in this study by using a polydimethylsiloxane (PDMS)-based microfluidic device. A single device consists of a pair of identical wells connected by ten channels 10  $\mu\text{m}$  high, 25  $\mu\text{m}$  wide, and 1000  $\mu\text{m}$  long. For each device, cells were seeded in one well, and cell growth media containing an organ extract was added to the opposing well as a chemoattractant. Our results indicate that for PC-3, the prostate and kidney extracts provided greater stimulation of cellular mobility over the course of five days than seven other organ extracts. However, no significant migration was detected for PZ-HPV-7 under identical experimental conditions. This work demonstrates the existence of tissue-specific chemical signaling, which may play an important role in the regulation of cancer metastasis. This information can aid in the development of novel therapies and diagnostics for metastatic cancer.

**SELF-EFFICACY, MEDICATION ADHERENCE AND BLOOD PRESSURE CONTROL IN MEXICAN IMMIGRANTS**

Presenter: Rayanne MacNee, Nursing Senior

Mentor(s): Donelle Barnes

Poster board: 110

**Abstract:**

Background:

According to the CDC (2012), hypertension (HTN) is a leading risk factor for cardiovascular disease and stroke, and Hispanics have higher rates of uncontrolled HTN than other ethnic groups. The purpose of this study was to describe blood pressure control, self-efficacy, and medication adherence in hypertensive Mexican immigrants in the United States. Thirty participants, Mexican immigrants with a previous diagnosis of HTN and over 18 years old, were recruited at a North Texas clinic. Once informed consent was obtained, blood pressure, medication adherence, self-efficacy, and demographic variables were measured. Data was analyzed for frequencies and range of response for the descriptive variables.

Findings:

80% of participants were female, 66.7% were married, average age was 51.6 years, and average years living in the United States was 16.2 years. 90% had an income of less than \$20,000 a year, with an average of 4.4 people living with them. Overall, 56.7% had a controlled systolic blood pressure, while 60% of diabetics and 53.3% of non-diabetics had controlled blood pressure. There was no significant difference in blood pressure control for men vs. women ( $\chi^2=0.467$ ,  $df=1$ ,  $p=0.49$ ), although there was a significant positive correlation in systolic blood pressure and age (Spearman  $\rho=0.348$ ,  $p=0.001$ ). The average score for self-efficacy was a 3.5 on a scale of 1-5, and the average medication adherence score was a 2.6 on a scale of 1-4. Gaining a better understanding of this population will assist with further research interventions for HTN.

**Dynamic Morphological as Diagnostic Modality for Cancer using Aptamer Functionalized Chips**

Presenter: Mohammed Mahmood, Electrical Engineering Graduate

10:20 AM, Concho

Mentor(s): Samir M. Iqbal

Group members: Mohammad Raziul Hasan

**Abstract:**

Tumor cells express multiple types of signatory receptors on their membranes. Epidermal growth factor receptor (EGFR) is also one such overexpressed protein. The capture and analysis of human glioblastoma (hGBM) cells was done on glass chips functionalized with EGFR-specific RNA aptamer molecules. In contrast to the healthy cells, the EGFR overexpressing tumor cells showed distinct changes in cell shapes. They formed into spherical to semi-elliptical shapes, depicted flatter spread covering larger surface area, formed greater number of pseudopods and showed enhanced and rapid variations in shapes when incubated on the aptamer surface. The quantitative image analysis of cell behavior on functionalized surfaces provided feature vectors that are statistically distinct between normal and cancer cells. The balancing forces between the aptamers and the receptors caused cells to show distinct dynamic activities and variation in their morphology. This is a promising trait to distinguish cancer cells from normal ones. The cancer cell behavior was quantified, when compared to healthy counterparts, in terms of their shape changes with time, non-uniformity in their contour, and enhanced frequency in the formation of pseudopods. A computational approach was developed to quantify these traits. The system has the potential to serve as an additional modality to support histological findings and to identify tumor cells based on their physical behavior.

**Gene Duplication in Mitochondrial Genomes**

Presenter: Jose Maldonado, Biology Senior

1:20 PM, San Jacinto

Mentor(s): Matthew Fujita

Group members: Bandita Adhikari

**Abstract:**

Animal mitochondrial genomes are invariably compact (~15 kilobases in length), perhaps due to selection pressure to maintain an efficient genome. Having a smaller mitochondrial genome reduces the time and energy it takes to replicate. Parthenogenetic lizards, however, have large tandem duplications, making their mitochondrial genomes some of the largest in vertebrates. My research aims to use parthenogenetic whiptail lizard to determine how these duplications originated, what gene are involved, and how they are evolving. Using next-generation sequencing technology, I sequenced 30 complete mitochondrial genomes from whiptail lizards by employing a newly developed protocol that avoids many of the pitfalls of traditional, PCR-based methods. Using a bioinformatics pipeline, I have assembled and annotated all of the genomes sequenced thus far. My preliminary results indicate that parthenogenetic lizards are all related to each other based on the mitochondrial genome sequences. Once additional genomes are sequenced, I will employ molecular evolutionary tools and theory to investigate how the duplications evolve.

### **Design principles for high-performance nano-structured thin-film bandpass filters**

Presenter: Manoj Niraula, Electrical Engineering Graduate

Poster board: 36

Mentor(s): Robert Magnusson

Group members: Dr. Jae Woong Yoon

#### **Abstract:**

The guided-mode resonance (GMR) effect is an optical phenomenon where trapped light in nano-patterned thin-films couples with unbounded light fields. This unique coupling is the functional basis of GMR bandpass filters with high peak efficiency and low, flat sidebands. Realizing these low-transmission sidebands is a challenging problem because the dielectric thin films used in these bandpass filters are generally transparent in nature. Previously, the working principle of a GMR bandpass filter was understood as a collaboration between two resonances; a broad resonance provides the low, flat transmission sidebands, and a sharp resonance provides the narrow transmission peak within the flat sidebands. Our research focuses on theoretical identification and characterization of the trapped light, i.e., resonant modes in three distinct classes of GMR bandpass filters: single-layer, two-layer and three-layer devices. We conducted the modal analysis by computing and analyzing the field strengths at different locations along the optical response spectra of these devices. Our study reveals that different classes of bandpass filters exhibit different mode and coupling configurations at the low sidebands and at the transmission peak. Another interesting find in our study is that the device parameters - grating depth, grating period, and film thickness - play a vital role in determining the major performance parameters such as transmission peak location, linewidth, efficiency, and side bandwidth. Our findings deepen the physical understanding of GMR bandpass filter operation and provide an excellent roadmap for their design with desired performance parameters.

*This research was supported in part by National Science Foundation Grant No. ECCS-0925774.*

### **Detection of Metastatic Breast Cancer Cells for Early Diagnosis and Metastatic Determination**

Presenter: Nuzhat Mansur, Electrical Engineering Graduate

9:20 AM, Concho

Mentor(s): Samir M. Iqbal

Group members: Y. Kim, S. M. Iqbal

#### **Abstract:**

The spread of cancer to other organs is called metastasis. Cancer cells are shed into bloodstream by primary tumors and these form secondary tumors. Early detection of these cells can lead to better prognosis and survival rate. In case of breast cancer, it is also important to know whether these circulating tumor cells are metastatic or not, as most deaths of breast cancer patients occur from metastasis. We have developed an approach to differentiate between metastatic and non-metastatic breast cancer cells using anti-EGFR aptamer modified glass surfaces. Anti-EGFR aptamer is an RNA molecule that binds selectively to epidermal growth factor receptors (EGFR), which are overexpressed on tumor cells. Both metastatic and non-metastatic cells were captured on anti-EGFR aptamer modified glass surfaces. Due to higher EGFR expression, the metastatic cells were attached more than the non-metastatic ones. After binding with the surface, the metastatic cells showed prominent morphological changes whereas the non-metastatic cells did not show such behavior. Metastatic cell membrane showed pseudopods that changed their shape, surface coverage and position after attachment. To test the effectiveness of the anti-EGFR aptamer, metastatic and non-metastatic cells were exposed on aptamers that were non-specific to EGFR. Neither type of cells got attached. Around 77% metastatic cells attached with anti-EGFR aptamer showed pseudopodial activity whereas 99% metastatic cells attached with non-specific aptamer and 100% non-metastatic cells attached with either type of aptamer remained inactive. This finding can be used for early detection of metastatic cancer and also for monitoring recurrence after treatment.

**Going Against The “Old Ways:” The Evolvement of Italian American Women’s Agency**

Presenter: Monica Marchi, English Graduate

11:20 AM, Neches

Mentor(s): William Arce

**Abstract:**

With this paper, I analyzed the evolution of Italian American women in the United States, in particular how their agency changed and led to the assimilation of Italians into mainstream America. I have used female characters in five books (Christ in Concrete, Mount Allegro, Umbertina, Memoirs of a Beatnik, The Right Thing To Do) written by Italians and Italian Americans. At the beginning of 20th century, the “old ways” were the law of the land in many Italian families, and when children were taken to the USA or were born on American soil, the rules of the game changed. Thus, this second generation was torn between a family that still held on to values that belonged to another time and another country, but also a family that pushed its children to be American, sending very mixed and confusing messages. Because of this opposition and this confusion, the Italian American women rebelled against the status quo and used this “rebellion” to create another identity that was American but that at the same time Italian. The purpose of this paper was to analyze how Italian women began gaining control of their own destiny in rebelling against some of the “old ways” but how they were still able to hold on to some of the values that held together the Italian family and community. My discussion of this evolvement will have significant applications in Italian American studies as well as in feminist studies.

**Dynamic stability against backward loss of balance while walking over an obstacle in the elderly compared to young subjects**

Presenter: Wendy Martinez, Kinesiology Senior

Poster board: 121

Mentor(s): Mark D. Ricard

Group members: Christopher T. Ray, Mark D. Ricard

**Abstract:**

Every year one in every three adults age 65 and older falls, leading to hospitalization and consequently, exacts a great cost to both the individuals and the healthcare system. The purpose of this study was to compare the dynamic stability against backward loss of balance while walking over an obstacle in elderly and young subjects. Stability in static situations is achieved when the vertical projection of the center of mass is within the base of support. In dynamic situations, however, an extension of this rule is proposed using an inverted pendulum model, taking into account the extrapolated center of mass. Five young subjects (age  $24.8 \pm 4.2$  years, height  $177.8 \pm 9.7$ , mass  $74.0 \pm 14.2$  kg) and seven elderly subjects (age  $74.7 \pm 7.7$ , height  $174.2 \pm 6.7$ , mass  $82.3 \pm 15.5$  kg) were asked to walk over an obstacle, 10 trials each. The model was derived from a 14 segment full-body kinematic (120 Hz) and kinetic (1080 Hz) data set. Data were collected using a Vicon Motion Capture System (120 Hz). There was no significant difference in backward stability between older ( $297.9 \pm 32.5$  kg·mm/s) and younger adults ( $291.1 \pm 65.6$  kg·mm/s),  $p > 0.05$ . Conversely, the elderly walked with a smaller backward angle and at a slower velocity than the young subjects,  $p < 0.05$ . Although there was no significant difference in backward stability between elderly and young, the inverted pendulum model demonstrates other significant factors like postural angles and velocity differences.

**The Psychological Reality of Stems in Cherokee and the Effect on Dictionary Creation**

Presenter: Nicholas Matthews, Linguistics Senior

Poster board: 123

Mentor(s): Colleen Fitzgerald

**Abstract:**

Cherokee is an endangered Native American language spoken by about 20,000 people, and characterized by complicated verb forms that impede the creation of a simple, easy-to-use dictionary. Using existing Cherokee sources, I developed a prototype for a different dictionary approach with enhanced usability.

Cherokee verbs are challenging because one word expresses a sentence. The sentence 'gaʔluhgoʔi' 'he arrives' is a single word; a verb root plus the affixes needed to make it a word. In contrast, English has 'arrive' as both a root and an independent word. Cherokee verb roots, however, never occur as independent words. Looking up 'go' in a Cherokee dictionary might show the Cherokee root (which never occurs unaffixed in speech) or give the root plus affixes (an occurring word). Problematically, verb roots in Cherokee lack 'real' (psychological) status for native speakers.

I show how conjugated Cherokee verbs, rather than roots, can provide a basis for constructing easy-to-use language resources. Using Feeling's Cherokee-English dictionary (1975), I chose several verbs to use as a basis for the project. Comparing these with other resources in Cherokee, I used the common approaches to standardize dictionary listings for Cherokee verbs.

By drawing on the differences of Cherokee verbs with English, I've developed a usable dictionary, searchable in both languages with definitions and basic additional information. Creating a simplified, easily accessible dictionary entry for Cherokee means users can find actually occurring words-and sentences-in their language. Such resources facilitate the revitalization of an endangered language and encourage Cherokee language learning.

**A preliminary phylogeny of the Palearctic naked-toed geckos (Reptilia: Squamata: Gekkonidae) with taxonomic implications**

Presenter: James Mcquillan, Biology Graduate

1:40 PM, Palo Pinto

Mentor(s): Matthew Fujita

Group members: Dr. Aaron Bauer, Dr. Todd Jackman

**Abstract:**

Palearctic naked-toed geckos are a group of gekkonid geckos that range from North Africa to northern India and western China, with their greatest diversity in Iran and Pakistan. Relationships among the constituent genera remain unresolved and the monophyly of key genera remains unverified. Competing classifications are in current use and many species have been allocated to different genera by different authors. We used both mitochondrial and nuclear genes to explore relationships among representatives in the group. *Siwaligekko* are more closely related to tropical Asian *Cyrtodactylus* than to Palearctic naked-toed geckos. *Asiocolotes* and *Altigekko* are sister taxa and here considered junior synonyms of *Altiphylax*. *Cyrtopodion sensu lato* is non-monophyletic; *Mediodactylus* and *Tenuidactylus* are both valid genera. *Indogekko* is embedded within *Cyrtopodion* and is here treated as a subgenus. *Bunopus* and *Crossobamon* are closely related to one-another with *Agamura* interdigitated among taxa previously assigned to *Cyrtopodion*. Our data confirm the previous identification of a Saharo-Arabian clade and verify that *Microgecko* and *Alsophylax* are not members of the main clade of Palearctic naked-toed geckos. The divergence between *Cyrtodactylus* and the Palearctic naked-toed clade predates the initial collision of the Indian and Eurasian plates, but deeper divergences within both groups are consistent with mountain building in the Himalayas and adjacent ranges as cladogenic events. Miocene divergences within *Tenuidactylus* are consistent with vicariant speciation caused by uplift events in the Iranian and Transcaspien regions. Taxonomic implications of our phylogenetic results are a preliminary allocation of all species of padless Palearctic gekkonids to genera is provided.

*This work was supported in part by the National Science Foundation*

# ACES Symposium 2014

## Presenter Abstract by Discipline

### **Kinetic Mechanisms of Mutation-dependent Harvey Ras Activation and Their Relevance for Development of Costello Syndrome**

Presenter: Michael Wey, Chemistry Graduate

Poster board: 37

Mentor(s): Jonyung Heo

Group members: Jungwoon Lee, Soon Seog Jeong, Jungho Kim

#### **Abstract:**

Costello syndrome is a rare genetic disorder linked to mutations in Harvey Ras (HRas), a cellular signal transduction protein that functions by cycling between inactive GDP-bound and active GTP-bound states. HRas plays a major role in cell growth, differentiation and survival. As a result, mutations in HRas often produce abnormally active HRas leading to diseases such as cancer. More than 10 HRas mutations which induce Costello syndrome have been identified, however, there are mutations linked to both Costello syndrome as well as cancer formation. The relationship between the mutation-mediated population of active HRas and Costello syndrome is unknown. To understand the relationship between HRas mutations, the effect which they have on cellular populations of active HRas and diseases connected to them, kinetic studies are necessary.

This study established novel kinetic parameter-based equations that estimate the value of the cellular fractions of active HRas mutant proteins. Such calculations differentiate between two basic kinetic mechanisms that populate the active form of HRas in cells. (i) The increase in active HRas by the mutation-mediated perturbation of its intrinsic kinetic characteristics. This generates a broad spectrum population of active HRas that typically causes Costello syndrome. (ii) The increase in active HRas because the mutations perturb the catalytic action of regulator proteins on Ras. This causes production of a significantly high population of active HRas linked only to cancer formation.

*This work was supported by National Institutes of Health Grant 1R15AI096146-01A1.*

### **Izztaccihuatl Tlakuikatl (Song of Izztaccihuatl)**

Presenter: Nicolas Miranda, Music Senior

1:00 PM, Guadalupe

Mentor(s): George Chave

Group members: Jessica Ramirez, Jonathan Wilson (performers).

#### **Abstract:**

The focus of my project is to compose a vocal work of music depicting one of the folk legends of the Nahuatl/Aztec (Nahuatl-Speaking) people of Central Mexico. This vocal work has been written in English and translated to the Huasteca Dialect of Nahuatl.

The myth is as follows: In the time of the Aztecs, the Tlaxcaltecas, were in bitter feud with the Aztec regime. The King of Tlaxcala requested help from a brave young warrior named Popocatepetl he also offered Iztaccihuatl's hand in marriage. Popocatepetl and Iztaccihuatl had been secretly in love for many years, so Popocatepetl immediately took up arms and traveled to Oaxaca to fight against the Aztec.

In an attempt to sabotage their love; false news of his death were sent back to the King, and when Iztaccihuatl heard this she died days later of grief. When Popocatepetl returned victorious in battle, he found his beloved lifeless. Consequently Popocatepetl took Iztaccihuatl's body to a spot outside of Tenochtitlan and knelt beside it. In reverence, the Gods covered them in snow until they became mountains.

My goal with these pieces is to preserve ancient indigenous myths through a medium in which stories could be told from several angles and with different variations. These folk tales were passed down mostly orally, some written down, thus there are many different versions, many are in danger of disappearing. The value of these myths is in the cultural heritage of the indigenous people of Mesoamerica and their descendants.

# ACES Symposium 2014

## Presenter Abstract by Discipline

### **Santa Muerte: The Saint of Second Chances**

Presenter: Litza Molina, Modern Languages Senior

Mentor(s): Christopher Conway

**11:00 AM, Guadalupe**

#### **Abstract:**

Santa Muerte or Sacred Death, is a growing cult that is not only being practiced in Mexico, but crossing borders and spreading to the United States producing new devotees every day. Santa Muerte's form, a skeletal female covered with different colored cloaks, can be found by devotees on statues, jewelry, votive candles, and prayer cards. Her believers come from a diverse background many considering themselves "the forgotten", these are generally the underclass, the foreigners, the murders, the homosexuals, or any person thinking they have been defeated or is looking for protection. In recent news Santa Muerte has caught the public's eye, including the Catholic Church, the Mexican government, and the FBI's because shrines dedicated to her have been found in Mexican drug cartel homes. These shrines have not only been found in drug cartel homes, but also in violent murders, leaving some to believe these murders are being performed as sacrifices to Santa Muerte. I argue that Santa Muerte is not behind the increase in drug cartel problems that have been affecting both borders. I discuss how more than two million believers come to her for love, money, health, or work. Sinners, yes, but not murders, thieves, or drug lords who sacrifice in her name.

### **Concrete Fabric Facade**

Presenter: Matt Morris, Architecture Graduate

Mentor(s): Brad Bell

Group members: Eddie Castaneda, Bryan Nors, Donovan Howard

**Poster board: 38**

#### **Abstract:**

Concrete Fabric Facade

A recent material innovation called Canvas Concrete or Canvas Cloth, is a concrete-impregnated fabric currently used for civil and military applications. It's anatomy as a fabric allows it to take nearly any shape and after water saturation hardens permanently. This presents an interesting opportunity to be used in an architectural application. Our research is an investigation of the material properties of canvas concrete to create a facade screen that parametrically responds to solar and programmatic conditions. Geometry, application, and performance are the primary veins of exploration. The utilization of parametric control within the scope of this investigation has been such to optimize the annual energy consumption of two rooms, along a south facing facade, in Dallas/Fort Worth by analyzing various configurations of a facade screen system responsible for the shading of the rooms in at the specified longitude and latitude. Optimization of the HVAC system loads is achieved by minimization of direct solar/thermal gain through the curtain wall system by variation in the composition of the facade screen system. If implemented across a facade the solar shading device would not only provide demonstrable solar mitigation, but would also render a novel facade quality of 'structural fabric' capable of both durability and moderate load transfer.

