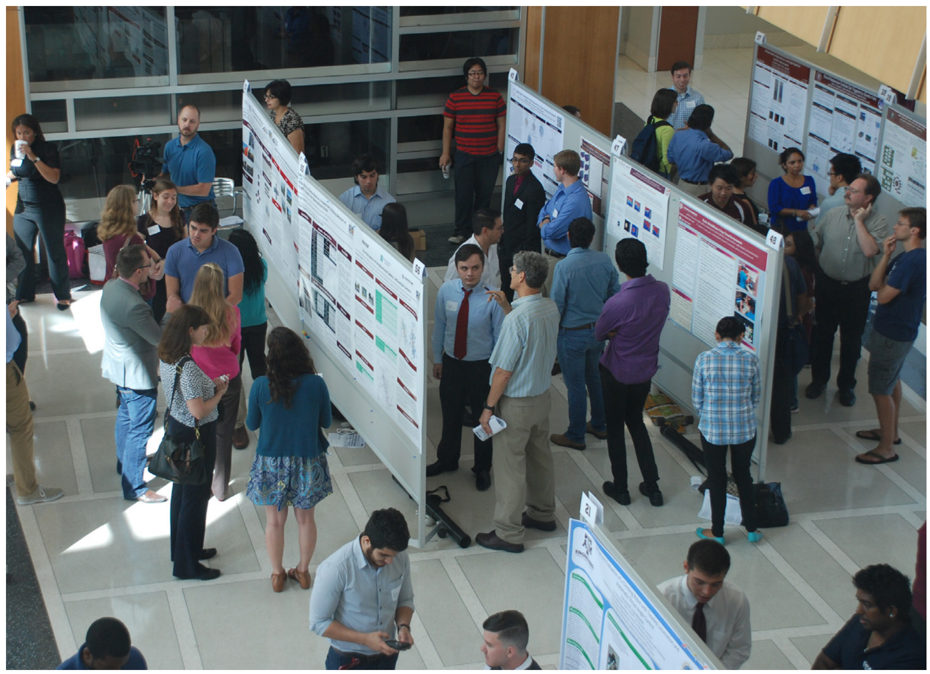
ABSTRACT BOOK

Undergraduate Research Summer Poster Session

Wednesday, August 3, 2016

Interdisciplinary Life Sciences Building Lobby



Physical Sciences and Engineering
10:00 AM – 12:00 PM

Life Sciences, Biomedical Sciences, Liberal Arts and Education
3:00 PM – 5:00 PM

LAUNCH
Undergraduate Research

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TEXAS A&M UNIVERSITY

Undergraduate Research Summer Poster Session

Wednesday, August 3, 2016
Interdisciplinary Life Sciences Building Lobby

Physical Sciences and Engineering

10:00 AM – 12:00 PM

Featured Summer Programs: *Astronomical Research and Instrumentation REU, Chemistry REU: Biological, Green, and Materials Chemistry Research, TURC: Texas A&M Undergraduate Research in Chemistry, Cyclotron REU, TTI ATLAS Summer Internships, Engineering Technology & Industrial Distribution REU: Mechatronics, Robotics, and Automated System Design, Transportation Summer Scholars, Research Intensive Community for Undergraduates (RICU) Summer Program*

Life Sciences, Biomedical Sciences, Liberal Arts and Education

3:00 PM – 5:00 PM

Featured Summer Programs: *Beckman Scholars Program, Biochemistry REU: Summer Undergraduate Research Program in Biochemistry, Cyber-Health GIS REU, TAMHSC COM Summer Undergraduate Research Program, DeBakey Undergraduate Research Program, Engineering Undergraduate Summer Research Grant (USRG) Program, Aggie Research Scholars, Research Intensive Community for Undergraduates (RICU) Summer Program*

Physical Sciences and Engineering

10:00 AM – 12:00 PM

Poster # 1

DuOCam: A Two-Channel Camera for Simultaneous Photometric Observations of Stellar Clusters