*Sponsored by the Digital Fabrication Consortium at UTA*

**The Relationship Between Family and Friend Social Support on Balance in Older Adults**

Presenter: Kamiah Moss, Kinesiology Graduate

Poster board: 39

Mentor(s): Christopher Ray

Group members: Ketaki Deo

**Abstract:**

*Previous research indicates that fall risk can decrease if older adults engage in regular moderate physical activity. Social support from family and friends could attribute to the likelihood that individuals will exercise regularly and see overall improvements in fitness. However, the effect of social support on these outcomes has not been well studied. The purpose of this study was to examine the relationship between social support from family and friends on balance improvements in older adults. Thirty-one participants of the Center of Healthy Living and Longevity at UTA participated in this study. Each participant completed the Social Support Exercise Survey, Revised Cheek and Buss Shyness Scale (RCBS), and the Senior Fitness Test before and after the twelve week exercise intervention. The participants' balance was assessed using the Sensory Organization Test (SOT) on the NeuroCom EquiTest before and after the intervention. During each exercise session attendance was taken. There was a marginally significant negative relationship between the participants change in shyness and their mean attendance percentage. There was also a relationship between change in exercise related family punishment and change in performance on the two-minute step test. Also, there was a relationship between the change in friendship reward for exercise and change in visual scores on the SOT; as well as for the change in peripheral balance. The results of this study indicate that social support from family and friends can affect factors dealing with individual's overall fitness. Social factors should be considered when designing an exercise program for older adults.*

**Debye Effects from Adjacent Nanopores towards High Throughput Analysis of Biological Molecules**

Presenter: Muhammad Usman Raza, Electrical Engineering Graduate

9:40 AM, Concho

Mentor(s): Samir M. Iqbal

Group members: Sajid Saleem, Waqas Ali

**Abstract:**

Solid-state nanopore biosensors have emerged as the most promising biosensors for individual biomolecule detection of DNA, RNA and proteins. These can be selectively detected at very low concentrations for early disease diagnosis. Solid-state nanopore biosensors promise early disease diagnosis such as cancer which can become the difference between life and death. However, the recurring problem with these single nanopore sensors has been low throughput and lack of ability to detect multiple disease biomolecules at the same time. Hence, the major challenge has been to place multiple nanopores on one membrane, where each nanopore may be functionalized to selectively detect different biomolecules. With multiple nanopores on a chip, metal electrodes are placed besides the mouth of each nanopore for selective biomolecule detection from that nanopore. However, multiple nanopores on a chip lead to electronic and electrostatic interference that may stem from adjacent nanopores. We have modeled the effect of electrolyte ions that move when subjected to an external bias. This bias leads to build up of nanopore electric field that if not controlled properly may result in false positives. So, the electric potential should drop by a value that is at least -3 dB less than that at the mouth of the nanopore. This will result in the electrodes detecting true value biomolecule signature. The model has been extended further also. Finally, if multiple biomolecules are detected specifically in high throughput by this manner then these multi nanopore biosensors can be the lifesaving agent for the diseases of today, tomorrow.

**Covalent Expression of Organic Moieties on Silicon Carbide Quantum Dots**

Presenter: Munuve Mwanja, Chemistry Graduate

1:00 PM, Pedernales

Mentor(s): Peter Kroll

**Abstract:**

Silicon carbide (SiC) quantum dots (QDs: particles with a size of 1-10 nm, where 1 nm =  $1 \times 10^{-9}$  meters) are candidates for applications ranging from nanoelectronics to energy conversion. Most of these require application-specific SiC QDs with tailor made properties. One problem to solve is that the QDs tend to form agglomerates and hence don't disperse well in aqueous and organic solvents. It is therefore imperative to modify the surface of SiC QDS with the right functional groups.

In this talk we describe fabrication of SiC QDs (< 10 nm) from bulk powders (> 50 nm) and slurries through photo-assisted electrochemical corrosion. We show that the process (hence, the amount of QDs synthesized as well as their sizes) can be controlled via regulating time and temperature. Transmission electron microscopy (TEM) and photoluminescence confirm this.

We also present a simple protocol for reliably tailoring the surfaces of the SiC QDs. We begin by covalently attaching primary amines (-NH<sub>2</sub>) to the QD surface. The amine terminations are then converted to amine/carboxylate (-NH<sub>2</sub>/COOH), amine/phosphonate (-NH<sub>2</sub>/PO<sub>2</sub>CH<sub>3</sub>), and amine/thiolate (-NH<sub>2</sub>/SH) functional groups. The presence of amine groups is confirmed by fluoresceamine assay measurement, X-ray photoelectron spectroscopy (XPS) and infrared spectroscopy (FTIR). While a negative fluoresceamine assay test confirmed the replacement of amine groups by thiol groups, the thiolation of the surface was also confirmed through Ellman's assay, XPS and FTIR. Our results open up possibilities to manipulate SiC QDs for various applications.

**Influence of variation in CPU utilization on the Rack Level fan configuration as a cooling technique for high end servers**

Presenter: Shreyas Nagaraj, Mechanical & Aerospace Engineering Graduate

1:20 PM, Red River

Mentor(s): Dereje Agonafer

Group members: John Fernandes, Richard Eiland

**Abstract:**

The data center industry has experienced significant growth over the past decade with the introduction and explosion of online banking, social networking and entertainment services. As a result, power consumption of such facilities continues to grow at a rapid pace. It has become imperative that energy savings and efficiencies be pursued in these components at various levels within the data center facility. This project aims to achieve the same by replacing internal server fans with larger, more-efficient fan units at the rear face of the rack. This study will be conducted by using a cluster of 1.5U Intel based Open Compute servers.

With the introduction of higher fan diameters at the rack, the fans will be characterized experimentally for its flow impedance, air flow rate, and its effect on die temperature and power consumption for various utilization levels. Since the utilization of the servers is not the same throughout the rack, it becomes important to study the impact on the server components. The experimental methods utilized in the new rack design configuration will be then compared with the existing chassis fan configuration determining the performance of the proposed system. This study will be used to establish guidelines between server or rack level deployment based on the utilization the servers are running at the stack. Thus conclusively, this study shall demonstrate the use of larger fans over server level fans, which shall save cooling power at the server level and rack level.

**A Combination of Biological and Analytical Methods to Pursue Elusive Medicinal Compounds from Natural Products**

Presenter: Yashaswini Nagarajan, Biology Freshman

Poster board: 122

Mentor(s): Kevin A. Schug

Group members: Yu-sheng Sung; Evelyn Wang; Lucie Hartmanova; Maria Bautista; Joshua Beachletendre; Laura D. Mydlarz; Frank W. Foss, Jr.; Richard D. Timmons; Kevin A. Schug

**Abstract:**

Fatal and infectious human bacteria are continually building resistance to current antibiotics; therefore, new antibiotics must be discovered. Using natural products from folk medicine with previously suggested antibacterial activity is hypothesized to increase the hit-rate when searching for new antibiotics.

The chemical complexity of a natural product extract poses a problem in isolating and identifying the active compound. A new mass spectrometry technique featuring *L*-Lysine-*D*-Alanine-*D*-Alanine (Kaa) tripeptide functionalized screen helps address this problem by selectively binding to the active compound for direct detection. Kaa mimics a part of the Gram positive bacteria cell wall that binds to antibiotics like Vancomycin. Asafoetida (a plant material used in Indian cuisine) and pepper extracts were shown to contain compounds of interest using the Kaa-functionalized screen and mass spectrometry. To confirm the capture of active compounds, bioassays against *E. faecalis* bacteria in the form of disk diffusion and optical density screening were conducted; however, the activity was observed, the complex nature of the extracts affected the precision of the bioassays. Therefore, solid phase extraction was used to fractionate the complex extracts, further isolating the active compounds to obtain more precise results of the bioassay.

The success of this project means that active compounds from natural products can be identified, confirmed, and extracted through a mass spectrometry-based analytical technique. This would greatly aid the discovery of new drug leads from complex mixtures. In addition, the active compounds detected in Asafoetida, pepper, and ginger could be the source of a new antibiotic in the future.

**Text Analysis of Social Development as a Concept**

Presenter: Shamsun Nahar, Social Work Graduate

3:20 PM, San Saba

Mentor(s): Vijayan K. Pillai

**Abstract:**

Theory of social development is composed of an amalgam of several interrelated and independent theories, such as representation, explanatory, and normative theories. Objective of this study is to contribute to the representational theories of social development by examining the contextual variations that characterize the discourse of development in published scholarly journals. Applying the text analysis method in all abstracts (N=707) of the journal of Social Development Issues (SDI) which is one of the prominent international journals where social development is analyzed from international and interdisciplinary perspectives, this study explores the associated terms of social development, their frequencies, and terms which are and are not con-centered to the terms of "social" or "development". Top three of the most frequent concepts are "social", "development", and "work" which have frequencies of 1070, 736, and 360 respectively. The terms strongly associated with "social" and "development" are "policy", "support", "analyze", "child", "concept", "approach", "culture", "context", "political", "conflict", and "impact". All the associated terms closely related to social development focus on various types of interventions, for example, psychological, feminist, communitarian, ecological, individualist-enterprise, and institutional. Results of this study manifest a remarkable diversity of the terms in social development that can help future researchers create conceptual images of social development theory.

# ACES Symposium 2014

## Presenter Abstract by Discipline

### **Influence of Nutrient Concentration on EPS Production and Biofilm Growth**

Presenter: Mouhamed Nashawi, Biology Senior

Poster board: 118

Mentor(s): Hristo Kojouharov

Group members: Kristen Masha, Amsal Chagani, Isheanesu Nyangani

#### **Abstract:**

Although the majority of our lives is spent interacting with living things such as loved ones or pets, the microscopic aspects of life, especially bacteria, are just as important. Research in bacterial behavior has implications in medicine. A phenomenon commonly observed in bacterial species is the formation of biofilms, aggregates of bacteria that are kept intact by a biological "goo" known formally as EPS (extracellular polymeric substances). Bacteria aggregate when under stress, which includes any properties of the local environment that pose a potential threat to the bacteria, such as adverse temperature or chemical contents. Bacterial life cycles have complex inputs and outputs, just like ours. Using mathematics as a tool to quantify these inputs and outputs, we can analyze a biofilm and understand bacterial behavior that would not have been apparent by superficial analysis alone. The primary goal of our work was to mathematically model the behavior of bacteria in a vegetative state and a biofilm state, under different nutrient inputs. Our results concluded that lower supplies of nutrient encourages the formation of biofilms and EPS, which confirms the notion that EPS is a stress response of the bacteria. Based on our results, we can better understand how bacteria function. The results of this experiment have possible implications in many applications. One possible innovation in better understanding the tendencies of bacteria through biofilm formation patterns is the controlled engineering of biofilms in a laboratory setting, through which model antibiotics that have not undergone FDA approval can be tested.

*This group project was supported by the National Science Foundation, Interdisciplinary Training for undergraduates in Biological and Mathematical Sciences (UBM).*

### **Flash Flood Inundation Mapping for the City of Fort Worth**

Presenter: Behzad Nazari, Civil Engineering Graduate

1:40 PM, Concho

Mentor(s): Dong-Jun Seo

#### **Abstract:**

As the population of municipal areas is increasing, and due to the high volume of paved area constructed in these areas that expedite the movement of runoff, decision makers are becoming more concerned about the consequences of flash floods and the resulting inundation. To provide enough information to emergency managers and to the public, timely and skillful real-time prediction of inundation extent is necessary. Inundation mapping in urban areas, however, is particularly challenging due to the large number of buildings, storm drains, culverts, channels, storage ponds and other features. Large, highly populated urban areas such as the Dallas-Fort Worth Metroplex (DFW) may be particularly vulnerable to the integrated effects of these features following very heavy rainfalls.

In this work, the sensitivity of inundation mapping to the scale and the depth of hydrologic and hydraulic details to be modeled is analyzed. This is important because if a model is extremely detailed, the computational time may end up being longer than the lead time helpful for real time forecasting whereas overly simplified models lack the required accuracy.

The results show that conservatively ignoring storm drainage pipes of smaller than a certain size can be in favor of computational time without a significant loss in the accuracy of the predictions. However, the subcatchments shouldn't be modeled large or the predictions will be fundamentally inaccurate. These findings are beneficial in future urban flood modeling efforts in addition to risk analyses involved in forecasting flash floods in large municipal areas.

# ACES Symposium 2014

## Presenter Abstract by Discipline

### **Automatic User Feedback System for Reviewing Web Items**

Presenter: Azade Nazi, Computer Science Engineering Graduate

8:00 AM, Red River

Mentor(s): Gautam Das

#### **Abstract:**

The growing widespread use of online review sites like Yelp, Epinion, and Angie's List, etc. over the past decade have motivated businesses of all types to possess an expansive arsenal of user feedback (preferably positive) to mark their reputation and presence in the Web. User feedback is available in various forms such as star ratings, number of visits, number of Facebook likes, tags, reviews, etc. Though a significant proportion of purchasing decisions today are driven by the average rating (e.g., a movie in IMDB), detailed reviews continue to influence a wide variety of critical activities such as buying an expensive digital SLR camera, buying a powerful laptop, reserving a vacation package, etc. However, since writing a detailed review for a product (or, a service) is usually time-consuming and may not offer any incentive, the number of useful reviews available is not many. According to survey conducted by Pew Internet in 2012, though 90% people conduct online product research, only 37% people have rated a product, service, etc. and only 32% have posted a comment or review online. The corpus of reviews available at our disposal for making informed decisions suffers from spam and misleading content, typographical and grammatical errors too. In this paper, we consider the novel problem of automating the online review writing to deal with the issues associated with the process. Given a user and an item, the task is to identify a set of meaningful phrases or keywords to help her review the item effectively.

### **The continuous study of the 30 cm x 30 cm gas electron multiplier detector**

Presenter: Ying Wun Yvonne Ng, Physics Senior

3:20 PM, San Jacinto

Mentor(s): Jaehoon Yu

Group members: Seongtae Park, Andy White

#### **Abstract:**

High energy physics is a subfield in physics that strive to study the fundamental constituents of matter and the forces between them. Experimentally, study of these fundamental particles requires a high energy level that can only be achieved by particle accelerators. In these particle accelerators, particles' energy and paths are studied. Therefore, tracking devices and their corresponding readout instrument, capable of providing an accurate measurements of the energy level of the particles, is of utmost importance to the success of an experiment. The advance detector group of University of Texas at Arlington has begun its study on a particle and radiation detector technology called the gas electron multiplier (GEM) since early 2000's. The detector utilizes the electron avalanche effect to multiply incoming cosmic ray particles and radioactive source signal. In the past 2 years, the long-term behavior of a 30cm x 30 prototype detector has been studied. Methods are adopted to compensate for effect of atmospheric pressure on the detector and noise signals are studied and eliminated from the data. Result of this study shows that the multiplication power of the detector was highly stable over a long period of time with few fC of noise. The research shows that GEM technology is a good candidate to serve as the sensitive gap detector for a calorimeter in future experiments.

**Enhancement of Implantable Neurotransmitter Sensors Using Encapsulated Biodegradable Materials**

Presenter: Cuong Nguyen, Electrical Engineering Graduate

10:40 AM, Concho

Mentor(s): Jung-Chih Chiao

**Abstract:**

Parkinson's disease, depression, addiction, chronic pain and many other neurological disorders have been found to associate with the release and uptake of neurotransmitters in the mammalian central nervous system (CNS). As one of the major excitatory neurotransmitters, L-glutamate is widely studied in neuroscience to understand its relation to these neurological disorders. *In vivo* implantable multi-array electrode (MAE) probe provides a means to spatially and temporally monitor CNS L-glutamate concentration. Nevertheless, the insertion of the stiff probes to the sensing sites could damage tissue in the brain or spinal cord. The injuries could become more severe after insertion in long-term experiments due to mechanical strains and micromotion of the brain. The ultimate goal of this research is to fabricate an ultra-flexible and implantable neurotransmitter sensor to monitor the concentration of L-glutamate. Micro-electro-mechanical system processes are utilized to mass produce the MAE probes. Each probe including five functionalized microelectrodes with a size of  $50 \times 100 \mu\text{m}^2$  was fabricated on a 10- $\mu\text{m}$  thick Parylene-C substrate. The probe was subsequently encapsulated with poly-vinylpyrrolidone (PVP), a biodegradable material to enhance stiffness for insertion. The penetrability of the probe was demonstrated by the experiment to insert the sensor into a rat brain. An *in vitro* study showed that the encapsulated PVP layer degraded to expose the sensing electrodes after 5 hours in a 0.01 M phosphate buffered saline solution. The results demonstrate that the encapsulated PVP layer not only improved stiffness of the probe for insertion, but also fast dissolved away after insertion.

**pH-responsive Biodegradable Photoluminescent Nanoparticles for Lung Cancer Treatment**

Presenter: Dat Nguyen, Biomedical Engineering Graduate

Poster board: 40

Mentor(s): Kytai T. Nguyen

Group members: Jyothi U. Menon

**Abstract:**

Among many types of cancer, lung cancer remains one of the highest incidences worldwide. Current cancer therapies such as chemotherapy still consist of several limitations, including severe side effects of anticancer drugs affecting healthy cells. Hence, the need for a safer and target-specific drug delivery system continues to drive research to find a more effective treatment. Here we synthesize pH-responsive, biodegradable photoluminescent nanoparticles for controlled drug delivery and imaging applications using biodegradable photoluminescent polymer (BPLP) with sodium bicarbonate (SBC) as porogens. Initial characterization shows that BPLP-SBC particles are uniformly distributed in size with average diameter below 250 nm. Particles stability study shows minor size fluctuation for up to 4 days when tested in both media and water, suggesting nanoparticles might not aggregate if they are used for systemic administration. Nanoparticles exhibit identical fluorescent intensity when dissolved in different pH solutions, confirming photoluminescence of BPLP-SBC for optical imaging. When loaded with bovine serum albumin (BSA) as a hydrophilic biomolecule model, results show a pH-dependent BSA release profile up to 21 days with higher release at a higher concentration of SBC. In cell toxicity studies, AT1 healthy lung cells incubated with BPLP-SBC nanoparticles see more than 80% viability with particle concentration up to 100  $\mu\text{g}/\text{ml}$  for 24 hours. An increased uptake of particles by A549 lung cancer cells with concentrations was also observed, indicating dose-dependent particle uptake by cancer cells. These preliminary results indicate the potential of BPLP-SBC nanoparticles as a drug carrier and bioimaging system for lung cancer treatment.

**Peripheral Nerve Guidance Using Muscle and Skin Targets for Neural Interfacing**

Presenter: Dianna H. Nguyen, Biology Senior

9:40 AM, San Jacinto

Mentor(s): Mario Romero-Ortega

Group members: Sanjay Anand, Srikanth Vasudevan, Vidhi Desai, Jonathan Cheng, Edward Keefer, Mario Romero-Ortega

**Abstract:**

With approximately 2 million people in the US currently suffering from limb loss, there is a great initiative toward neural prosthesis development. While advanced prosthetics closely resemble and mimic the human hand, providing natural control and feel for such devices have not been achieved. We developed a regenerative multi-electrode interface (REMI) capable of recording neural activity from peripheral nerves. However, most nerves contain mixed-modality fibers (i.e., motor, nociceptors for pain, thermoreceptors for heat, mechanoreceptors for touch, and proprioceptors for limb position) and identifying the nature of the interfaced axons and achieving specific sensory stimulation remains a challenge. Therefore, we compartmentalized the path of nerve regeneration in order to achieve modality-specific interfacing. We fabricated a "Y"-shaped polyurethane tube that placed the mixed sciatic nerve at one end, and guided its regeneration into separate compartments by attaching natural targets of muscle and glabrous skin at the ends of the Y-arms. The accuracy of segregation was evaluated 45 days post-implantation by retrograde tract-tracing from both ends of the Y-tube using Fluoro-Gold dye. Regenerated axons successfully reached the targets in both Y-arms as demonstrated by traced neurons in the dorsal root ganglion and the ventral spinal cord. The results also suggest surrogate muscle targets can attract an increased number of regenerated motor neurons compared to skin; supporting the notion that compartmentalization of nerve regeneration using surrogate natural tissue targets is feasible.

*This work was sponsored by the Defense Advanced Research Projects Agency (DARPA) Microsystems Technology Office (MTO), under the auspices of Dr. Jack W. Judy (jack.judy@darpa.mil) as part of the Reliable Neural Technology Program, through the Space and Naval Warfare Systems Command (SPAWAR) Systems Center (SSC) Pacific grant No. N66001-11-C-4168.*

**Evaluation of HMP-Kinase Analogs, A New Strategy for Antibiotics**

Presenter: Jessica Nguyen, Chemistry Senior

Poster board: 104

Mentor(s): Frank W. Foss Jr.

Group members: Diego Lopez, Sumit Bhawal

**Abstract:**

Current bacterial chemotherapy faces reduced effectiveness due to elevated drug resistance resulting in high clinical demands for new antibiotics. Vitamin pathways offer a promising area for antimicrobials due to their function in bacterial metabolism. HMP-Kinase is a key enzyme in the thiamin (Vitamin B1) pathway that plays a vital role in the survival of many antibiotic-resistant bacteria. By manipulating different positions of the natural substrate HMP, analogues can be synthesized and tested for substrate turnover. Both *in vivo* and *in vitro* studies have been carried out by bacterial growth and luminescence, respectively. Furthermore, computational models have aided for the analysis and synthesis of further HMP mimics. Determining the substrate scope of the kinase will provide the best pharmacophore for a pro-drug discovery approach.

**Deducing Structural Details in Silicon Oxycarbide from 29-Si Nuclear Mass Resonance Spectroscopy**

Presenter: John P. Nimmo II, Chemistry Graduate

1:20 PM, Pedernales

Mentor(s): Peter Kroll

**Abstract:**

In this work we investigate the relationship between structure and properties of silicon oxycarbide. These materials are used in high-temperature applications, for example, in engine spark plugs, heat shields, and thermal barrier coatings. Characterizing the structure of SiCO ceramics, and in particular the inclusion of so-called "free carbon" into the ceramic, is crucial to rationalize the high-temperature properties.

We analyze the effects of carbon present in silicon oxycarbide on the computed 29-silicon nuclear mass resonance (NMR) spectrum by computing h show that this distribution uniquely relates to the distribution of angles surrounding the Si atoms; quantitative equations are provided for SiO<sub>2</sub> and SiCO ceramics. We reveal that the chemical nature of the carbon atom  $\bar{n}$  whether bonded to three or to four adjacent atoms  $\bar{n}$  impacts the chemical shift of the Si. Consequently, different bonding environments of the carbon in SiCO ceramics can be analyzed via the chemical shift measured at the Si site.

With this information in hand, we analyze 29-Si NMR data published for various SiCO ceramics and deduce the real structure of the material by mat

**Variations in Indoor and Outdoor Particulate Matter at UT Arlington**

Presenter: Joseph Nixon, Geology Senior

Poster board: 128

Mentor(s): Andrew Hunt

Group members: Rogers, Robert; McCullars, Justin; Young, Alex

**Abstract:**

Indoor and outdoor air quality has a major impact on human health. With upwards of 34,000 students attending UT Arlington it is important to ascertain the quality of air inhaled by students and faculty. A preliminary investigation is underway to determine whether indoor and outdoor particulate matter (PM) vary by location, season, thermal and aeolean variances. 10 locations were sampled every 30 seconds at 5 minute intervals both inside and outside of buildings on UT Arlington. Samples were collected using a P-Trak Ultrafine Particulate Matter Collector. Data from these samples are being used to address two primary questions: (1) Can P-Trak technology accurately describe concentrations of PM inside and outside buildings on campus and (2) Do PM concentrations differ with variations in seasons, temperatures, and wind speeds? The creation of a 10-point geographical plot was used and separated into 5 indoor and 5 outdoor locations. Initial findings show varying amounts of PM, but are generally higher in populated indoor areas and during calm, warm periods outdoors. This is to be expected as more populated warm areas are prime conditions for accumulation of pm in the atmosphere. While variations in sample locations are normal, wind speed also has a significant impact on PM concentrations; the higher the wind speeds the more diluted the PM becomes, therefor the lower the pm concentrations and readings. Further samples will be taken during the winter, spring and summer to ascertain the impacts of variations in the seasons as it relates to PM concentrations.

## ACES Symposium 2014

### Presenter Abstract by Discipline

#### **Consistency and Accuracy Assessment of Tipping Bucket Rain Gauge Measurements**

Presenter: Amir Norouzi, Civil Engineering Graduate

1:00 PM, Concho

Mentor(s): Dong-Jun Seo

Group members: Arezoo Rafieei Nasab, Behzad Nazari, Beomgeun Kim, Fernando A Pulido

#### **Abstract:**

[High-quality rainfall data are necessary to calibrate hydrologic simulation models, which may then be used for urban flash flood forecasting. In this presentation, we test the accuracy and consistency of rainfall observations from a network of 8 tipping-bucket rain gauges deployed in the City of Fort Worth, TX. Two approaches are used to assess the quality of the data: 1) inter-gauge comparison and 2) scale-compatible comparison with multiple radar-based rainfall products. In the first comparison, rain gauge rainfall at a site is compared with that at other locations to check spatial consistency and to assess spatial variability. In the second comparison, comparative evaluation is carried out between the rain gauge data and the radar rainfall products, the latter of which includes radar-based rainfall estimates from the Multisensor Precipitation Estimator (MPE), NEXRAD Digital Hybrid Scan Reflectivity (DHR), Q2 and CASA (Collaborative Adaptive Sensing of the Atmosphere). The second comparison allows a check on spatiotemporal consistency of the rain gauge data and assessment on the quality of the radar-based rainfall products. We present the results of the two analyses and describe their linkage with the ongoing development at UTA of the prototype flash flood forecast system for a large part of the Dallas-Fort Worth Metroplex (DFW).]

#### **Exaltation of Cultural Mestizaje as a Societal Ideal in the Early Twentieth Century Venezuelan Works of Rómulo Gallegos and Ramón Díaz Sánchez**

Presenter: Jennifer Omaña, English Graduate

11:00 AM, Neches

Mentor(s): William Arce

#### **Abstract:**

The indigenista and primitivist movements of the early part of the twentieth century exalted Native American and African cultures and traditions in both literature and art. However, much like our modern attempts at multiculturalism, their focus was centered on a plurality of cultures. Venezuelan authors Rómulo Gallegos and Ramón Díaz Sánchez both produced novels during this time period which share many characteristics of each of these movements, and yet form part of a Venezuela literary tradition that goes beyond the scope of either. Each author seeks to exalt racial and cultural *mestizaje* as more than just a societal reality, but also as an ideal. Each one centers a novel on a character who is not only the hero of the story, but also represents the voice of reason in the novel. In each case, the reader is witness to the character's struggle with his identity, and yet fully aware that the author attributes the character's superior moral and rational capabilities to his mixed cultural identity. A study of Gallegos's *Pobre negro* and Díaz Sánchez's *Cumboto* reveals the characteristics of key Venezuelan literary works that attempt to validate the cultural mestizaje of the racial majority.

### **Thermal Analysis in Data Center Cooling**

Presenter: Chris Onyiorah, Mechanical & Aerospace Engineering Graduate

Mentor(s): Dereje Agonafer

Poster board: 41

#### **Abstract:**

One of the major concerns of companies around the world is business continuity and with that comes the need to prevent operational dysfunction by keeping their information systems available and functional. IT professionals therefore, are constantly striving towards network sustainability by boosting the cooling cycle and infrastructure in data centers while also reducing overall energy consumption. Various airflow management technologies have been implemented that propose significant energy savings and potential reduction in net annual cost for running data centers. In this work, the concept of using server rack-level containment has been explored as an alternative airflow management and energy saving strategy and may prove to be appropriate for specific data center configurations and applications.

A baseline data center model is used as an example, comparing the effectiveness of using these individual rack containment devices, "Snorkels" to remove hot-spots by directing and aiming cool air from a data center sub-floor plenum to individual server racks/cabinets, hence minimizing inlet temperatures by over 4°F and improving cooling by more than 85%. Over 40 Computational Fluid Dynamics models have been analyzed in this work and the relative magnitudes of inlet temperature reduction and uniformity with this procedure have been quantified. Various test cases with different combinations of other containment strategies have also been included for the purpose of comparison. The results present the feasibility of this strategy as a preliminary review and give an initial guideline on when this concept can be implemented, depending on the respective data center layout and design.

### **Kinetic characterization of the recombinant F420-Dependent Glucose-6-Phosphate Dehydrogenase from *Mycobacteria tuberculosis*.**

Presenter: Mercy Oyugi, Chemistry Graduate

Mentor(s): Kayunta Johnson-Winters

Group members: Toan Nguyen, Coung Le, Ebenezer Joseph

Poster board: 42

#### **Abstract:**

*Mycobacterium tuberculosis (Mtb)* is a pathogenic bacterium that causes the deadly, infectious Tuberculosis disease (TB). The World Health Organization (WHO) estimates that there were 1.3 million TB-related deaths worldwide in 2012, mostly due to the continuous emergence of Multidrug-Resistant Tuberculosis (MDR-TB) and Extensively Drug-Resistant Tuberculosis (XDR-TB). There is a great need to study other avenues by which *Mtb* can be targeted so as to effectively cure all forms of TB, especially MDR-TB and XDR-TB. Our study, therefore, focuses on F420-Cofactor Dependent Glucose-6-Phosphate Dehydrogenase (FGD), an enzyme that is crucial for the survival of *Mtb*. FGD catalyzes the conversion of glucose-6-phosphate to 6-phosphogluconolactone. The goal of our study is to understand the mechanism of the FGD reaction by using kinetic methods. The work presented here focuses on production, purification and kinetic analysis of *wild-type* FGD and three FGD variants (Histidine (H) to Alanine (A)). We have successfully created the FGD H40A variant based on the proposed mechanism, which suggests that Histidine<sub>40</sub> (H40) acts as the active site base for the FGD reaction. The FGD H260A variant was created based on the closer proximity of Histidine<sub>260</sub> (H260) to the substrate than H40, making H260 a more viable active site base. We also created the FGD H40A/H260A double mutant to study how the reaction would proceed without any potential active site bases. Here, we will discuss the results of the kinetic analysis of both *wild-type* FGD and the three FGD variants.

*The University of Texas at Arlington Research Enhancement Program (UTA-REP)*

*National Science Foundation (NSF)*

**Biodegradable Temperature sensitive and fluorescent magnetic nanoparticles towards targeted bio active factor delivery.**

Presenter: Nikhil Pandey, Biomedical Engineering Graduate

Poster board: 43

Mentor(s): Kytai T. Nguyen

**Abstract:**

This work demonstrates the development of novel biodegradable thermo-responsive fluorescent polymer-coated magnetic nanoparticles (TFP-MNPs) towards targeted cancer imaging and therapy. These nanoparticles were designed to enable both imaging and therapeutic modalities within a single system, making them function as sensitive imaging probes while also serving as effective therapeutic reagent delivering vehicles. The TFP-MNPs (135 nm) demonstrated a zeta potential value of -31 mV, which is indicating excellent dispersion stability, and temperature responsiveness at 39°C. The magnetic property of these particles was confirmed using a vibrating sample magnetometer (VSM) and visual observation. Further, these nanoparticles are degradable, cyto-compatible, and possessed temperature-dependent drug release characteristics. TFP-MNPs also exhibited a bright fluorescence in the prostate cancer orthotopic mouse model, suggesting that they can be easily visualized *in vivo* following systemic administration. Thus preliminary investigation on these nanoparticles demonstrated their potential to function as efficacious bioengineered therapeutic and diagnostic entities that can find major applications in medical research globally.

**Convenient approach to gram scale synthesis of (R)-(+)-2'-Amino-1,1'-binaphthalen-2-ol (NOBIN) using (R)-(+)-1,1'-Binaphthyl-2,2'-diamine (BINAM)**

Presenter: Darshan Patel, Chemistry Graduate

Poster board: 44

Mentor(s): Daniel Armstrong

Group members: Zachary S. Breitbach, Ross M. Woods, Craig Keene, Yeeun Lim, Daniel W. Armstrong

**Abstract:**

Axially chiral, enantiomerically pure (R)-(+)-2'-Amino-1,1'-binaphthalen-2-ol (NOBIN) and its derivatives are a popular class of ligands with diverse applications including in asymmetric catalysis and pharmaceuticals, many on industrial scale. Important pharmacophores, optically active biaryl motifs are also found in vast number of natural products and are inevitable in pharmaceutical design. Current popular methods of synthesis of NOBIN are expensive, complex, and environmentally harmful involving usage of rare earth and toxic heavy metals as catalysts. Here we present a simple, one-step synthesis of optically pure NOBIN using (R)-(+)-1,1'-Binaphthyl-2,2'-diamine (BINAM) as a starting material under acidic conditions in the presence of benzoyl peroxide. R-BINAM with equivalent moles of benzoyl peroxide was dissolved in a mixture of aqueous HCl and 1,4-dioxane and heated to obtain R-NOBIN with isolated yield in excess of 70%. Reactions were monitored by chiral high performance liquid chromatography and the products were characterized by High-Resolution Mass Spectrometry and NMR. BINAM stereochemistry was maintained throughout the reaction and no racemization of product was observed. The novel one-step reaction provides enantiomerically pure NOBIN without any use of toxic metal catalysts and provides high yields. Investigations into the plausible reaction mechanism will be discussed. The method also works to convert derivatized BINAMs to create their NOBIN counterparts, many of which have not been synthesized.

*This work was supported in part by Welch Foundation.*

**Transformation Paths in Boron Nitride: from Soft to Hard Materials**

Presenter: Prajay Patel, Chemistry Senior

Mentor(s): Peter Kroll

**8:20 AM, San Jacinto**

**Abstract:**

Boron nitride has a number of national security and technological applications due to its beneficial properties, in particular, its hardness. One of these forms, cubic boron nitride (c-BN), is a hard material second in hardness only to diamond. Conversely, rhombohedral boron nitride (r-BN), a more common form, is a soft material that is easier to synthesize and easily morphs into c-BN at elevated temperature. Therefore by investigating the transformation path between r-BN and c-BN, the pathway between soft and hard materials is better understood. The key result is the energy barrier required to convert r-BN into c-BN, which governs the kinetics of the reaction and gives insight on the relative stability of r-BN and c-BN.

Using accurate density functional theory calculations, the modeling of the transformation occurs by creating an energy landscape depicting the structural changes as one changes into the other. Through additional investigation on the impact of pressure and impurities on the transformation, optimal conditions can be achieved. Through computational evaluations, this study provides a better understanding of materials synthesis, which in turn leads to new synthetic procedures towards hard cubic boron nitride.

*This work was supported in part by Teledyne Scientific Company*

**Design of a Telemetry Link for Direct Communication between Femtosatellites in Low Earth Orbit and Earth Ground Stations**

Presenter: Tracie Perez, Mechanical & Aerospace Engineering Graduate

Mentor(s): Ben Harris

**Poster board: 45**

**Abstract:**

Compared to conventional satellites with a mass of 1000 kg or more, small satellites are clearly cheaper to build and launch. The race to the bottom in terms of size has led to the concept of a satellite-on-a-chip, or chipsat, with a mass less than 100 grams. It had been assumed that the power and spatial limitations of a chipsat would prohibit communication between chipsats in low Earth orbit and ground tracking stations, and that a larger relay satellite would be required. However, direct communication between chipsats and ground stations would reduce mission complexity, reduce cost of development and launch, and eliminate the single point failure risk that a relay satellite would pose.

This study demonstrates that a direct communication link between chipsats in low Earth orbit and ground stations is possible. The key component of the communication system is a system on a chip. To prototype a chipsat system, the BeagleBone Black was chosen as a development platform. This low-power, open source hardware system is actually a single-board computer capable of running various operating systems. Running an operating system allows the chipsat to employ existing software radio libraries and broadcast a custom signal. Using forward error correction and spread spectrum techniques, experimental data shows that a telemetry link design is possible for direct communication between chipsats in low earth orbit and ground tracking stations, allowing for reduced complexity and reduced cost missions in the future.

**Perceptions of Gender Identity Formation: A Phenomenological Study of Age Versus Distance in a Sample of Lesbian and Gay Individuals**

Presenter: Heather Peterson, Social Work Graduate

Poster board: 46

Mentor(s): Julie Nagoshi

**Abstract:**

Studies and theories of sexual and gender identity development in gay/lesbian individuals emphasize the importance of the "coming out" process, which commonly occurs in adolescence or young adulthood. Gay sexual identity is often associated with transgressing gender roles, so early childhood experiences of non-heteronormative gender identity are important for the development of same-sex sexual attractions and subsequent gay sexual identity. A qualitative study that used the phenomenological approach amalgamated the lived experiences of six gay men and five lesbian women. Findings are discussed in the context of the age at which the individual became aware of their non-heteronormative gender identity and whether they recalled specific life events associated with that awareness. Consistent with the previous literature, six of the participants reported that their gender identity became particularly salient in adolescence or young adulthood and in the context of some aspect of the coming out process. Another four participants reported a specific early childhood age when their gender identity became salient. The last participant reported an awareness of non-heteronormative gender identity became salient. The last participant reported an awareness of non-heteronormative gender identity in early childhood, with no specific age given. For the latter five participants, there was a specific childhood event recalled when their non-heteronormative gender identity became apparent, which was the basis for later explorations of gay sexual identities. These findings are discussed in terms of the intersectionality of gender and sexual identity in the development of non-heteronormative gender/sexual identities.

**Functionality of Organic Hydroperoxide Resistance Genes in Nitrogen-Fixing Soybean Symbionts**

Presenter: James Pharr, Biology Graduate

2:20 PM, Palo Pinto

Mentor(s): Woo-Suk Chang

Group members: Su-Yeon Jeong

**Abstract:**

Rhizobia are a group of soil bacteria known for forming symbioses with legume plants, like soybeans. Rhizobia colonize the plant roots to form nodule structures in which atmospheric nitrogen is converted into a biologically available form plants can use. This symbiosis allows for legume crops to be grown with little to no input of chemical nitrogen fertilizers. However, in order to establish these symbioses, the rhizobia must overcome oxidative bursts as part of the innate immune response of the host plant. Our transcriptomics studies have shown a certain group of genes, known as organic hydroperoxide resistance (*ohr*) genes, are significantly upregulated in response to oxidative stress. Two mutant strains of *Bradyrhizobium japonicum* (a soybean symbiont) were constructed lacking one of two *ohr* genes, and a third with both genes knocked out. Differences in the symbiotic capability of three knockout mutants were examined. Germinated soybean seeds inoculated with each mutant strain were placed in growth chambers for six weeks and nodule formation was observed. The roots were examined for nodule number, nodule size, and the distance of nodules from the original root tip. Overall, we detected no significant differences among the bacterial strains in any of the aforementioned variables. This outcome could be explained by 1) *ohr* genes are not important in the nodulation process or, 2) an alternative method is perhaps used to handle oxidative stress during the symbiosis. Increased understanding of genes involved in stress response mechanisms is critical for improving rhizobial efficiency in the rhizobia-legume symbiosis.

**Porous Polyurethane Microspheres for in Vitro Drug Screening and Tissue Engineering Application**

Presenter: Kushal Pokhrel, Biomedical Engineering Graduate

Poster board: 47

Mentor(s): Kytai T. Nguyen

Group members: Jyothi U. Menon, Akanksha V. Sharma, Yi Hong

**Abstract:**

Polyurethane (PU), one of the major class of synthetic elastomers, in recent years have gained increased attention due to their versatile nature. This highly biocompatible and biodegradable polymer with excellent mechanical property can be used for various tissue engineering applications including and not limited to making cardiac pacemakers and vascular grafts. The objective behind this study was to develop 3D porous microspheres as cell substrate for tissue regeneration and drug screening purposes. Polyurethane microspheres were fabricated by double emulsion technique using ammonium bicarbonate (ABC) as porogen. Initial studies indicate that the porous microspheres have spherical morphology with an average diameter of  $60.45 \pm 8.35 \mu\text{m}$  and pore size of  $6.96 \pm 1.98 \mu\text{m}$ . Scanning Electron Microscope (SEM) images also indicated that the pores were interconnected. Stability studies in water and serum demonstrate that the particles were relatively stable with minimal aggregation on day 4 in serum. Similarly, 24 hour cell attachment study was used to optimize the seeding density. These preliminary results indicate that PU particles are stable and have great potential as a 3D scaffold for tissue engineering and drug screening applications. Future studies involve forming 3D tumors using these microspheres to test the therapeutic efficacy of anti-cancer drugs in vitro.

**Study of Geogrid Reinforcement Using Two Dimensional Discrete Element Method**

Presenter: Asheesh Pradhan, Civil Engineering Graduate

Poster board: 48

Mentor(s): Xinbao Yu

**Abstract:**

Geogrid which is a mesh structure made of polymers and is a subset of main group of geosynthetic, has been widely used in pavements, railways, and retaining walls to reinforce granular soil. Understanding the reinforcement mechanism of such geogrid is important in appropriately designing those earth structures. Numerical models can be useful in understanding such mechanisms with analyses at particles level which is difficult if not impossible in physical laboratory experiments. Two dimensional (2D) Numerical models of geogrid reinforced granular soil samples were created using discrete element method (DEM). Biaxial compression tests, in which out of plane stresses are ignored, were performed on the numerical soil samples. The numerical study focused on the influence factors that affect the reinforcement effect such as loading rate, boundary conditions, confining pressure, particle shape, and particle friction. The results show that proper selection of loading rate is crucial in assessing reinforcement effect of geogrid in numerical simulations. Boundary conditions such as flexible and rigid boundary did not have significant effect on the strength of reinforced samples but produced different amount of particles rotations and shape of deformed sample at the end of loading procedure. The simulations showed that particles near geogrid experienced reduced rotations signifying the interlocking mechanics of reinforcement due to geogrid. The reinforcement effect was more pronounced in angular particles than in circular particles.