Emily Witt (St. Olaf College); Erin Maier (University of Iowa)

Astronomical Research and Instrumentation REU

Research Advisor: Dr. Darren Depoy

We have designed the Dual Observation Camera (DuOCam), which is capable of simultaneous photometric observations at red and blue wavelengths. The instrument was designed for implementation on the .9 m, f/13.5 telescope at McDonald Observatory. Light collected by the telescope passes into DuOCam's optical assembly, where it is collimated, split into red and blue wavelengths and focused onto two independent charge-coupled devices (CCDs). In order to test the effectiveness of the camera, observations of both open and globular stellar clusters were carried out at McDonald Observatory. The resulting data was used to construct R vs. B-R color-magnitude diagrams for each cluster. Using isochrone fitting, the age, metallicity, and distance of each cluster will be determined.

Poster # 2

The Search for RR Lyrae in the Dark Energy Survey

Chandler Nielsen (Purdue University)

Astronomical Research and Instrumentation REU

Research Advisor: Dr. Jennifer Marshall and Dr. James Long

RR Lyrae variables are stars with a characteristic relationship between magnitude and phase and whose distance can be easily determined, making them extremely valuable in mapping and analyzing galactic substructure. We present our method of searching for RR Lyrae variable stars using data extracted from the Dark Energy Survey (DES). The DES probes for stars as faint as $i = 24.3$. Finding such distant RR Lyrae allows for the discovery of objects such as dwarf spheroidal tidal streams and dwarf galaxies; in fact, at least one RR Lyrae has been discovered in each of the probed dwarf spheroidal galaxies orbiting the Milky Way (Baker & Willman 2015). In turn, these discoveries may ultimately resolve the well-known missing satellite problem, in which theoretical simulations of galaxies predict many more dwarf satellites than observed in the local Universe. Using the Lomb-Scargle periodogram to determine the period of the star being analyzed, we could display the relationship between magnitude and phase and visually determine if the star being analyzed was an RR Lyrae. We began the search in frequently observed regions of the DES footprint, known as the supernova fields. We then moved our search to known dwarf galaxies found during the second year of the DES. Unfortunately, we did not discover RR Lyrae in the probed dwarf galaxies; this method should be tried again once more observations are taken in the DES.

Poster # 3

Supernova Classification Using Swift UVOT Photometry

Madison Smith (New College of Florida)

Astronomical Research and Instrumentation REU

Research Advisor: Dr. Peter Brown

With the great influx of supernova discoveries over the past few years, the observation time needed to acquire the spectroscopic data needed to classify supernova by type has become unobtainable. Instead, using the photometry of supernovae could greatly reduce the amount of time between discovery and classification. For this project we looked at the relationship between colors and supernova types through machine learning packages in Python. Using data from the Swift Ultraviolet/Optical Telescope (UVOT), each photometric point was assigned values corresponding to colors, absolute magnitudes, and the relative times from the peak brightness in several filters. These values were fed into three classifying methods, the nearest neighbors, decision tree, and random forest methods. We will discuss the success of these classification systems, the optimal filters for photometric classification, and ways to improve the classification.

Poster # 4

Measuring Stellar Kinematics in the S0 Galaxy NGC 4203

Zuzana Calbo (Hofstra University)

Astronomical Research and Instrumentation REU

Research Advisor: Dr. Jonelle Walsh

At the center of every massive galaxy lies a black hole. The masses of black holes have been found to depend on the large-scale properties of the galaxy, which suggests that black holes and galaxies evolve together over time. However, there are very few objects at the low-mass end of the black hole-host galaxy relations. Here we present measurements of the stellar kinematics of NGC 4203, an S0 galaxy possibly harboring a $< 5 \times 10^7$ solar mass black hole. Data used in this study were taken with the integral-field spectrograph OSIRIS, assisted by adaptive optics, on the Keck II telescope in the near infrared. We fit the observed galaxy spectra with template stars to extract the velocity, velocity dispersion, and higher-order moments within ~100 pc of the galaxy nucleus. We find that the galaxy is rotating and there appears to be a drop in the stellar velocity dispersion at the center of the galaxy. The stellar kinematics on these small spatial scales are an excellent tracer of the inner galaxy potential and are essential for a robust determination of the NGC 4203 black hole mass.