**Isolation and characterization of a novel nickel(II) ammonia complex**

Presenter: Abhijit Pramanik, Chemistry Graduate

1:40 PM, Pedernales

Mentor(s): Rasika Dias

Group members: Animesh Das, Muhammed Yousufuddin

**Abstract:**

Activation of ammonia is of immense importance due to its extensive uses in various industry processes. It is a cheap and abundant source of nitrogen which is prevalent in molecules in pharmaceuticals and other fine chemicals. Many transition metal complexes are known for their ability to activate ammonia. But highly efficient as well as cheap transition metal complexes in ammonia activation are still scarce. In this context, a novel four coordinated nickel(II) ammonia complex has been synthesized. Nickel is a cheap transition metal and well known for its efficiency in catalysis. Very high affinity of ammonia gas to be attached with the nickel center has been observed. The isolated complex was characterized by X-ray and other techniques. Further investigations are going on to utilize the attached ammonia for the synthesis of useful nitrogen containing molecules. Herein, the synthesis and characterization of the above mentioned metal complex and its significance in catalysis will be presented.

**Effects of vision on dynamic stability against backward loss of balance in young and elderly subjects.**

Presenter: Brian Prejean, Kinesiology Graduate

Poster board: 49

Mentor(s): Mark D. Ricard

Group members: Dr. Christopher Ray

**Abstract:**

Clinical observations indicate that falls in elderly individuals are more likely to occur under low-light conditions during movement. The purpose of this study was to determine dynamic stability in young and elderly subjects while walking with eyes open and eyes closed. An inverted pendulum model derived from a 14 segment full-body kinematic (120 Hz) and kinetic (1080 Hz) data set was used to determine dynamic stability against backward loss of balance. Five young subjects (age  $24.8 \pm 4.2$  years) and seven elderly subjects (age  $74.7 \pm 7.7$ ) were recruited. Data were collected using two AMTI force plates (1080 Hz) and a Vicon Motion Capture System (120 Hz). Each subject completed five walking trials with eyes open and with eyes closed. Dynamic stability was determined by computing the momentum of the extrapolated center of mass. A 2 x 2 repeated measures ANOVA was used to determine the effect of vision (eyes open, eyes closed) and age (young, elderly) on dynamic stability. There were no significant differences in dynamic stability for the young subjects for eyes open ( $330.2 \pm 19.8$  kg-mm/s) and eyes closed ( $323.8 \pm 31.9$  kg-mm/s),  $p < 0.05$ . There were no significant differences in dynamic stability for the elderly subjects for eyes open ( $304.5 \pm 28.2$  kg-mm/s) and eyes closed ( $288.2 \pm 40.8$  kg-mm/s),  $p < 0.05$ . While not statistically significant, the inverted pendulum model did illustrate that elderly subjects had lower dynamic stability.

**An Analysis of Sports Industry Career Preparation with a Focus on Sports Marketing Undergraduate Curricula**

Presenter: Destiny Price, Marketing Senior

**2:20 PM, San Jacinto**

Mentor(s): Elten Briggs

**Abstract:**

This paper reports on a research effort that analyzes existing undergraduate sports marketing degree programs and the desires of sports professionals to address the educational needs in the industry. A study was conducted that involved the collection of both secondary and primary data. Existing sports marketing degree programs were evaluated to establish a core set of courses vital to effective sports marketing education. The top areas of study in sports marketing education were found to be: Field Experience, Sports Marketing, Management and Organizational Skills, Legal Aspects of Sports, and Ethics in Sports. Interviewees from the sports industry unanimously agreed that internships prepare sports professionals better for careers in the sports industry than existing undergraduate degree programs. This study develops a unique undergraduate sports marketing curriculum with the potential to more effectively prepare students for careers in the sports industry than the standard degree program. The recommended curriculum involves internal and external internships throughout the four years of the students' undergraduate career, a real world sports marketing research project during their final semester, sport specific courses, and seminars featuring sports professionals. The recommended curriculum could benefit institutions considering the modification or introduction of an undergraduate degree program in sports marketing.

*Ronald E. McNair Scholar Program*

**Improving Surgical Precision by using Long Term Augmented Reality on Live Endoscopic Videos**

Presenter: Gustavo A. Puerto-Souza, Computer Science Engineering Graduate

**10:40 AM, Red River**

Mentor(s): Gian-Luca Mariottini

**Abstract:**

The goal of this research is to design innovative algorithms to automatically process and interpret real-time videos from endoscopic cameras during Minimally-Invasive Surgeries (MIS). MIS replaces traditional open-surgery because the use of small surgical tools and tiny endoscopic cameras reduce post-surgical trauma and hospitalization time. Despite these advantages, limited field of view and the loss of depth perception make this modality more challenging for the surgeon, increasing the risk of hitting high-risk anatomical targets (e.g., nerves or blood vessels).

We are interested in Augmented Reality (AR) to increase the surgeon's visual awareness by accurately overlaying radiological organ models onto intra-operative video. Since placing shafts or fiducial markers on the operated organs during MIS is unfeasible, next-generation AR systems will rely only on natural features extracted from the live endoscopic videos. However, several technological challenges need to be addressed to make AR robust to the loss of visual features in case of occlusions and strong organ deformations.

We developed a novel video-processing algorithm that automatically recovers in real time the lost features, even in case of organ deformations. We validated the accuracy of our method over large surgical-video sequences extracted from real kidney- and prostate-cancer surgeries. This work is in collaboration with the Urology Department at UT Southwestern Medical Center. Our research was recently awarded with the best paper award at the 6th Pacific-Rim Symposium on Image and Video Technology.

**Drug-releasing biodegradable elastomeric fibers for vascular engineering**

Presenter: Primana Punnakitikashem, Biomedical Engineering Graduate

Poster board: 50

Mentor(s): Kytai T. Nguyen

Group members: Danh Truong, Jyothi U. Menon, Dr. Kytai T. Nguyen, Dr. Yi Hong

**Abstract:**

The use of small diameter synthetic vascular grafts (inner diameter <6 mm) is still limited due to their rates of restenosis caused by thrombosis and intimal hyperplasia (IH). Currently, biodegradable vascular grafts with anti-proliferative drug release or non-thrombogenic modification have been used to overcome these limitations. Although both methods can reduce IH formation for increasing patency *in vivo*, they may also facilitate reverse effects on the endothelial cell layer. To this end, we developed electrospun biodegradable polyurethane (BPU) fibrous conduits loaded with dipyridamole (DPA), whereas BPU would provide the mechanical support matching with native arteries while DPA release would prevent blood platelet deposition without adverse effects on the endothelium. After formation, the scaffolds had continuous fibrous structure with strong mechanical properties and high suture retention strength. The drug-loaded fibers exhibited sustained release of DPA over 3 months with a low burst release within 24h. The human blood contact tests showed that the DPA-releasing fibers exhibited good blood compatibility with a low hemolysis and reduced platelet deposition and blood clot time. The *in vitro* cell studies showed the drug release from the scaffolds inhibited smooth muscle cell proliferation and had no adverse effects on endothelial cell proliferation. These results indicate that this DPA-releasing material with attractive multiple functions has a great promise for use as biodegradable small diameter vascular grafts.

**THE PAIN DISABILITY QUESTIONNAIRE: A VALIDATION OF ITS UTILITY, RESPONSIVENESS AND ONE-YEAR OUTCOMES IN A CHRONIC DISABLING OCCUPATIONAL MUSCULOSKELETAL DISORDER POPULATION**

Presenter: Rachel Purdum, Psychology Graduate

1:00 PM, Neches

Mentor(s): Robert J. Gatchel

Group members: Randy Neblett, M.A., LPC, BCB; Meredith M. Hartzell, M.S., Ph.D. Candidate; Tom G. Mayer, M.D.; Robert J. Gatchel, Ph.D., ABPP

**Abstract:**

**INTRODUCTION:** Chronic pain patients often have severe disability. Though there are several well-known disability measures, they are for lumbar pain and have lower reliability and validity. The Pain Disability Questionnaire (PDQ) is one questionnaire often overlooked.

**AIMS AND METHODS:** The purpose of this study was to confirm the PDQ's clinical utility in a larger treatment sample and determine its relation to other psychosocial and socioeconomic variables in chronic disabling occupational musculoskeletal disorder patients. A consecutive cohort (N = 1,657) completed a functional restoration program, consisting of quantitatively-directed exercise progression and multi-modal disability management. Patients were divided into 3 categories by admission PDQ score: mild/moderate disability (n = 233), extreme disability (n = 564), and severe disability (n = 860). Demographic, occupational, psychosocial, medication-use, and socioeconomic outcome data were analyzed.

**RESULTS AND CONCLUSION:** Patients with severe or extreme PDQ disability scores reported higher pain intensity, disability, and depressive symptoms, and lower health-related quality of life, at treatment admission and discharge ( $p < .001$  for all). At admission, those with extreme PDQ disability scores were more likely to meet DSM-IV-TR criteria for psychological disorders. At one-year after discharge, patients with severe or extreme PDQ admission disability scores were less likely to have returned to or retained work, and more likely to have additional follow-up visits, ( $p \leq .03$ ) than those with mild/moderate PDQ scores. These results show that the PDQ is a highly useful and valid self-reported disability measure, utilized to better understand a wider range of chronic musculoskeletal disorders.

### **Comparative evaluation of multiple radar-based precipitation estimates for North Texas**

Presenter: Arezoo Rafieei Nasab, Civil Engineering Graduate

1:20 PM, Concho

Mentor(s): Dong-Jun Seo

Group members: Amir Norouzi, Thomas Mathew, Dong-Jun Seo, Haonan Chen, V. Chandrasekar, Paula Rees, Brian Nelson

#### **Abstract:**

In the U.S., more than three-quarters of the population live in urban areas which are more prone to flash floods. Given the high population density, high-resolution observation and modeling capabilities are necessary for prediction of flash floods in urban areas. Hence, the use of weather radar and high-resolution hydrologic modeling is a natural progression. This study develops and implements a prototype high-resolution flash flood warning system for the Dallas-Fort Worth Metroplex (DFW). There are different radar systems and algorithms used by different agencies to derive the precipitation estimates resulting in precipitation products with different resolution and accuracy. For effective use of radar-based precipitation estimates for high-resolution flash flood forecasting, it is necessary to understand and assess how the errors in radar-based precipitation may differ and how they may manifest in streamflow simulations. Toward that end, we carry out comparative evaluation of four different radar-based precipitation estimates, MPE, NEXRAD DHR, Q2 and CASA. First, we carry out intercomparison of these products, compare them with rain gauge observations and assess the relative information content among the precipitation products. Then, we evaluate streamflow simulation using a hydrologic model forced by different radar-based precipitation. Among the radar-based precipitation estimates, MPE tends to underestimate the rainfall depth while Q2 overestimate it. It suggests that a combination of different precipitation estimates may be a better representative of actual precipitation. Also, there is a reasonable correlation between the simulated streamflow and the observed water level data which confirms the advantage of using radar-based precipitation.

### **Ranking Item Features by Mining Online User Item Interactions**

Presenter: Habibur Rahman, Computer Science Engineering Graduate

Poster board: 51

Mentor(s): Gautam Das

Group members: Sofiane Abbar, Saravanan Thirumuruganathan, Carlos Castillo, Gautam Das

#### **Abstract:**

The fundamental maxim of any successful business is "Know Your Customer". In other words, knowing (a) what are the items that users like? and (b) why do they like them? The advent of web has enabled businesses to easily quantify what items users like by measuring online interactions between users and the items such as by page visits, number of likes, ratings, etc. Such interactions provide a rich window into what users like but answering the second question of why a user likes the items is much trickier. The reason is that the user could have liked a movie for any combination of the artists involved in the movie. We argue that the vast majority of user feedback online is similarly implicit. In our project, we seek to peek behind the curtain by leveraging the fact that we have millions of similar implicit feedback over thousands of items. Using sophisticated statistical models, we seek to rank the components of an item based on how much they contributed to their popularity. For example, given a movie we could decompose what fraction of the movie's box office revenue was due to a given star. We evaluate our algorithms using both real-world and synthetic datasets and conduct a comprehensive user survey to demonstrate the effectiveness of our proposed method which outperforms the popular Tag-Cloud based approach.

*This work was done during the internship of Habibur Rahman and Saravanan Thirumuruganathan at Qatar Computing Research Institute. The work of Habibur Rahman, Saravanan Thirumuruganathan and Gautam Das is partially supported by NSF grants 0812601, 0915834, 1018865, a NHARP grant from the Texas Higher Education Coordinating Board, and grants from Microsoft Research and Nokia Research.*

**Development of Linear Regression Models for Predicting Water Quality Parameters and Estimating Methane Generation Rates from Anaerobic Treatment of Vinasse.**

Presenter: Shammi Rahman, Civil Engineering Graduate

2:00 PM, Concho

Mentor(s): Melanie Sattler

Group members: Dr. Sahadat Hossain, Dr. Hyeok Choi

**Abstract:**

One of the most prominent biofuels today is ethanol. The production of ethanol from biomass, whether from sugar crops, starch crops, dairy products, or cellulosic materials, results in the production of a high-strength liquid waste called vinasse. Vinasse is high in solids and organic content or BOD, ranging from 30 to 40 g/L, (Polack et al., 1981), with a low pH, typically from 3-5(Wilkie et al., 2000).

The research described here increases our knowledge of anaerobic biological treatment of vinasse. Such treatment reduces the vinasse waste strength and produces stabilized residuals that can be used as fertilizer without creating water pollution problems. Anaerobic biological treatment of vinasse also produces methane, which can be used as a renewable energy resource. This research explored the behavior of 6 different compositions of vinasse in an anaerobic environment at three different temperatures (30, 35, and 40C).

From the results it is evident that as methane generation increased over time, COD (Chemical Oxygen demand) has been decreasing significantly. Other results show that Biochemical oxygen demand and Potassium have decreased significantly over time with little or no changes in Ammonia  $\bar{n}$  N, Sulfur and Total Dissolved solids.

The main objective of the study is to make a model for methane generation and waste destruction for a wide range of vinasse composition over time. It will promote estimation of methane generation and waste removal of unlimited composition of vinasse without further experiments. Such extensive study of vinasse will be the first to our knowledge

**FUZZY LOGIC APPROACH: A BETTER SCOPE FOR THE DEVELOPMENT OF A FREEWAY INCIDENT RATING SYSTEM**

Presenter: Ziaur Rahman, Civil Engineering Graduate

Poster board: 52

Mentor(s): Stephen P Mattingly

**Abstract:**

For reducing the impact of incidents on the freeways, managing agencies must provide the proper response for a given incident; therefore, the agencies need tools that can evaluate and rank incidents based on limited information. During incident clearance, the magnitude of the incident's severity is typically revealed, but at the time of its occurrence, its time to clearance and impact on the transportation network may not be easily determined. Statistical predictions are limited with parameters and freeway traffic incidents are very uncertain. A fuzzy logic system with several inputs and one output will be designed in the Matlab software environment using Fuzzy Logic Toolbox which reduces the effect of boundary condition problems for real-time systems like a Freeway. This research details various factors like number of lanes affected, number of cars stopped or crashed, severity of injured people and so on. The Objective behind the development of such a rating system is two-fold. First, it offers an efficient and standard way of forming the information about the number of incidents in a freeway over a time period. A second objective, once some skill has been gained in rating incidents, is to allow traffic management centers to rate incidents at their onsets. Communicating those ratings using a universally understood terminology to all responding agencies could then result in a more synchronized response to an incident. Keeping these as the future goal, this paper will develop fuzzy logic model to analyze its scope in the development of freeway incident rating system.

## Presenter Abstract by Discipline

### **What Impact Does Education Have On Latin American Women?**

Presenter: Sirah Ramirez, Modern Languages Junior

Mentor(s): Christopher Conway

**Poster board: 119**

#### **Abstract:**

"What Impact Does Education have on Latin American women?"

Today in Latin America women struggle to become educated and enter the work force to improve their lives. There have always been barriers that have gotten in the way but there are promising trends that show a better future for the women of Latin America. The image of Latin American women has always been domestic and subordinate to men's roles.

Throughout the years many women have broken out of this stereotype, and by doing so their position in society is starting to change. There are many factors that play into why these women have found this change difficult. Some are financial insecurity, cultural norms, and their role as homemakers. One cultural norm that plays a role in this problem is "machismo." The Latin male has always been viewed as the breadwinner and the one in charge of the household. In my presentation, I demonstrate many ways that Latin American women have struggled to break from their subordinate role. I present the trends and life decisions that are driving Latin American women to fulfill their goals and dreams of becoming more educated and achieving equal rights. Understanding the success of Latin American women today is important because it provides models for promoting the success of women.

### **Sizing X-20 DynaSoar Orbital Mission using Space Planner's Guide**

Presenter: Loveneesh Rana, Mechanical & Aerospace Engineering Graduate

Mentor(s): Bernd Chudoba

**Poster board: 53**

#### **Abstract:**

Developed by United States Air Force in 1965, Space Planner's Guide is a conceptual planning tool for future space missions and vehicles. Based on the fundamentals of sizing, it is a unique tool which was used in conceptual design stages of a number of legacy vehicles.

Initiated in 1957, Boeing X-20 Dyna-Soar was the first US space plane program with mission capabilities ranging from military application to space access. Before getting cancelled in 1963, it was the biggest military project with a budget of \$660 million (\$5 billion today). As Space Planner's Guide was published after cancellation of X-20, it is observed that Guide has capabilities of sizing Dyna-Soar.

This study applies Space Planner's Guide to size X-20 Dyna Soar for an orbital mission. The final results can be summarized in two steps. First result is a complete mission profile for X-20 performing with orbital capabilities. It must be noted that X-20 was a three stage program with first stage performing sub-orbital missions. As the program got cancelled before even the first stage was developed, an orbital mission was never planned. The results from this sizing study develop the orbital version of the vehicle. Second impact is the application and verification of a legacy design tool. This understanding can be of importance to develop a sizing program analogous to the potentials of Space Planner's Guide. Such a tool is of critical importance for mission planning, more so with commercialization of space exploration.

## Presenter Abstract by Discipline

### **Digitally Re-configurable Formwork**

Presenter: T. Cord Read, Architecture Graduate

Mentor(s): Brad Bell

Group members: Austin Ede, Nathan Barnes, Chris Chrysler

1:20 PM, San Saba

#### **Abstract:**

While precast concrete is more efficient than cast-in-place concrete in relation to both formwork costs and quality output, there is still an opportunity to improve the process. The precast industry's current standards for creating concrete formwork are time consuming, labor intensive and high in material demand to generate formwork. Each formwork typically produces one geometric outcome. Our research examines the viability of a digitally re-configurable formwork allowing for a range of geometric outcomes from a single formwork. Both applied and empirical research methodology were utilized to create digital and physical testing scenarios. These tests produced a range of physical samples combining traditional precast urethane mold making techniques with an adjustable stepper motor framework to provide a spectrum of panel geometries. The culmination of these tests is a full-scale digitally re-configurable formwork controlled by a computer model capable of producing a wide range of geometric outcomes and a full-scale panel prototype. The potential benefit to the precast industry would be to reduce cost and production time while providing geometric flexibility not currently present in the traditional casting process. This would effectively place the precast industry in a position to cost effectively implement mass customization into emerging design standards. †

*This work was supported in part by the Digital Fabrication Consortium at UTA.*

### **Evaluation of Structural Performance of Epoxy Linings for Manhole Rehabilitation using Laboratory Testing and FEM Simulations**

Presenter: Elmira Riahi, Civil Engineering Graduate

Mentor(s): Xinbao Yu

Group members: Xinbao Yu, Mohammad Najafi, Firat Sever

2:20 PM, Concho

#### **Abstract:**

Large amount of manholes in the United States are suffering from serious structural decay and are in need of immediate rehabilitation or replacement. Among various candidate rehabilitation techniques, spray-on-place lining is one of the promising techniques for manhole rehabilitation and replacement. Based on a proposed new manhole rehabilitation classification system proposed by the authors, epoxy lining is considered as semi-structural material and relies on residual strength of existing manhole structure to withstand external loads. Prediction of structural capacity of epoxy lined manhole structure is a challenging task as the epoxy lining reinforcement mechanism is not clearly understood. In this study, laboratory tests on bare concrete cylinders and beams and their counterparts with epoxy lining were performed to evaluate structural performance of concrete with epoxy lining. The laboratory testing can provide measurements of some basic mechanical properties of concrete and epoxy. However, the lined manhole structures in the field operation conditions cannot be accurately represented by laboratory testing. Finite element simulation was adopted to simulate epoxy lined concrete members in both laboratory and field loading conditions. ABAQUS simulation was able to analyze how structural capacity of epoxy lined manhole is affected by mechanical properties of epoxy such as flexural strength, elongation, adhesion and thickness of epoxy liner. Results show that FEM simulation can be used to help analyze and design epoxy lining for deteriorated manhole rehabilitation.

### **Improving water quality forecasting using HSPF via real time data simulation**

Presenter: Hamideh Riazi, Civil Engineering Graduate

3:00 PM, Concho

Mentor(s): Dong-Jun Seo

Group members: Dr. Sunghee Kim, Dr. Changmin Shin

#### **Abstract:**

Being able to predict water quality in the river system accurately is critical to protecting public health from harmful water quality conditions such as algal blooms or bacterial pollution and to allowing the decision makers to respond more quickly to emergency situations such as oil spills for protection of water resources systems. One of the most cost-effective ways to improve the accuracy of water quality forecast is to improve the accuracy the initial conditions of the computer model used by adjusting them based on real-time observations. Data assimilation (DA) is a technique that optimally combines computer model results with observations to provide a more accurate estimate of the model initial conditions. In this work, we developed and evaluated a DA procedure for water quality forecasting for a sub-catchment of the Nakdong River Basin in the Republic of Korea for prediction of 7 water quality variables and river flow. The results showed that the DA procedure improves prediction of river flow and most water quality variables substantially but that, for a number of variables, improvement comes largely from correcting systematic biases. The latter suggests that, in addition to DA, model calibration needs to be improved to further increase the prediction accuracy. This research demonstrates the value of DA in water quality forecasting. The outcome of this research is being implemented for operational use at the Water Quality Control Center of the National Institute of Environmental Research in the Republic of Korea.

*This work is supported by the Water quality Control Center, the National Institute of Environmental Research (NIER) of the Republic of Korea, under the Agreement of the Cooperative Study between Geosystem Research Corporation, Korea, and The University of Texas at Arlington.*

### **Genetic mapping and characterization of the recessive red locus in domestic pigeons**

Presenter: Clifford Rodgers, Biology Senior

Poster board: 128

Mentor(s): John W. Fondon III

Group members: Johnny Reyes, Shreyas Krishnan, John W. Fondon III

#### **Abstract:**

Despite being a favored experimental model of early geneticists, including Darwin and Morgan, scant progress on understanding the molecular nature of red plumage color in fancy pigeons has been made in the nearly 100 years since its recessive inheritance was characterized. Here we report the elucidation of the molecular basis of recessive red in pigeons using comparative genomics and genetic association. Strikingly, two independent deletions of the same distal enhancer element in pigeons correspond closely to homologous deletions causing pigmentation defects in chicken and mouse, suggesting that this locus is under strong pleiotropic constraints and/or the region is genetically unstable. In either case, these results indicated that the genetic and genomic architecture of pigmentation introduces a strong bias in the accessibility of adaptive evolutionary paths. Recessive red phenotypes show considerable variation within and among pigeon breeds, and we set out to determine whether unrecognized functional differences between the two deletion alleles underlie this diversity by examining phenotypic variation in recessive red families in which both deletion alleles are segregating. Using this approach, we are able to exclude functional differences between these alleles as the source of differences in white spotting found to occur in some, but not all recessive red families.

# ACES Symposium 2014

## Presenter Abstract by Discipline

### **Decolonizing Immigration**

Presenter: Rod S. Sachs, English Graduate

Mentor(s): Penelope Ingram

**11:40 AM, Neches**

#### **Abstract:**

Immigration is a problem here in America and in Europe as well. To contribute to a potential solution for this international problem, an investigation of European and American colonial history is essential because it was during the colonial period that the social scars of ethnic dehumanization formed. This presentation will therefore use personal interviews and mixed media to demonstrate that if migratory laws can be delinked from our colonial past then immigration can be de-colonized. To investigate the current immigration crises, I interviewed traditional immigration specialists like UTA's Dr. Zolniski, Director of CMAS. I then travelled to Europe, as a COLA Global Research Fellow, to interview world-renowned decolonization historians, who are immigrant researchers from every continent. The results of these eyewitness accounts show the benefits of migratory laws based on sustainable policies that do not dehumanize our fellow migrants— which calls into mind that we all were immigrants. The interpretation of the results reveals that nationalistic pride, fear of foreign threats, and the need to migrate is linked with our colonial past. That is, because of our past we are safeguarding power and luxury by discriminating migrants based on ethno- and socio-economic data. Thus we need to de-colonize immigration. This mixed media presentation gives viewers face-to-face access with scholars and activists— it is an eyewitness account of how immigration touches us all. These interviews show how we can delink immigration policy from colonistic processes and instead create sustainable policies that do not dehumanize people who migrate.

*This work was supported in part by Mr. Ahmad, Donor of the Global Research Fellowship, and by the College of Liberal Arts.*

### **Organic-inorganic hybrid scintillating materials**

Presenter: Sunil Sahi, Physics Graduate

Mentor(s): Wei Chen

**9:40 AM, San Saba**

#### **Abstract:**

Scintillators are the materials that emit light when excited with high energy radiation. Inorganic single crystals and organic (plastic and liquid) scintillators are the most widely used scintillators. Inorganic crystals have higher efficiency and high stopping power but single crystal are difficult to grow and are very expensive. Also, some inorganic scintillators like NaI-Tl are not environmental friendly. On the other hand organic scintillators have poor stopping power because of low Z-value. This limits the application of organic scintillator for gamma spectroscopy. So, to overcome these deficiencies, we have proposed nanocomposites scintillating materials by embedding the inorganic scintillating nanoparticles into organic polymer. Scintillating nanoparticles are synthesized and characterized using X-ray diffraction (XRD) and Transmission Electron Microscope (TEM). As synthesized nanoparticles are then embedded in to the polymer matrix to make nanocomposite scintillator and their optical properties have been studied. The nanocomposite scintillators have shown improved luminescence properties as compared to the plastic scintillator and can be useful for radiation detection.

*We would like to acknowledge the support from the NSF and DHS joint ARI program (2011-DN-077-ARI053-02&3)*

### **Thermal modelling of remote radio head units**

Presenter: Manasa Sahini, Mechanical & Aerospace Engineering Graduate

3:20 PM, Red River

Mentor(s): Dereje Agonafer

Group members: Betsegaw Gebrehiwot

#### **Abstract:**

Remote radio heads (RRHs) have become one of the most important subsystems of today's new distributed base stations. In order to meet zoning restrictions, wireless operators conceal these RRH units and other telecommunication equipment in an enclosure. Thermal modeling of concealed RRH units which are placed on a cell tower is the main interest of this paper. RRH units which dissipate fixed amount of heat are modeled in ambient temperature at 55°C. The effect of concealing enclosure on RRH units along with factors such as solar load and wind is studied.

The aim of this study is to analyze if concealment of the RRH units is possible under natural convection for cooling under the following boundary conditions of high ambient temperature of 55 °C, solar loading and wind. Also, the study has been made to investigate if stacking of one, two, or three concealed sections is possible under natural convection cooling process. Stacking concealed sections poses more challenge since hot exhaust air from a lower section may enter the top sections through the air inlets. Various configurations were modeled and tested in a CFD tool, 6 SIGMA ET. Results show that with proper airflow management and arrangement of sections, it is possible to stack three sections one on top of the other.

### **Development of Expression Vector for *Clostridium difficile* and its Use in Antibiotics Target Validation**

Presenter: Madhab Sapkota, Biology Graduate

3:20 PM, Palo Pinto

Mentor(s): Julian G. Hurdle

Group members: Manish Kumar, PhD

#### **Abstract:**

*Clostridium difficile* is a gram positive, anaerobic, spore forming bacteria that causes diarrhea during antibiotic treatment for other infections. Due to the higher relapse rate and recent outbreaks with emergence of hyper-virulent strains, it warrants effective drugs for its treatment. The availability of genetic tools is limited for *C. difficile* and new approaches need to be employed to find the novel antibiotic targets in this pathogen. Antisense expression has been successfully used in human pathogens where the function of a gene can be studied by controlling its expression. To control the expression of a gene, it is cloned in antisense orientation under the control of a promoter that can be activated by adding a specific chemical compound. Using anhydrotetracycline inducible system, we targeted murA (a gene involved in bacterial cell wall synthesis). The antisense clones containing the ends of murA gene (N- and C- terminus) were hypersensitized in the sub inhibitory concentration of antibiotic fosfomycin in *C. difficile* 630. In order to optimize the expression of antisense fragments, we also designed another antisense vector which can be induced by xylose. We propose that such tools will facilitate the drug target validation and exploration of new drug targets in *C. difficile*.

**Orbital configuration and stability analysis of the giant planet in the HD 196885 binary star system**

Presenter: Suman Satyal, Physics Graduate

10:40 AM, Palo Pinto

Mentor(s): Zdzislaw Musielak

Group members: Tobiash Hinse, Billy Quarles, Joaquin Noyola

**Abstract:**

The advent in planet detection technology, such as the radial velocity and the transit method, has led to the discovery of hundreds of extra solar planets (exoplanets) in the recent years. Among these planets, 93% are found to orbit around a single star and the remaining planets are orbiting a binary star system. Depending on the planetary orbit around the host star(s), a planet could orbit either one or both stars as a satellite (S-Type) or as a planet (P-Type), respectively. Planets within binary systems can be transiting if the orbital plane of the planet and the star(s) are coplanar with the line of sight as seen from Earth or inclined with respect to the binary plane. We study the S-Type planet in the HD 196885 binary system whose orbital inclination ( $i_{pl}$ ) is unknown. We have used a chaos indicator called the mean exponential growth factor of nearby orbits (MEGNO) maps and have successfully determined regions of chaos and stability for the various choices of  $i_{pl}$  and semi-major axis ( $a_{pl}$ ). Our results show that the likely configuration of the  $i_{pl}$  is between  $40^\circ$  and  $80^\circ$  to the binary plane. In addition, we inspect the time evolution of the planet's eccentricity and inclination to see whether the stability found in the higher inclination regime is due to the Kozai oscillation. With this, we have improved the known parameters of the system with a more consistent data based on our stability analysis.

**Quantitative Comparison of Metastasizing and Non-metastasizing Breast Cancer Cell Migration via Various Dimension Microchannels**

Presenter: Bailey Sayles, Biology Senior

11:20 AM, San Jacinto

Mentor(s): Young-Tae Kim

Group members: Loan Bui

**Abstract:**

Breast cancer is one of the leading causes of death in women. Treatments include surgery, radiation, and chemotherapy. The most common chemotherapy drug right now is Paclitaxel which binds to microtubules inside the cell and restricts replication. Using soft-lithography techniques to make PDMS based microchannel devices, we investigated the effect of this drug on metastasizing breast cancer cells at several different concentrations and microchannel dimensions. We also quantified the distinct migratory patterns between metastasizing (MB-231) and non-metastasizing (MCF-7) breast cancer cells through six dimensions of microchannels (20, 15, 10, 8, 5,  $3\mu\text{m}$ ). While both are able to fit through microchannels as small as  $3 \times 3\mu\text{m}$ , the rate of migration between the two types of cells is significantly different. Three different substrates on which cells could be cultured were tested. Glass, a collagen coating, and collagen gel were all used with the collagen coating giving the best environment for cells to grow. This paper provides the groundwork for future testing of migration patterns as well as the causes and effects of migration through microchannels on cell proliferation and morphology.

**Using genome-wide single nucleotide polymorphisms to estimate patterns of gene flow and population structure in *Crotalus atrox***

Presenter: Drew R. Schield, Biology Graduate

10:40 AM, San Saba

Mentor(s): Todd A. Castoe

Group members: Daren C. Card, Jacobo Reyes-Velasco, Carol L. Spencer

**Abstract:**

How the dynamics between gene flow and selection shape the genomic landscape of natural populations is a major question in evolutionary biology. Interpreting how local selection acts upon populations is important for understanding how species adapt to local climate and habitat, and for understanding how speciation occurs. The Western Diamondback Rattlesnake (*Crotalus atrox*) is a species of North American rattlesnake with an expansive distribution that is subdivided by distinct biogeographic regions, making it a prime system for addressing questions about the influence of local selection on populations in the face of other evolutionary forces (e.g., gene flow). A previous study using mitochondrial DNA sequences found evidence for two anciently diverged lineages of *C. atrox*, which have since introgressed, leading to a region of their range that contains populations showing mixed mitochondrial ancestry. Here, we generated a substantially more thorough mitochondrial DNA data set to test previous estimates of gene flow and population genetic structure. We also used restriction-site associated DNA (RADseq) libraries to obtain nuclear-genome-wide estimates of population genetic patterns. Using these complementary data sets, we estimated historical demography and inferred population structure, and used RADseq data to identify genomic regions putatively under selection. Our estimates from both data sets were congruent, and they provide a solid framework for further examination of local selection in *C. atrox*.

**The Influence of Sleep on ImPACT Performance**

Presenter: Mathew Schneider, Biology Senior

Poster board: 120

Mentor(s): Jacob Resch

**Abstract:**

The Immediate Postconcussion and Cognitive Testing (ImPACT) battery is a Computerized Neurocognitive Test (CNT) widely used in assessing neurocognitive deficits following sport related concussion (SRC). The focus of this study is to determine the effect of varying levels of sleep on ImPACT performance. The participants consisted of forty-one healthy college students (8 males, 33 females): with a mean age  $19.7 \pm 1.93$  years, without, history of SRC within six months of participation, any diagnosed psychiatric condition, learning disability, and/or ADD/ADHD. Participants were assigned into quartile groups based on self-reported hours of sleep: Group 1 ( $\leq 5.5$ ), Group 2 (5.51-6.49), Group 3 (6.5-7.99), and Group 4 (8-9.5). Participants completed a consent, health questionnaire, the Green's Word Memory Test (WMT) and the ImPACT. WMT was used as an external measure of effort. An Analysis of Variance (ANOVA) was conducted to assess group differences for age, number of prior concussions, years of education and for the ImPACT composite scores of Visual and Verbal Memory, Visual Motor Speed, Reaction Time, and Total Symptom Score. Analyses were performed with  $\alpha = 0.05$ . No significant differences were observed between groups for demographic variables or ImPACT composite score ( $p > .05$ ). Our results support previous reports suggesting that sleep does not influence performance on CNTs such as ImPACT. Identifying sources of random error such as sleep may ultimately increase the reliability and sensitivity of CNTs which would increase clinical utility.

# ACES Symposium 2014

## Presenter Abstract by Discipline

### **Bridging the Gap: The Use of Explicit Theory in *Research on Social Work Practice***

Presenter: Donna Schuman, LCSW, Social Work Graduate

Poster board: 54

Mentor(s): Alexa Smith-Osborne

Group members: Rosalind Evans, MSSW; Dante Bryant, MSSW; Pamela Fox, LCSW

#### **Abstract:**

Historically, the field of social work has been criticized for failing to adequately tie theory and research to direct practice. Theory, research, and practice are the principal constructs that form the lens through which researchers and practitioners define, engage, assess, and advocate for societal needs. The purpose of this study was to examine how these constructs were being presented in current social work literature. Evidence-based research is the standard of excellence for exemplary social work practice. Because journal reviews are a highly effective way to capture the state of evidence-based research on which to guide competent and ethical social work practice, 136 journal articles were examined to determine the prevalence of use of an explicit guiding theoretical framework in articles published between January 2011 and September 2013 in a major peer-reviewed social work journal, *Research on Social Work Practice*. This study sought to identify the prevalence of research-based articles; use of quantitative, qualitative, or mixed method design; and whether or not a stated relationship existed between theory and research. Results indicated a significant majority of articles were research based and used a quantitative design, yet most failed to connect this research to social work theory, supporting the notion that social work as a discipline needs to reassert the importance of theory-based research as it relates to practice. The implications of this research project highlight the need for social work to strengthen its endeavor to bridge the gap between theory, research, and direct practice.

### **CONNECT : Exploiting Human Mobility Pattern for Constructing a Consistent and Connected Virtual Oppnet Backbone**

Presenter: Md Mehrab Shahriar, Computer Science Engineering Graduate

9:40 AM, Red River

Mentor(s): Sajal Das

#### **Abstract:**

Unlike the traditional cellular or wired networks, opportunistic network (Oppnet) is an infrastructure-less network, created opportunistically. Recently, increasing penetration of smartphones and tablet devices with device-to-device networking capabilities (e.g., Bluetooth, WiFi Direct) have created exciting scopes in the field of Oppnets. The direct connectivity features in these smart devices imply that they no longer need to rely on traditional infrastructure (e.g., base stations, access points) for network formation. The absence of fixed infrastructure suggests that, communication is only established when two devices come in the signaling range of each other. However, as a drawback, real time networking interactions like instant-messaging or live streaming is not guaranteed.

As a matter of fact, the nodes in Oppnet often denote humans, as they carry the mobile communication devices.

Researchers have found that people make repeated and patterned visits to the popular places. As an illustration, we can consider a real-world scenario evolving around a university campus, where each student attends her classes at specific times and specific class rooms. This motivates us to construct a connected virtual Oppnet backbone exploiting people's location visit patterns, thus paving the way for real time interactions.

We propose a novel framework, called CONNECT, based on residence-time information of 24 volunteers at their respective homes for 6 weeks and successfully extract the intrinsic virtual Oppnet backbone. Associated results pertaining to our test scenario, shows the week-long connectivity level to be as high as 85% of the hours consistently, which proves the feasibility and effectiveness of virtual backbones.

**Environmental variation and its effect on fitness and immunity in wolf spiders**

Presenter: Humera Shaikh, Biology Senior

10:40 AM, San Jacinto

Mentor(s): Laura Mydlarz

Group members: Matthew Steffenson, Whitney Mann, Joshua Beach, Laura Mydlarz

**Abstract:**

Climate change models predict that drier, hotter summers are expected in subtropical regions. It is important to understand how organisms that cannot regulate body temperature (ectotherms) will respond to these environmental changes. As a strategy to endure these stressors, ectotherms may alter their allocation of energy between factors such as immunity and fitness. The goal of this study was to identify whether variation in precipitation over the growing season influenced the allocation of energy toward immunity and fitness among wolf spiders (*Tigrosa helluo*) in North Texas. Sixteen males were collected every two weeks from May to September. Spiders were brought back to the laboratory and had their running speed recorded. Each specimen was weighed and had their carapace length recorded to calculate a ratio index. Hemolymph was then extracted, homogenized, and frozen for immunological assessment (protein concentration, prophenoloxidase [PPO] and superoxide dismutase [SOD] activity). Ratio indices significantly decreased over the growing season, while running speed varied with no discernable pattern. Higher precipitation may have a positive influence on protein concentration and PPO activity, which may be due to higher prey abundance. SOD activity appeared to be influenced negatively by high precipitation. Low precipitation and high temperatures may have increased respiration rates, requiring an increase in antioxidant activity to relieve oxidative stress. It appears there is a positive relationship between precipitation and immune function and so it is important to understand how this species will respond to chronic drought conditions in the future.

**A Study Correlating Hypnotic Susceptibility with Relaxation Techniques**

Presenter: Soundarya Shankar, Biomedical Engineering Graduate

Poster board: 55

Mentor(s): Mario Romero-Ortega

Group members: Naresh Lakshman Raman

**Abstract:**

About 10-15% of people worldwide are highly susceptible to hypnosis, and about 10-15% are highly unresponsive to hypnosis. The main aim of this study is to find the effectiveness of relaxation therapies, which are highly prevalent in today's stressful life. This study also explores the correlation between the relaxation techniques (music therapy and binaural beats), and its impact on subjects susceptible and non-susceptible to hypnosis. The 12 subjects were divided equally into two groups - susceptible and non-susceptible to hypnosis based on the Harvard Group Scale (HGSS) Form-A test. The state of relaxation was measured and monitored by measuring two characteristics- electroencephalogram (EEG) and the breathing rate (BPM). The alpha to beta ratio was primarily used to identify relaxation. The results obtained from the study indicated that binaural beats was not an effective relaxation technique, as compared to music therapy, for both the groups. Music therapy was very effective and was able to achieve a relaxed state irrespective of the group. Prior studies have shown that there is a substantial difference in the theta waves between two different types of people- introverts and extroverts, artistic and analytical etc. A similar observation was obtained in our study, between the susceptible and non-susceptible groups, which is the first of its kind.