Poster # 5

Identifying Galaxy Mergers in the Distant Universe Using the Hubble Space Telescope

Crystal-Lynn Bartier (Utah Valley University)

Astronomical Research and Instrumentation REU

Research Advisor: Dr. Kim-Vy Tran

By studying galaxy clusters we can better understand the evolution of galaxies and how interactions between galaxies can change their morphology. In clusters, galaxies evolve through close interactions and merging together. Here we present the results of finding mergers in the IRC0222A cluster with a look-back time of 9.2 billion years and the IR0222B cluster with a look-back time of 9.9 billion years. The Hubble Space Telescope (HST) imaged both clusters in three different filters. Grism observations were used to obtain the look-back time for galaxies in both clusters. Galaxy mergers in both clusters were identified by measuring the flux of each individual object and using a search radius to constrain the distance between objects. The mergers were crosschecked with mergers that have previously been visually identified. We measure a merger fraction of approximately 39% for IRC0222A and 49% for IRC0222B.

Poster # 6

Eat Your Veggies: Green Pea Galaxy Abundance at Redshifts of 1.0 – 2.3

Madeline Horn (Smith College)

Astronomical Research and Instrumentation REU

Research Advisor: Dr. Casey Papovich

We investigate starbursting, compact Green Pea galaxies at a z of 1.0 − 2.3 using the ZFOURGE Survey conducted on the 6.5 m Magellan Baade telescope. Little is understood about these Green Pea galaxies that are classified by their strong [OIII] lines (5007Å and 4959Å). We model the theoretical colors of starbursting sources, using the Starburst99 stellar population synthesis model, where we add the effects of nebular emission. We then select objects that have broad-band colors indicative of having a strong emission line in one of the bands. We search for Green Peas in color-color space using the J1, J2, J3, Hs, and Hl bands from ZFOURGE, effectively identifying galaxies with strong emission lines, down to stellar masses of $10^{8} - 10^{9.5}$ Msol. We find that these Green Peas are much more isolated in low-mass galaxies typically ranging from masses of $10^{8} - 10^{9.5}$ Msol. These green peas are typically more concentrated at lower redshifts, ranging from 8% at low z and about 1% at higher z.

Poster # 7

Probing the Debris Disks of Nearby Stars with the Fermi Gamma-Ray Space Telescope

Alexander Riley (University of Texas at Dallas)

Astronomical Research and Instrumentation REU

Research Advisor: Dr. Louis E. Strigari

Many nearby stars are known to host circumstellar debris disks, similar to our Sun's asteroid and Kuiper belts, that are believed to be the birthplace of extrasolar planets. The asteroids in these debris disks give off gamma radiation resulting from interactions with cosmic rays from their host star, as previously observed from measurements of the gamma ray albedo of the Moon. We present the results of applying a point source analysis to four of these nearby debris disks using the past nearly-eight years of data taken by the Fermi Gamma-ray Space Telescope. Through this analysis, we obtain upper limits on the gamma ray flux from these debris disks that provide constraints on the physical parameters of the disk.

Poster # 8

Natural Product-Based Engineering Polymers: A Special Emphasis Toward (Degradable) Materials for Orthopedic, Drug Delivery, and Other Applications

Brooke Versaw (Texas A&M University)

Beckman Scholars Program

Research Advisor: Dr. Karen L. Wooley

Recent demand for sustainable commodity plastics has prompted interest in the development of new classes of naturally-derived engineering polymers. The natural product quinic acid is of particular interest as a starting material for these types of polymers, as it is readily found in coffee, tree bark, and a variety of green vegetables; moreover, it provides an alternative to traditional petroleum-based starting materials. In this presentation, advances towards the conversion of quinic acid into mechanically-tunable crosslinked composite materials will be discussed. Quinic acid was first functionalized to afford the trifunctional monomer tris(alloc)quinic acid (TAQA). Crosslinked polycarbonate networks were then fabricated from the TAQA monomer and a range of complementary comonomers using rapid, solvent-free reactions. To expand the versatility of these materials, composites were made with nanocrystalline cellulose. These polycarbonate network composites allow for the rapid production of biocompatible and biodegradable materials suitable for a wide range of applications in industry and biomedicine, including orthopedic implants.