**Effect of Blends of Ashless Antiwear Additives and ZDDP on Tribofilm Formation in Base Oil Mixes**

Presenter: Vibhu Sharma, Material Science Engineering Graduate

8:20 AM, Concho

Mentor(s): Pranesh B Aswath

**Abstract:**

Lubricant and lubricant additives are used to reduce the frictional as well as wear losses to the moving parts in various applications. For many decades Zinc Dialkyldithiophosphate (ZDDP) is being used as an effective antiwear additive in automobile application such as engine oils, transmission oils etc. But the use of ZDDP is limited to the presence of metallic zinc which burns down during the combustion process and results in the formation of ash which subsequently causes sludge formation on the catalytic converter thus increased harmful emission. In an effort to reduce sludge formation and deposits in automotive applications new ashless antiwear additives have been examined as possible supplements to ZDDP to enhance wear resistance and formation of stable tribofilms. In this study two ashless antiwear additives were examined in blends with ZDDP in base oil. HFRR tests were employed to study the wear behavior in a pin on flat type HFRR set-up. The incubation times for the formation of the tribofilms are reported from ECR results. Tribofilms formed on the rubbed surfaces were characterized with XANES. The morphology of tribofilms was studied with high resolution SEM images and their mechanical properties were measured with Nano-indentation test. Results indicate that improved wear behavior (as much as 80.7% at 54N load test and 42.7% at 350N load test) is possible at equivalent levels of phosphorous (0.1% P) when some of the ZDDP is replaced with suitable ashless additives.

**Play Two Hours and Call Me in the Morning: Video Games as Therapy**

Presenter: Kimberly Shashoua, Social Work Graduate

2:20 PM, San Saba

Mentor(s): Randall Basham

**Abstract:**

Mental health therapies such as narrative therapy, experiential therapy, biblio-therapy, or psycho-education have been supported in the literature for improving affective responses among those suffering from emotional distress. While these techniques have empirical support for positive emotional change among clients, little is known, as to whether online or game based equivalents, have similar capacity to improve affective states. A limited content analysis of highly popular virtual games (n=10), representative of each common genre (puzzle, shooter, and adventure) was conducted to evaluate the types of games that contained narrative elements, and/or facilitated autonomous decisions, similar to those found in common mental health therapeutic techniques such as identification, catharsis, psychodrama, and passive developmental growth. The content of the selected virtual games demonstrated pro-social and affirming outcomes, consistent with conventional interventions. 50% of the games dealt with overcoming trauma or made explicit mention of PTSD. 60% had loss or grief as a major theme. 50% contained themes of reconciling with parents. Though limited, these results indicate that games may be used to facilitate emotional growth, adjunct to or in place of traditional methods. This original and critical finding suggests that virtual games have associated content that may provide positive therapeutic gains. The finding will be of interest to mental health service providers seeking to improve the affective response outcomes of clients suffering from negative emotional states and of interest to numerous other gaming researchers who have developed systematic reviews, suggestive of the negative effects of virtual gaming (obsessive compulsive issues and violence).

### **Thermospheric winds around the cusp region**

Presenter: Cheng Sheng, Physics Graduate

Mentor(s): Yue Deng

Group members: Yue Deng, Qian Wu, Aaron Ridley

**10:20 AM, Palo Pinto**

#### **Abstract:**

The cusp is the boundary layer between the closed and open field lines of the Earth. It is special since the mass and energy from the solar wind can directly go into the Earth's upper atmosphere in this region. The sunward wind has been observed by the balloon-borne Fabry-Perot interferometer (FPI) at the equatorward of the cusp on the dayside, which is caused by the heating added in the cusp and the corresponding changes of the horizontal pressure gradient. However, this phenomenon has not been reproduced by the Thermosphere Ionosphere Electrodynamics General Circulation Model (TIEGCM) under the resolution of  $5^\circ \times 5^\circ$  in longitude and latitude. In this study, the Global Ionosphere Thermosphere Model (GITM) has been run in different cases and different resolutions to understand the dynamics around the cusp region. First, we compare the simulations with and without the cusp energy inputs to identify the influence of the cusp heating on the horizontal dynamics. Both runs are done under the resolution of  $5^\circ \times 1^\circ$  in order to better resolve the cusp region. Results show that the meridional winds turn from poleward to equatorward after adding the cusp energy, which is consistent with the observation.

### **Smart Gloves For Arthritis Diagnosis**

Presenter: Kaustubh Shinde, Electrical Engineering Sophomore

Mentor(s): Jung-Chih Chiao

Group members: Obinna Igwe, Julius JeVaughn, Dr. Smitha Rao

**Poster board: 103**

#### **Abstract:**

As of today, about 50 million people suffer from arthritis in America. One of the main problems doctors encounter is to judge arthritis based only on the patients' verbal description. There is definitely a need for a more scientific measuring method. The main objective of this research project was to design, test and develop mass-producible strain sensors to measure muscle and joint movements for potential applications in arthritis diagnosis.

The sensors, made up of Kapton, were coated with amorphous carbon to give them electrical conductivity. Cutting was done using an industrial laser before encapsulation with PDMS. Then, they were attached to a glove which could be worn by patients. When fingers bent, the sensor experienced strain changes and electrical signals were recorded in real time by a computer. The voltage variations in the sensor were inputs to a wireless module so the patient was not tethered to a machine. The wireless module without limiting patient's mobility sends data to a computer program in LabView.

After testing various designs of the sensors, we found out that only certain designs would function properly to measure the strains caused by joint movements. The device dimensions were determined to overcome maximum strain, flexibility, linearity and torque issues.

This project is of significance to my discipline since the industry has become a multidisciplinary field that includes electrical engineering, material science and medicine. This would definitely be a more scientific and accurate method than any current methods to aid the diagnosis of arthritis.

**The Influence of Mood on Sensory Organization Test Performance.**

Presenter: Cadi Shurbet, Biology Senior

Mentor(s): Jacob Resch

Poster board: 128

**Abstract:**

The Sensory Organization Test (SOT) has gained acceptance as a measure of balance following sport-related concussion (SRC). The SOT has been reported to possess variable stability reliability. An extraneous variable that may influence SOT performance is mood. The purpose of this study was to investigate the influence of mood on SOT performance. In order to assess mood's influence on SOT performance participants completed the Profile of Mood States (POMS-B) which measures fatigue-inertia, vigor-activity, tension-anxiety, depression-dejection, confusion-bewilderment, anger-hostility, and total mood disturbance. SOT composite scores consist of an equilibrium score and somatosensory, visual, vestibular, and visual conflict ratios. Pearson correlation coefficients were calculated for each POMS-B and SOT composite score. Analyses were performed with  $\alpha = .05$ . We observed significant correlations between fatigue-inertia the SOT equilibrium score ( $r = .61$ ,  $r^2 = .37$ ,  $p = .005$ ), vestibular ratio ( $r = .47$ ,  $r^2 = .22$ ,  $p = .04$ ), visual ratio ( $r = .53$ ,  $r^2 = .28$ ,  $p = .02$ ), and visual conflict ratio ( $r = .68$ ,  $r^2 = .22$ ,  $p < .001$ ). We also observed significant correlations between the SOT visual conflict ratio and depression-dejection ( $r = .05$ ,  $r^2 = .002$ ,  $p = .03$ ) and anger-hostility ( $r = .47$ ,  $r^2 = .22$ ,  $p = .04$ ). The SOT somatosensory ratio was significantly correlated to tension-anxiety ( $r = .52$ ,  $r^2 = .27$ ,  $p = .02$ ). Results suggest that mood state may influence SOT performance. Mood states, fatigue, irritability, and depression are commonly associated with SRC. Our preliminary findings warrant caution when interpreting SOT results following SRC as an athlete's true ability may be influenced by mood states that are commonly associated with this injury.

**A Pfennig Saved: The Complexity of German Saving Behavior**

Presenter: Shane Sloan, Mechanical & Aerospace Engineering Senior

Mentor(s): Pete Smith

Poster board: 107

**Abstract:**

This study provided unique, culturally-themed data collection and analysis about German savings behavior, due to debates around cultural description theory. Chen (2012) posited that language context affects savings behavior, utilizing German as an example with a weak future reference and thusly higher value placed on financial savings. As Chen's work utilizes linguistic structural factors to predict a German savings society, this study provides a picture of the cultural context around German savings behavior. The study utilized questions drawn from standardized cultural stud instruments of Hofstede (1988) and The World Values survey (2012) to broaden the understanding of saving in Germany. Results indicate that cultural factors such as the value placed on family and a communal sense of reliability play the strongest role in German financial behavior. Germans could be categorized as future oriented with an inclination towards uncertainty avoidance. They value preparedness and are motivated to avoid uncertainties. They accumulate wealth in order to create a situation in which they feel in control.

Learning what factors affect why people save can be of importance to governments because it would allow them to apply incentives to alter economic behavior. This study shows that cultural values have a stronger influence than linguistics. This is important because savings behavior can perhaps now be grouped by people of similar backgrounds and ideologies. Policies will thus be region specific. These results allow for more accurate research. Cultural values can be compared with language structure and linguistic behavior to gain a deeper understanding of this phenomenon.

*The Petsche Scholarship for Independent Study Abroad financed this study.*

**PSYCHOLOGICAL ATTRIBUTES OF CHILDREN WITH DEVELOPMENTAL COORDINATION DISORDER**

Presenter: Jonathan Smith, Kinesiology Junior

Poster board: 109

Mentor(s): Priscila CaÁola

**Abstract:**

Children with Developmental Coordination Disorder (DCD) have low motor skills that include, poor balance, low coordination, and handwriting difficulties. Cross-sectional studies have shown that children with DCD were at a significantly higher risk of having mental health difficulties which impacted their lives at home and at school. This study examined psychological attributes of children with DCD as viewed by their parents and teachers.

Nine children with DCD aged 7-10 years participated in this study. Parents and teachers of those children filled out the Strength Difficulties Questionnaire (SDQ), an inventory that assesses positive and negative psychological attributes in, 5 different scales: Emotional Distress, Behavioral Difficulties, Hyperactive/ Inattention Difficulties, Getting Along with Others, and Kind and Helpful Behavior. The form also includes an Overall Stress scale which shows the attributes together as a whole and Impact of any Difficulty scale which measures the influence on life due to their psychological attributes from the parent and teachers perspective.

A dependent t-test analysis indicated significant differences between the scales Emotional Distress, Difficulties Getting Along with other Children, Overall Stress, and Impact of any Difficulties on the Childs Life with parents scoring higher than teachers for all four scales. We conclude that both parents and teachers supported the finding of emotional and social difficulties in children with DCD, but the rating differences between parents and teachers suggest that these children need to be evaluated from different contexts.

**Conducting a common garden experiment: Investigating the phenotypic differences of a native prairie grass (*Schizachyrium scoparium*) in search of ecotypes**

Presenter: Rachel Carmickle, Biology Senior

Poster board: 116

Mentor(s): Laura Gough

Group members: Michelle Green, Dr. Laura Gough

**Abstract:**

The urban environments created through the rise of cities change preexisting ecosystems, and these changes impact how plants grow. The breakup of existing ecosystems into smaller areas - coupled with changing human activity near those areas - may result in locally adapted forms of the same species because of particular local environmental conditions. Such adaptations are an important consideration when reestablishing native species in an area that has experienced a disturbance, such as land use change. This experiment was conducted to investigate whether or not observed differences in plant growth at remnant prairie sites are genetic in nature. Little bluestem, a native Texas bunchgrass, was collected from high and low urban proximity locations in North Texas and planted in identical soil in a common garden to determine whether or not it has begun to locally adapt to characteristics associated with urban environments. Results showed that there is indeed possible local adaptation for reproductive output, in that number of reproductive shoots was greater for plants originating in high urban proximity locations. Future findings could influence species selection for restoration efforts in the North Texas area and beyond. For humans, understanding the changes that our activity makes in an ecosystem gives us the ability to further educate ourselves in order to cultivate a better, more balanced relationship between the effects of our presence and the health of our ecosystems.

*This work was supported in part by the IEngage mentoring program, and the Native Plant Society of Texas.*

**VERIFICATION OF CFD MODEL OF AN AZTEC SHOW UNIT**

Presenter: Vishnu Sreeram, Mechanical & Aerospace Engineering Graduate

**3:40 PM, Red River**

Mentor(s): Dereje Agonafer

Group members: Suhas Sathyanarayan

**Abstract:**

Evaporative cooling method is preferred over compressor based cooling methods for hot and dry climates since evaporative cooling systems consume less power compared to the latter. In addition, this method of cooling is reliable, efficient and best suited for cooling data centers. Typically, evaporative cooling systems can function in different cooling modes namely air-side economization (ASE), direct evaporative cooling (DEC), indirect evaporative cooling (IEC) and a combination of direct/indirect evaporative cooling.

This study focuses on establishing good correlation between computational fluid dynamics (CFD) model of an indirect evaporative cooling unit and its real world counterpart. The unit modeled in CFD is a custom made Aztec cooling unit which is made to fit into trade shows and is not a production version of Aztec cooling unit. Verification of the CFD model will enable scaling up the model to reflect the actual Aztec unit that will be used for cooling a research modular data center under construction. Aztec show unit comes with a horizontal duct that supplies cold air to the modular data center with specified volume flow rate, dry-bulb temperature and relative humidity. CFD results show that temperature distribution, airflow rate and pressure drops across various components of the unit are in good agreement with expected values.

**Starvation and its effects on wolf spider (*Tigrosa helluo*) fitness**

Presenter: Matthew Steffenson, Biology Graduate

**1:20 PM, Palo Pinto**

Mentor(s): Laura Mydlarz

Group members: Humera Shaikh, Whitney Mann, Joshua Beach, Laura Mydlarz

**Abstract:**

All organisms must allocate their limited energy toward several major mechanisms including growth, reproduction, maintenance, and defense. Understanding how organisms distribute energy when faced with constraints gives us an opportunity to identify allocation pathways that are the most important to individuals. The goal of this study was to identify how wolf spiders respond to a decreased energy budget using several measures of fitness, behavior, and defense. Spiders (*Tigrosa helluo*) were collected from Arlington, TX and brought back to the laboratory where they were provided one prey item per week or withheld food. At the end of 4 or 6 weeks specimens had their running speed and a ratio index (body mass divided by carapace length) determined. They were subsequently weighed, anesthetized using CO<sub>2</sub> gas, and hemolymph was extracted for immunological assessment (protein concentration, melanin synthesis pathway, and antioxidant activity). Spider ratio indices (a measure of physical fitness) were not affected by starvation; however the running speed of the six week starvation group was significantly lower than that of the controls. While protein concentration significantly decreased in both starvation groups, all measures of immune activity increased. Our results indicate that as prey become less frequent, due perhaps in response to anthropogenic or environmental disturbances, spiders may sacrifice measures of fitness to maintain a higher degree of immune activity. Future research is necessary to determine how spiders will respond to chronic starvation as future habitat destruction has the potential to result in dramatically altered energy budgets.

**Characterization of the tRNA-modifying non-heme diiron monooxygenase, MiaE**

Presenter: Bishnu Subedi, Chemistry Graduate

Mentor(s): Brad Pierce

Poster board: 56

**Abstract:**

A central theme in biochemistry is that the vast majority of cellular infrastructure is comprised of proteins, RNA, and DNA. The DNA transcribe specific message to mRNA, which in turn is used as a template for 'translating' the gene sequence into a linear amino acid strand to form the desired protein. During the translation process, each amino acid needed for protein assembly is sequestered by attachment to a tRNA molecule. Interestingly, tRNA molecules appear to be highly modified within the cell. Though the physiologic roles of such modifications are not well understood; several examples have been identified to suggest that the presence of modified nucleosides in tRNA can impact protein assembly, regulation of central metabolic pathways, and bacterial virulence. To date, nearly 90 post-transcriptional modifications of tRNA have been identified across all phylogenic domains of life. As the ribosomal machinery has historically proven to be an effective target for the development of anticancer, antibiotic, and antiviral agents, characterization of enzymes involved in nucleoside transformations represent a rich area of mechanistic study with high potential impact on human health. In this work we characterized the structural factors influencing binding and reactivity for a tRNA-modifying enzyme (MiaE), which is postulated to signal O<sub>2</sub>-availability within the pathogenic bacteria, *Salmonella typhimurium*. In addition to standard biochemical methods (steady-state kinetics and X-ray crystallography), a variety of spectroscopic methods (CD, EPR, and Mössbauer) are utilized to observed changes within the diiron active site of MiaE upon tRNA-binding.

**Simulated expansions of oxygen minimum zones in the warmer ocean waters.**

Presenter: Teresa Sykes, Geology Graduate

Mentor(s): Arne Winguth

9:00 AM, Pedernales

**Abstract:**

Due to chemical, biological, and physical processes in the ocean, there is the potential for both positive and negative feedbacks from the carbon cycle. The result of these changes will affect the oxygen distribution in the ocean. Oxygen is a key component for biogeochemical cycles; therefore, global changes in oxygen concentrations are important for our understanding of the climate system and the fate of atmospheric pCO<sub>2</sub>. In this study, an oxygen minimum zone (OMZ) in oceanic waters is defined as having a core concentration of  $\leq 20 \mu\text{mol L}^{-1} \text{O}_2$  and a maximum O<sub>2</sub> concentration of  $\leq 50 \mu\text{mol L}^{-1}$  to define the total OMZ area. Using an annually averaged version of the global biogeochemical model (HAMOCC 2.0) expanded to include the iron and phosphorus cycles, we investigate the physical changes of OMZs under different emission scenarios and the mechanisms that lead to future intensification. The study revealed large horizontal expansion of the equatorial Pacific OMZ in each simulation as well as the formation of a new OMZ north of Australia at 3 times pre-industrial atmospheric carbon dioxide concentration. The Arabian Sea OMZ shoals but has limited horizontal expansion and the Atlantic OMZ expands symmetrically. The Arabian Sea and Atlantic OMZs are responding to changes in O<sub>2</sub> solubility as a primary control of expansion; however, the expansion in the Pacific is controlled primarily by changes in organic matter production. The total ocean area with oxygen concentrations of less than  $50 \mu\text{mol L}^{-1}$  increases by approximately 2% per doubling of pCO<sub>2</sub>.

# ACES Symposium 2014

## Presenter Abstract by Discipline

### **The Demotion of Humanity**

Presenter: Lukas Szrot, Anthropology Graduate

Mentor(s): Ben Agger

**8:20 AM, Palo Pinto**

#### **Abstract:**

In the seventeenth century, it was determined that the Earth orbits the sun and is therefore not the center of the universe. Since then, the expansion of scientific knowledge has generated further "Great Demotions," to borrow a phrase from the late astronomer and science advocate Carl Sagan. Sociologist Max Weber saw in this *The Disenchantment of the World*. This paper seeks to explore Weber's theory of disenchantment in broad, conceptual terms. Examining the work of physicists, biologists, philosophers, theologians, sociologists, psychologists, and historians of science reveals potential changes in the way humanity has come to see itself in relation to the universe, raising profound questions about human origins, destiny, and the nature of the divine. First, regarding time and space, scientists have discovered that the universe is far larger and older than it once seemed, and that our place in it is not nearly as central as we once supposed. Second, understanding life via Darwinian evolution raises questions about the interpretation of traditional holy books. Furthermore, the late nineteenth century was a time of both increased interest in science among the literate public and vocal intellectual criticisms of traditional religious ideas. This provides important historical context for Max Weber's ideas. Finally, in the twenty-first century, the continued role and sociological significance of traditional religion, particularly but by no means exclusively in the developing world, raises interesting and unanswered questions, revealing a modern human race that finds itself in a position both predicted by and transcending the work of Max Weber.

### **Examining the Effect of Latent Semantic Similarity in Unstructured Same-Sex Dyadic Interactions**

Presenter: Vivian Ta, Psychology Graduate

Mentor(s): William Ickes

Group members: Meghan Babcock and William Ickes

**3:20 PM, Neches**

#### **Abstract:**

The present study investigated an index of semantic similarity, Latent Semantic Similarity (LSS), to examine its role in initial, unstructured same-sex dyadic interactions. Transcripts of the interactions were used to compute LSS indices for each dyad, which were then correlated with various dyad-level behaviors that occurred during the interaction (e.g., mutual gaze, nonverbal acknowledgements) and dyad-level perceptions of their interaction (e.g., how smooth they thought they interaction was, how much they understood their partner). The results suggest that LSS develops out of highly involving interactions in which a lot of verbal information is exchanged between mutually attentive and acknowledging partners. Additional behavioral measures (e.g., number of questions asked, frequency of positive affect) and post interaction measures (e.g., how much they liked their partner, how awkward they thought the interaction was) were also correlated with LSS, further supporting and extending this finding. Mediation analyses demonstrated that the total number of words spoken during the interaction and the percentage of repeated words used during the interaction each mediated the association between a number of nonverbal and verbal behaviors and LSS.

# ACES Symposium 2014

## Presenter Abstract by Discipline

### **Verbs of Motion in Ojibwe**

Presenter: Elizabeth Tatz, Linguistics Graduate  
Mentor(s): Colleen Fitzgerald

**8:00 AM, Neches**

#### **Abstract:**

Ojibwe is a language spoken in Canada and parts of the U.S. and belongs to the Algonquian language family. Like many other indigenous languages in North America it is highly understudied. Because of its endangered status, and complex word structure, it is a fascinating language to study. Among many different categories based on meaning, verbs of motion are perhaps one of the most basic. Johnson 1987 states that motion events, "are among the earliest, most basic, and most pervasive events in our lives" (Johnson 1987). Children's first verbs often express motion.

Motion events describe the movement of an entity from one location to another. There are two main categories of motion verbs, manner and path, prevalent in Romance languages. This study was conducted to see where Ojibwe fits in.

Ojibwe words are often comprised of different pieces, each adding specific meaning. Because of this complexity, Ojibwe verbs can be highly specific. Ojibwe fits in the big picture.

### **Urethane Doped Polyester (UPE) based nanoparticle scaffolds for the treatment of Peripheral Arterial Disease**

Presenter: Dheeraj Thakore, Biomedical Engineering Graduate  
Mentor(s): Kytai T. Nguyen  
Group members: Primana Punnakitikashem, Richard Tran, Dr. Jian Yang

**Poster board: 57**

#### **Abstract:**

Peripheral Arterial Disease (PAD) is a condition where plaque builds up in the arteries carrying blood to the limbs, affecting an increasing population in the United States. The current treatments for PAD are angioplasty and/or stenting. However, most of the PAD patients are not eligible for interventional cardiology procedures due to their old age. Without proper treatments, they might lose their limbs, resulting in an increase of the morbidity/mortality rate overall. Thus alternative therapies are necessary to treat these PAD patients. For the past few years, nanoparticles have been developed and used for treatments of cardiovascular diseases as they consist of negligible inflammation and provide for targeted delivery of therapeutic reagents. Here, we propose to develop a UPE based nanoparticle scaffold loaded with growth factors and incorporated with biomolecule motifs as an alternative PAD therapy. The function of the biomolecule motifs is to capture the endothelial progenitor cells (EPCs) and prevent the occurrence of thrombosis. The loaded growth factor will help in EPC proliferation and angiogenesis to form blood vessels de novo. The nanoparticles were synthesized and characterized for size, charge, and drug release profile. The size of the nanoparticles was found to be around 180nm in average diameter and a zeta potential of  $-25 \pm 4$  mV, suggesting that these nanoparticles were stable. They also showed reasonably stable behaviors in media without any aggregation. Future work involves studies of cytotoxicity, hemocompatibility, and effectiveness of these nanoparticles for use to treat PAD.

## ACES Symposium 2014

### Presenter Abstract by Discipline

#### **Aggregate Estimation Over Twitter**

Presenter: Saravanan Thirumuruganathan, Computer Science Engineering Graduate

9:00 AM, Red River

Mentor(s): Gautam Das

#### **Abstract:**

Microblogging platforms such as Twitter have experienced a phenomenal growth of popularity in recent years, making them attractive platforms for research in diverse fields from computer science to sociology. However, most microblogging platforms impose strict access restrictions (e.g., API rate limits) that prevent scientists with limited financial resources - e.g., who cannot afford microblog-data-access subscriptions offered by GNIP et al. (such as \$3000 per month for DataSift) - to leverage the wealth of microblogs for analytics. For example, Twitter allows only 180 queries per 15 minutes, and its search API only returns tweets posted within the last week. In this paper, we consider a novel problem of estimating aggregate queries over microblogs, e.g., "how many users mentioned the word 'privacy' in 2013?" or "what is the average number of followers for users who mention 'NSA' in 2013?" etc. We propose novel solutions exploiting the user-timeline information that is publicly available in most microblogging platforms. Theoretical analysis and extensive real-world experiments over Twitter, Google+ and Tumblr confirm the effectiveness of our proposed techniques.

*This work is partially supported by NSF grants 0812601, 0915834, 1018865, a NHARP grant from the Texas Higher Education Coordinating Board, and grants from Microsoft Research and Nokia Research.*

#### **Real Men do Cry: Sentimentality and Homosociality in Piri Thomas' *Down These Mean Streets***

Presenter: Alison Torres Ramos, English Graduate

10:40 AM, Neches

Mentor(s): William Arce

#### **Abstract:**

Sentimental literature is thought to predominantly encompass literature published in the late eighteenth to the nineteenth century. Traditionally, Sentimentality as a genre included domestic novels and abolitionist literature which meant to provoke strong feelings and inspire agency within the predominantly white female readership. Because of Sentimentality's strong emphasis on emotion it received many critiques and eventually fell out of favor with audiences after the Civil War. However, this study proposes that Sentimentality lives on - particularly in Latino Autobiographies such as *Down These Mean Streets* where emotionally driven homosocial male bonds flourish against the backdrop of twentieth century New York. By analyzing Piri and the emotional undercurrent of the homosocial bonds that he shares with his friends, family, and certain segments of society I will demonstrate that this autobiography can fit into the genre of sentimentality. There is a significant gap in the field of literature with regards to Latino authors which my study hopes to address through the analysis of this Nuyorican autobiography. Latinos constitute a significant segment of the American population and the University of Texas in Arlington recently became a Hispanic Serving Institution which points to a need for studies in this area both at a local and national level.

# ACES Symposium 2014

## Presenter Abstract by Discipline

### **Li insertion in SiCO ceramics**

Presenter: Tran Tran, Chemistry Senior  
Mentor(s): Peter Kroll

**8:00 AM, San Jacinto**

#### **Abstract:**

Our project investigates the capacity of amorphous and hypothetical crystalline silicon oxycarbide (SiCO) ceramics in storing Li using a combination between modeling and simulation studies.

Our previous work with amorphous SiCO models shows that Li prefers bonding to O as cationic Li<sup>+</sup>, while the surplus electron is promoted to unoccupied states. The enthalpy of insertion depends strongly on the energy of such unfilled electronic states available in the SiCO host matrix, which can be tailored by amount and structure of embedded graphite or nano-clustered Si.

We, then, propose hypothetical crystalline models of SiCO comprising strips of graphene separated by silica walls. These models are bare of topological defects that provide low-lying defect states for electron capture  $\bar{n}$  thus irreversible binding of Li  $\bar{n}$  but instead exhibit a fortuitous energy balance between Li-O bonding and electron promotion.

### **Biosynthetic Nerve Implants for the Regeneration of Peripheral Nerve Gaps and Evaluation of Functional Recovery**

Presenter: Shannon Trinh, Biology Senior  
Mentor(s): Mario Romero-Ortega

**1:00 PM, San Jacinto**

Group members: Johnston, Benjamin; Le, Matthew; Alsmadi, Nesreen; Granja-Vazquez, Rafael

#### **Abstract:**

Due to the complexity of nerve regeneration, recovery from peripheral nerve injuries is often incomplete and patients suffer from the loss of sensory and motor functions. The "gold standard" surgical repair of the peripheral nerve defects is the autograft procedure which uses a patient's own nerve as donor material, and does not guarantee recovery of function. With these limitations, the development of alternative therapeutic devices such as an implantable nerve scaffold to guide nerve regeneration is currently underway. In our research we developed a biosynthetic nerve implant (BNI) and evaluated the addition of neurotrophic and pleiotrophic factors to aid in peripheral nerve regeneration. After development and fabrication, BNIs were implanted to repair a 4-cm Common Peroneal nerve gap in 24 New Zealand White Rabbits and recovery of sensory and motor functions was evaluated over 4 months. The experimental groups were: autograft (+ control); and 4 BNI groups; no growth factors (- control), with GDNF (a neurotrophic factor), with PTN (a pleiotrophic factor), and with a combination of both growth factors. We hypothesized that BNIs containing both growth factors would achieve functional recovery comparable to the autograft standard. All animals had characteristic functional deficits following injury, and subsequently had significantly different functional recovery between groups after neural tissue was regenerated. BNIs were able to regenerate functional nervous tissue across 4-cm defects, one of the longest repairs reported. BNIs are promising alternative to replace the "gold standard" autograft procedure for the repair nerve gaps in peripheral nerve injuries.

**Tandem Dual Hydrosilylations of  $\alpha,\beta$ -Unsaturated Carbonyl Compounds**

Presenter: Gabriela Trog, Chemistry Graduate

Mentor(s): Junha Jeon

Group members: Hiep Hoang Nguyen, Dr. Yuanda Hua, Dr. Junha Jeon

Poster board: 58

**Abstract:**

Transition metal catalysts have been shown to effect both carbonyl and alkene/alkyne hydrosilylation. Silylation of homoallyl alcohols, followed by hydrosilylation to create substituted oxasilacycles, has been the standard method of creating chiral 1,3-diols via hydrosilylation. To date, a versatile method for tandem dual hydrosilylations of  $\alpha,\beta$ -unsaturated carbonyl compounds to directly afford oxasilacycles has not been found in the literature. We are currently exploring efficient, one-pot diastereo- and enantioselective tandem dual hydrosilylations of  $\alpha,\beta$ -unsaturated enals and enones leading to the 1,3-diol after subsequent Tamao oxidation. In addition, our mechanistic studies are underway.

**IDENTIFYING NOVEL CELLULASE AND XYLANASE ACTIVITIES THROUGH SCREENING OF A FOSMID LIBRARY FROM A TERMITE ASSOCIATED *VERRUCOMICROBIUM***

Presenter: Luis Velazquez, Biology Senior

Mentor(s): Jorge Rodrigues

Group members: F&#225;bio L. Soares junior

11:00 AM, San Jacinto

**Abstract:**

Termites are well known for their ability to degrade lignocellulosic polymers present in the wood. This capability comes from a partnership with different species of protozoa and bacteria. Among bacterial types, the *Verrucomicrobia* is an important phylum, but still poorly characterized. In an effort to understand the roles of microorganisms of this group in the termite hindgut, we isolated five strains of Termite Associated *Verrucomicrobia* (TAV strains). Genome sequencing was performed and DNA of strain TAV2 was used for a fosmid library construction, followed by insertion into *Escherichia coli* cells. A total of 384 clones with an average genomic insert size of 32 kb were obtained and screened for the degradation of cellulose and xylan. Bacterial clones were grown in minimum media, supplemented 1% carboxymethylcellulose or 0.2% xylan as the sole carbon source. Plates were incubated for 3 days at 37<sup>o</sup> C and stained with an iodine solution to test for enzymatic activity. We identified four positive clones for endo-1,4-beta-D-glucanase activity and three positive clones for xylanase activity. These emerging results provide an important step towards the bioprospect of enzymes for different applications such as food, pharmaceutical, agricultural, and second-generation biofuel industries. Future studies will be conducted to characterize positive clones and locate the genes encoding for the degradation of both cellulose and xylan

**Changes in the Structure of Bone of a Low Phosphate DMP1-null Murine Model**

Presenter: Megen Velten, Material Science Engineering Graduate

9:00 AM, Concho

Mentor(s): Pranesh B Aswath

Group members: Olumide Aruwajoye, Vibhu Sharma, Ami Shah, Kush Shah

**Abstract:**

Though bone is arguably one of the most well-studied natural biomaterials, the process of bone formation (aka biomineralization) is still not well understood even as recent research has broadened our understanding of bone's role in the body to a part of the endocrine system—the so-called bone-kidney axis. A better understanding of calcium and phosphate (Pi) in bone, has become increasingly relevant, particularly in the context of pathologies that can alter Pi levels in the body. This study was designed to further understand incorporation of Pi into bone through the study of Dentin Matrix Protein-1 (DMP1) transgenic mice, which are known to have low serum Pi levels. The control groups (n=5) of wild-type and DMP1-null mice were fed a standard rat chow while the treatment group were fed a high Pi diet. The femurs were retrieved after 21 days and studied using both materials characterization techniques (SEM, Raman,  $\mu$ CT, XANES) in addition to more standard histological techniques. Data showed a pronounced effect on the Pi coordination into the bone of the DMP1-null control animals that was corrected with the high Pi diet while Ca distribution in the DMP1-null bones was not restored to that of the wild type control. The partial rescue suggests that DMP1-null mice may be used in the future to study the effect on bone of treatments designed to control Pi levels in the blood.

**Antibacterial Drug Discovery from Natural Products Assisted by Novel Mass Spectrometry Technique**

Presenter: Evelyn H. Wang, Chemistry Graduate

11:40 AM, Pedernales

Mentor(s): Kevin A. Schug

Group members: Lucie Hartmanov&#225;; John Gurak; Maria Bautista; Yashaswini Nagarajan; Yu-shen Sung; Joshuah Beach-Letendre, Laura D. Mydlarz; Frank W. Foss, Jr.; Richard D. Timmons; Kevin A. Schug

**Abstract:**

Increasing bacterial infection around the world is one of the urgent problems we face today. Lacking effective antibiotics to combat the current situation makes the need of finding new antibiotics more crucial than ever. Natural products throughout history have shown to be a promising source for drug discovery; however, conventional methods of isolation and identification are extremely time consuming and labor intensive due to the complex nature of the extracts. A novel and effective approach of natural product drug discovery was developed using polymer screens functionalized with the peptide *L*-Lysine-*D*-alanine-*D*-alanine (Kaa) to mimic parts of the bacteria cell wall known to bind to antibiotics. This functionalized mesh screen will capture active compounds from natural product extracts, minimizing fractionation and sample preparation steps. It can be directly analyzed using transmission mode- desorption electrospray ionization mass spectrometry (TM-DESI-MS). A proof-of-principle experiment was conducted with vancomycin and spectinomycin as positive and negative control respectively to display the selectivity of the affinity capture screen. Asafetida, ginger, and pepper were chosen as the natural product sources for antibacterial agent investigation. Both asafetida and pepper showed antibacterial activity against *E. faecalis* and the functionalized mesh screen was able to capture compounds of interest in the pepper and asafetida extract. The compounds of interests from pepper and asafetida were detected through a TM-DESI-MS setup as 878.13 and 898.80 m/z respectively. This valuable information will guide future fractionation and isolation processes to identify prospective antibiotics from these natural product sources.

**Profiling functional arginine residues of proteins by selective chemical labeling and mass spectrometry**

Presenter: Maheshika Wanigasekara, Chemistry Graduate

Poster board: 59

Mentor(s): Saiful M Chowdhury

**Abstract:**

Arginine residue of proteins goes to several kinds of post translational modifications and associated with several inflammatory diseases. Residue specific chemical modification of protein is a powerful strategy to identify functional amino acid residues of proteins. The extent of modification was analyzed by using mass spectrometric technique. Modification was carried out in alkaline medium followed by 1,2- cyclohexanedione (CHD) reaction and allowed to stand at 25°C for 24 hrs. The reaction was carried out with peptides bradykinin, neurotensin, substance p, protein bovine ubiquitin, and bovine serum albumin and tryptic digest of these proteins. Mass spectrometric (MS) analysis was performed by MALDI-QIT-TOF-MS (matrix-assisted laser desorption/ionization-time of flight mass spectrometry) in positive ion mode with 2, 5-dihydroxybenzoic acid (DHB) as the matrix. Under the above mentioned conditions arginine-CHD adduct formed with the reaction in the guanidino group resulting in a mass increase ( $\Delta m$ ) of 94 Da. All in these peptides, arginine residues were completely derivatized by CHD. The collision induced dissociation (CID) fragments of high mass products provide further clear evidence that the modification is successful. The vast majority of the b and y type product ions were detected for each precursor ion. We see selective labeling of arginine residues in BSA by CHD reaction. This method allows profiling of reactive arginine residues for identifying enzyme activity and arginine post-translational modification.

**Intact Morphine Conditioned Place Preference**

Presenter: Danielle Weidemann, Psychology Graduate

Poster board: 60

Mentor(s): Linda Perrotti

Group members: A.K. Denobrega, S. A. M. Bobzean, L.I. Perrotti

**Abstract:**

Female humans and animals are more sensitive to the reinforcing effects of mu-opiate receptor agonists (i.e., morphine) than males. The ovarian hormone estradiol (E2) has been implicated in regulating behaviors which facilitate addiction to opiates and other drugs of abuse. Surprisingly, few studies have examined the influence of natural fluctuations of ovarian hormones over the reproductive cycle of female animals. Thus, the purpose of the present study was to further investigate sex differences and examine the impact of the different phases of the rat estrous cycle on morphine reward. Using a standard conditioned place preference (CPP) procedure, 49 adult male and female Long Evans rats were conditioned to associate one of two visually and tactically distinct environments with one of three doses of morphine (0, 1.25, or 5 mg/kg) or saline. Estrous cycle stage was recorded daily and females were divided into estrous cycle phase groups at the end of the experiment. Once conditioning was complete, all rats were given a CPP test to determine if they had developed a preference for the morphine-paired environment. Overall, both males and females developed preference for the morphine paired environment ( $p < .05$ ); however no significant sex differences were detected. Phase of the estrous cycle significantly influenced the females' CPP response to the drug at different doses ( $p = .03$ ), with the most robust response during the estrus phase of the cycle at the 1.25mg/kg morphine dose. Currently we are expanding these results to include a wider range of morphine doses.

# ACES Symposium 2014

## Presenter Abstract by Discipline

### **Race and Politics in the Cartoons of Thomas Nast**

Presenter: Cory Wells, History Graduate

Mentor(s): Kenyon Zimmer

**9:20 AM, Neches**

#### **Abstract:**

Some of the most well-known American political cartoons of the 19th century are those of Thomas Nast, published in Harper's Weekly. An innovator in many respects, Nast is possibly most remembered for his editorial crusade against William "Boss" Tweed and the Democratic political machine at Tammany Hall in New York City. Because Irish Catholics in New York were typically supporters of Tweed's political machine, they were often the subject of Nast's cartoons, where they were invariably depicted as apelike sub-humans. Previous assumptions have posited that the depiction of the Irish was a reflection of the nativism and anti-Catholicism of the time, but evidence points to other explanations. No other "races" were relentlessly depicted in such a negative manner. African-Americans were sometimes portrayed in unflattering ways, while other times as proud and admirable humans who deserved the rights of full citizens. The Chinese were generally depicted by Nast as honorable, hardworking victims of American prejudices.

This paper analyzes the ways in which various ethnicities were represented in the political cartoons of Thomas Nast. Some of the questions it addresses are: What were the differences in how these ethnicities were depicted? What were the political goals of these cartoons? Why were some groups, particularly the Irish, portrayed in a negative manner more frequently than others? The paper concludes that Thomas Nast's motivation behind the depiction of various "races" in his works was political, but still informed by the racism of mid and late nineteenth-century America.

### **Assessing China's Military Power in a U.S. World Order**

Presenter: Wesley P. Watson, Political Science Graduate

Mentor(s): Ayten Burcu Bayram

**8:00 AM, Palo Pinto**

#### **Abstract:**

China's increasingly aggressive military power in the Pacific Rim has attracted a great deal of scholarly and policy interest, yet we still have a weak grasp of Washington's response to this military build up. This paper addresses this question. I argue that the United States, constrained by the security dilemma with Taiwan, maintains a realist foreign policy with China in order to deter its military scope and clout within the region, as well as to ensure its survival and gain hegemony within the international system. I use data from the Stockholm International Peace Research Institute's (SIPRI) Arms Transfer database to examine this claim. I find that arms transfers originating from the United States to its allies within the region fall over time, whereas those from China increase significantly. This result implies a variety of implication for both theory and policy, such as neo-realism's strength as a descriptive theory in international relations and Washington's current endeavor to pursue an unprecedented trade agreement with much of the Asia Pacific.

Keywords: China; neorealism; power; military modernization; security dilemma; arms transfers

**Limits of *In Vivo* Bioluminescence Imaging of Prostate Tumor Development: *Caveat Emptor***

Presenter: Derek White, Biomedical Engineering Graduate

Poster board: 61

Mentor(s): Hanli Liu

Group members: Ralph P. Mason (UT Southwestern)

**Abstract:**

Background: Imaging provides non-invasive insights into tumor growth, development, and response to therapy. It is fundamentally more efficient than traditional biopsy approaches. Optical imaging is particularly convenient by offering high throughput and sensitive assays of tumor development. *In vivo* bioluminescence imaging (BLI) is an optical imaging technique that has been used extensively in mice. However, I discovered that this is not the case in luciferase transfected human PC-3 (PC-3-luc) cancer cells implanted in adult nude rats.

Aim: To monitor the growth of prostate tumors implanted in rats, as a foundation for evaluating tumor radiobiology non-invasively.

Material and Methods: Human prostate PC-3 cells transfected to express the firefly luciferase reporter gene were implanted in adult male nude rats subcutaneously in the leg or orthotopically in the prostate and examined using *In vivo* BLI, ultrasound imaging (US), or mechanical calipers.

Results: Subcutaneous tumors were observed to grow in the leg, yet no BLI signal could be detected upon administering luciferin substrate. A second group of tumors was implanted with Matrigel™, and *in vivo* BLI signal was observed, but intriguingly it decreased with time in both implantation sites despite evidence of tumor growth determined by US or MR.

Conclusion: This study indicates that *In vivo* BLI must be used with caution. While reliable in mice, it appears that clonal selection or gene silencing may complicate measurements in rats.

*This work was supported in part by the R01 research funding (5R01CA139043-04) received from the National Cancer Institute.*

**Syntheses of Miscellaneous Azides and their Reactivity with N-Heterocyclic Carbenes**

Presenter: Kana White, Chemistry Senior

Poster board: 108

Mentor(s): Bugrin Alejandro

Group members: Siddapa Patil

**Abstract:**

Azides are a very valuable and versatile tool in organic chemistry due to their physical and chemical properties. It is known that azides can be used as; nucleophiles, intermediates in synthesis of organic and bioorganic compounds, and as starting materials in click chemistry. In this project various azides (alkyl, vinyl, acyl, aryl, sulfonyl, and heteroaryl) were synthesized in moderated to excellent yields. Different synthetic methods were employed for the preparation of azides. For example, for aliphatic azides, a SN2 was performed on their respective alkyl halide with sodium azide. Aryl azides were prepared by diazotization of aryl amines with sodium nitrite, in the presence of either hydrazine or sodium azide, under acidic conditions. Acyl and sulfonyl azides were synthesized via substitution from their corresponding chloride precursor. It was found that the products yields varied with different starting materials, as well as, the preparation method. These newly synthesized azides were then reacted with N-heterocyclic carbenes (NHC) to afford triazenes with a general formula (R1N=N-N=R2R2) and their physical and spectroscopy properties were studied.

**Examining the Rostral and Caudal Anterior Cingulate Cortex in Pain Processing**

Presenter: Michelle M. White, Psychology Graduate

Mentor(s): Perry N. Fuchs

Group members: Christopher T. McNabb, Celina A. Salcido

Poster board: 62

**Abstract:**

The anterior cingulate cortex is one of the brain regions that processes the emotional component of pain. Two regions of the anterior cingulate cortex, the rostral (rACC) and caudal (cACC) areas, may contribute differentially to pain behaviors. Lesions of the cACC have been shown to decrease formalin pain behavior, but it is currently unknown whether lesions of the rACC will alter formalin pain behavior. The purpose of this study was to examine whether lesions of the rACC and the cACC influence pain behaviors in the formalin test. Female rats were randomly assigned to one of four lesion conditions: rACC lesion, cACC lesion, rACC sham, or cACC sham. Following recovery from surgery, animals underwent formalin testing in which each animal received a subcutaneous injection of 0.05 mL of 1% formalin into the left hindpaw. The amount of time that each rat spent putting pressure on the hindpaw, raising the hindpaw, and licking the hindpaw was then recorded and compiled into an average pain score. Results indicated that sham lesions to the rACC and cACC were associated with higher formalin pain scores during the tonic phase of the test, showing that these animals experienced characteristic levels of pain. Both groups receiving lesions to the ACC displayed lowered pain scores in the tonic phase of the test. In the groups that received lesions to the cACC, there was a general trend towards significance ( $p = .098$ ), relative to shams. These results indicate that lesions of the rACC and cACC decrease formalin pain scores.

**Women & Compromise in U.S. Politics**

Presenter: Jarryd Willis, M.S., Psychology Graduate

Mentor(s): William Ickes

3:00 PM, Neches

**Abstract:**

Following the 2013 government shutdown, many senators, analysts, and news hosts stated that congresswomen were instrumental in shepherding through a resolution to the standoff. Because my dissertation experiment is going to focus on the issue of political compromise, I decided to empirically test whether or not congresswomen are less partisan in their voting behavior than congressmen.

Method.

Using the DW-NOMINATE dataset available at VoteView.com and Congressional information for the House of Representatives since 1967, I coded all the women as '2' and men as '1'. I started from 1967 because it would be harder to find significant results based on sex in previous Congresses (there simply weren't enough women elected yet).

The Polarization measure contained in this dataset ranges from -1 (Liberal) to +1 (Conservative), with greater scores reflecting party loyalty as a function of members' voting behavior (Hare and Poole, 2013; Keith Poole, 2008).

Results.

Republican women were less partisan than any other Party x Sex group from 1967-1994. Since 2003-2012, however, Republican women have been more partisan than all Democrats.

Republican men were less partisan than Democratic women from 1973-1978. From 1997-2012, however, Republican men have been more partisan than Democratic women.

Finally, data from the 112th (2011-2012) Congress reveals women in the House of Representatives were less partisan than men,  $F(1, 440)=4.71$ ,  $p=.031$ .

In short, Congressional data supports the conventional wisdom that women are less polarized and more likely to compromise than men.

**Neonatal Ketamine Exposure Causes Long-Lasting Deficit of Spatial Learning Associated with Impairment of Synaptic Plasticity in the Forebrain Cortex of Rats**

Presenter: Andrew Womack, Psychology Senior

Poster board: 102

Mentor(s): Qing Lin

Group members: Ruirui Wang, John Perish, Dan Lyu, Xiaojun Zou, Perry Fuchs, Qing Lin

**Abstract:**

Many studies reveal that prolonged ketamine exposure at clinically relevant doses causes and age-dependent apoptotic neurodegeneration in neonatal brains, which is suggested to link to a subsequent long lasting cognitive impairment. The neuroapoptosis is proposed to be initiated by compensatory upregulation of N-methyl-D-aspartate receptors (NMDARs), which leads to Ca<sup>2+</sup> overloading. In this study, we examined whether neonatal ketamine exposure induces impairment of spatial memory and further analyzed the long-term change in synaptic plasticity in the forebrain. Rats were repeatedly administered (subcutaneous injections) ketamine 6 times, at ages of 4-7 postnatal days (PND 4-7). At 3-4 weeks of age; 1) spatial learning and memory were evaluated behaviorally with the Morris Water Maze test; 2) change in synaptic plasticity was examined electrophysiologically by recording NMDAR-dependent long-term potentiation (LTP) in the forebrain slices *in vitro*. Spatial learning (measured by the Morris Water Maze spatial learning task) was impaired in rats that were neonatally treated with ketamine. This is evident by the prolonged latency and total time spent in the target quadrant. LTP was evoked by theta-burst stimulation (TBS) and sampled by recording NMDAR-mediated excitatory postsynaptic currents (EPSCs). In ketamine treated rats, LTP induction was suppressed substantially by the feature that the amplitude of NMDAR-mediated EPSCs was significantly inhibited. Based on these observations, we suggest that neonatal ketamine exposure causes alterations of NMDAR-mediated synaptic transmission in the forebrain cortical neurons that persist into adulthood. This can lead to long-lasting abnormalities in LTP, which is likely contributing to the deficit of learning and memory.

**Agency as Identity**

Presenter: Daria Woods, Philosophy & Humanities Senior

11:40 AM, Guadalupe

Mentor(s): Charles Hermes

**Abstract:**

The question most central to life concerns personal identity. Who am I? Daria Woods. What am I? A woman, a student, a sister. While these answers are true, they do not tell me anything about my fundamental identity. What is essential and indispensable to me being me? How we answer these questions have significant implications for one's moral, religious, political, and even scientific positions. When I decide to raise my hand, regardless of how my neurons fire, my muscles contract, and my hand reacts, it seems as though none of these was the cause of my decision. I am the agent that decided to raise my hand. My position is that identity is inextricably linked to this free will agency. I come to this conclusion by methodically removing secondary attributes of me through thought experimentation to find what is irremovable. This Cartesian conception of body-independent identity directly refutes Eric Olson's "An Argument for Animalism". Employing the class nominalist approach of Willard Quine, agency is also distinct from psychological brain functions, cognition, and consciousness. Ferdinand de Saussure and Harry Frankfurt's stringent linguistic analysis of meaning help to refine the connection between agency and identity. Finally, I explore the work of Robert Kane, Randolph Clarke, and others to expound on my position and address potential problems. I conclude that agency and identity are indispensable aspects of one another. While my position directly refutes and relies upon current free will and identity literature, there is currently no published position linking the two disciplines.

**Naturally derived biomimetic hydrogels for cartilage regeneration**

Presenter: Jinglei Wu, Biomedical Engineering Graduate

Mentor(s): Yi Hong

Group members: Qing Ding, Ahana Dutta

Poster board: 63

**Abstract:**

Osteoarthritis (OA) and meniscus injury are often met from injury and aging. In the USA alone, approximately 50 million people are affected by OA, and over 50% among them require replacing total joints, which cost approximately \$15 billion per year. Tissue engineering (TE) approach to cartilage regeneration has promises to repair damaged or diseased cartilage. Biodegradable scaffolds as one of key elements in TE are expected to offer a complex biological microenvironment mimicking with native tissue to promote cell ingrowth and tissue regeneration. However, current scaffolds cannot simulate the complex microenvironment of native cartilage. To the end, our group developed a biodegradable extracellular matrix (ECM) hydrogel derived from pig cartilages. The hydrogel contained complex components including collagen, glycosaminoglycan, growth factors and peptides, which were mimetic with biological components in the cartilage. This hydrogel solution was flowable at 4°C and formed a solid hydrogel at a body temperature, which is appropriate for non-invasive surgery. The mechanical properties of the hydrogels could be tuned by altering ECM concentration. The chondrocytes survived and proliferated inside the hydrogel with a round shape due to a good cellular microenvironment. The hydrogel solution was easily injected into a mouse subcutaneous model and formed a solidified hydrogel in vivo. No severe immunogenetic response was observed till to 7 day implantation, indicating a good biocompatibility. The attractive injectability and biomimetic complexity showed that the cartilage-derived hydrogel would be a good candidate to be applied for cartilage regeneration.

**Paired ion electrospray (PIESI) mass spectrometry for the highly sensitive determination of acidic pesticides in water**

Presenter: Chengdong Xu, Chemistry Graduate

Mentor(s): Daniel Armstrong

8:40 AM, San Saba

**Abstract:**

Inherently low response of acidic pesticides in negative ion mode ESI-MS brings difficulty for their direct analysis by mass spectrometry in trace amount. On the other hand, the often low concentration of pesticides in water requires the development of analytical approaches that allows for detection and quantification of pesticides with high sensitivity. Paired ion electrospray (PIESI) mass spectrometry involves the introduction of very low concentrations of a structurally optimized ion-pairing reagent (IPR) into the sample stream, and the anionic molecules can be measured in positive ion mode mass spectrometry with enhanced sensitivity. The anions associated with IPR through non-covalent interaction and form highly surface active complexes, which allows for a more efficient ionization and was proposed to be a main factor resulting in the significantly enhanced sensitivity in ESI-MS. The LOD of 19 pesticides obtained with the use the optimal dicationic ion-pairing reagent ranged from 0.6 pg to 19 pg, demonstrating a superior sensitivity usually 2 to 3 orders of magnitude compared with negative ion mode ESI-MS. Off-line solid-phase extraction (SPE) and high-performance liquid chromatography (HPLC) were conducted with PIEESI for the analysis of pond/river samples. 19 acidic pesticides were simultaneously quantified by using this technique at the low parts per trillion (ppt) levels

### **Blink Controlled Brain Machine Interface Using EEG**

Presenter: Oguz Yetkin, Biomedical Engineering Graduate

8:40 AM, Palo Pinto

Mentor(s): Mario Romero-Ortega

Group members: Kristi Wallace, Chelsea Mont

#### **Abstract:**

Individuals afflicted with disabilities (e.g. ALS, MS) can be paralyzed to the extent that they can only move their eyes or blink. They can't utilize traditional computer input devices or robotic manipulators. We have developed an electroencephalogram (EEG) based Brain Machine Interface (BMI) which detects the blinking of the user using the EEG blink artifact, allowing the user to control a remote camera.

The system works by successively flashing LEDs mounted on a monitor displaying the video feed. The user chooses the movement direction by blinking after the left or right LED. The system detects the EEG blink artifact from electrodes placed on the user's head, and utilizes the blink timing after the LED flash to move the camera in the desired direction.

We developed custom software and hardware to interface an Arduino UNO microcontroller to a BIOPAC MP-30 EEG system. We programmed the microcontroller to re-sample the EEG signal, isolate the blink artifact, detect whether a blink occurs after an LED flash, and drive a servo motor attached to the camera.

Our system has an average accuracy of 81.1% ( $\pm 6.94$ ) based on 90 trials performed on three subjects. Each subject responded to randomly generated instructions of "Right," "Left," or "Don't move" with the results recorded.

Our system can be extended to improve the lives of the disabled by allowing them to control more sophisticated multiple degree of freedom robotic manipulators, which has also been a long standing goal of BMI research.

### **Dynamic Managed Lane Pricing under Freeway Incident Conditions**

Presenter: Maryam Zabihi, Civil Engineering Graduate

Poster board: 64

Mentor(s): Siamak Ardekani

#### **Abstract:**

Excess capacity in High Occupancy Vehicle (HOV) lanes during congestion periods can be made available to other types of vehicles, including single occupancy vehicles for a price (toll). Such dual use lanes are typically referred to as Managed Lanes. The price may be varied depending on peak and non-peak periods. This study assesses the effectiveness of dynamically pricing managed lanes as an added strategy for incident management.

A seven-mile southbound segment of US-75 north of downtown Dallas with four free lanes and one HOV lane is selected as the study section. Traffic data of the 2010 AM peak is simulated by the Toll Pricing Model simulation package. Four pricing scenarios are developed including \$0.10/mile, \$0.25/mile, \$0.50/mile, and \$0.75/mile. First, volume split, toll revenue and managed lane operating speeds under normal condition for each scenario are predicted. The simulation is done again for the same levels of pricing under incident conditions on the free lanes (one of the adjacent free lanes is closed).

Comparing the volume splits, generated revenue, and managed lane operating speeds for normal versus incident conditions shows that the optimum price point for the generated revenue is different under each condition. The maximum revenue is generated at \$0.25/mile for non-incident condition, while for incident condition it occurs at \$0.75/mile during the same period. It concludes that dynamic pricing of managed lanes should be not only a function of time of day but also whether or not there are incidents on neighboring free lanes.

**Innovative Sensing Network for In Situ Monitoring of Biological Toxins and Harmful Algal Blooms**

Presenter: Hesam Zaman Khan Malayeri, Civil Engineering Graduate

Poster board: 65

Mentor(s): Hyeok Choi

Group members: Sungyong Jung

**Abstract:**

The increasing occurrence of harmful algal blooms (HABs) is of great concern to environmental and health authorities. There have been federal efforts to monitor HAB activities and toxin release. 1) On-site sampling followed by in-lab analysis, 2) Remote sensing relies on spectral analysis of color images taken from satellites to provide the large spatial scale and high frequency of observations. 3) In situ sensing of phycocyanin as an accessory pigment to chlorophyll often associated with HABs. Considering each observing system has its own advantages and limitations, we have attempted to compare and correlate the observing systems and HAB-associated data collected from Lake Erie (41 49.663; 83 11.649) where all of the three observing data are available. Based on the results of our study, there is a nice correlation between MC concentration measured by water sampling and HAB activities estimated by remote satellite image analysis but phycocyanin concentration has different trend. We aim at integrating the observing systems to reliably monitor HAB activities with high accuracy. In addition, comparison of the current observing information with data on actual biological toxins directly detected by an innovative in situ wireless sensing network we have been developing is in progress.

**Provenance of deltaic sandstone in the Fort Worth Basin: constraints from detrital zircon U-Pb geochronology**

Presenter: Juan Zamora, Geology Graduate

9:20 AM, Pedernales

Mentor(s): Majie Fan

Group members: Randy Griffin, Robert Stern

**Abstract:**

The Fort Worth Basin was formed by the flexural loading of the Ouachita fold-and-thrust belt, which is a mountain belt caused by the collision of Laurentia and Gondwana continents 350-250 million years ago (Ma). Despite the fact that the depositional environment of the sediments filling the Fort Worth Basin has been intensely studied for petroleum exploration and production, the provenance of the sediments remains controversial. Two major schools of thought include: 1) distal Appalachian mountain-sourced sediment dispersed westward into the Fort Worth Basin; 2) combined local sources from the basin-bounding Ouachita highland to the southeast of the basin and the mountains to the north of the basin. Therefore, constraints to the provenance of sandstones in the Fort Worth Basin can help to evaluate the two hypotheses. In addition, the timing of Gondwana-derived sediment may help to infer the tectonic processes forming the Ouachita fold-and-thrust belt. We apply detrital zircon U-Pb geochronology to determine the provenance of the deltaic sandstones 323-300 Ma old in the Fort Worth Basin, and compare their provenance with the deltaic sandstones ~500 Ma old formed in the southern margin of Laurentia. Seven samples were collected to document potential changes in sediment provenance. Maximum depositional age constrained from youngest zircon population may improve the age controls of the sedimentary rocks in the Fort Worth Basin. This research will shed light on the paleogeography and tectonic processes forming the Fort Worth Basin and the collision between Laurentia and Gondwana.

### **Development and evaluation of thermo-TDR probe**

Presenter: Nan Zhang, Civil Engineering Graduate

Mentor(s): Xinbao Yu

Group members: Asheesh Pradhan

**Poster board: 66**

#### **Abstract:**

In the design of shallow geothermal systems such as energy piles and ground source heat pumps, it is necessary to have accurate characterization of soil thermal properties. In general practice, soil thermal properties are estimated from design charts or semi-empirical models developed in the middle of last century. These methods do not consider site specific conditions and often result in inaccurate estimation. In this study, a new thermo-TDR probe was developed to accurately measure soil moisture content, dry density as well as thermal properties. Probe calibration was completed by testing five chemicals, NaCl and KCl solutions for dielectric constant ( $K_a$ ) and electrical conductivity (EC). Calibration relationships between  $K_a$ , EC and moisture content were obtained by linear regression analyses from four thermal probe tests on ASTM graded sand, Brown sand, Ottawa sand and Kaolin clay. Through the comparison of measured thermal properties between thermo-TDR probe and KD2 device, it has been proved that the thermo-TDR probe can be used to measure soil thermal properties satisfactorily. Based on the two calibration relationships, prediction in moisture content and dry density by Topp's equation, heat pulse method and "one step method" was also conducted and compared with each other. It is concluded that "one step method" has the highest prediction accuracy for estimating soil moisture content and dry density by thermo-TDR probe.

### **Spatiotemporal processing for fast image update of functional imaging probes**

Presenter: Cong Zhao, Physics Graduate

Mentor(s): Mingwu Jin

Group members: Jinming Wu

**11:00 AM, Palo Pinto**

#### **Abstract:**

A complete removal of the tumor tissue without excessive normal tissue damage is critical for the patient survival and quality of life. Functional imaging probes can provide the location, shape and size information of the occult tumors. However, these probes usually take a long acquisition time for good image quality, which limits their clinical adoption. In this work, we investigate the effectiveness of the advanced spatiotemporal processing to shorten the acquisition time of each image frame to be able to capture the object motion with good image quality. Spatiotemporal image processing is to add a temporal processing step to traditional spatial processing. The crucial step is to estimate the motion among the image frames from short acquisition and to apply temporal smoothing along the motion trajectory. We simulated beta imaging of a moving tumor phantom at different imaging dose levels for long (10-sec) and short (1-sec) acquisition time. Different spatial and spatiotemporal processing methods were applied to restore the image quality corrupted by noise. Quantitative measures for the image quality and tumor detectability were used to evaluate and compare different methods. The spatiotemporally processed images have better image quality than those with spatial smoothing only using either long or short acquisitions. Spatiotemporal processing also achieves almost the perfect detection performance and is affected little by the dose reduction. These results show that spatiotemporal processing is effective for fast image acquisition. The excellent detection performance at low-dose also indicates the feasibility of a sub-second acquisition.