Poster # 9

Discovery of New Thiaminase I-producing Bacteria

Elizabeth Kelley (College of William and Mary)

Chemistry REU: Biological, Green, and Materials Chemistry Research

Research Advisor: Dr. Tadhg Begley

Thiaminases I & II comprise the known thiaminase protein class, a group of enzymes which degrade thiamin (vitamin B1) by splitting the pyrimidine and thiazole moieties. Rendering thiamin biologically inactive, thiaminase-producing organisms cause debilitating and potentially fatal disorders across the animal kingdom. Well-documented case studies of thiamin deficiency disasters in humans, livestock, and marine ecosystems have established the dangers thiaminases pose to public health and agricultural infrastructure. The successful application of screening protocols on soil bacteria for the detection of thiamin degradation has led to the discovery of heretofore unknown thiaminase I-producing bacteria. Using the Prebluda-McCollum diazo reagent, bacterial colonies on agar plates were screened for thiamin degradation capabilities. Positive hits were further subjected to HPLC analysis to confirm thiaminase I activity specifically and to probe the fates of the pyrimidine and thiazole moieties. The thiaminase I-producing strains discovered are reported here.

Poster # 10

Synthesis and Reactivity Studies of Rhodium Complexes Supported by a PNSi Pincer Ligand

Benjamin Morse (Ithaca College)

Chemistry REU: Biological, Green, and Materials Chemistry Research

Research Advisor: Dr. Oleg Ozerov

Group nine metals ligated by tridentate "pincer" ligands have attracted substantial attention as potential catalysts for carbon-carbon and carbon-heteroatom coupling. Recently, while investigating rhodium and iridium complexes supported by the SiNN pincer architecture as catalysts for the dehydrogenative borylation of terminal alkynes, our group showed that the silyl functionality could bind on a gradient between silyl hydride and traditional L type sigma donation. However, it was unclear if this interaction affected the catalytic cycle. We sought to further investigate pincer complexes featuring SiH donors. Herein we report the synthesis and preliminary reactivity studies of the PNSi ligated complex (PNSi)Rh(COE) (COE=cyclooctene), where PNSi is an analogue of the bisphosphinodiarylamido PNP ligand with one phosphine donor replaced by a silyl group. Carbon monoxide displaces both the olefin and the SiH resulting in a dicarbonyl product that converts to a monocarbonyl pincer complex when exposed to vacuum. Unlike (PNP)Rh(L) species, which undergo oxidative addition with phenyl halides to form five coordinate Rh(III) species, the PNSi complex releases the SiH from the pincer with concomitant generation of benzene. In an attempt to produce a stable six coordinate oxidative addition product (PNSi)Rh(COE) was reacted with o-bromonitrobenzene. Complexes containing a non-olefin L type ligand could be accessed, with varying degrees of success, by substitution of COE for sulfide and phosphite. Using a variety of NMR techniques, we have been able to observe the SiH interaction with the metal.

Poster # 11

13C Kinetic Isotope Effects and the Mechanism of the Cope-Type Hydroammination of Alkynes

Rosalyn Rivera (Stockton University)

Chemistry REU: Biological, Green, and Materials Chemistry Research

Research Advisor: Dr. Daniel Singleton

The mechanism for the Cope-Type Hydroamination between alkynes and hydroxylamine by a combination of 13C intermolecular kinetic isotope effects (KIEs) and theoretical calculations. Conventional transition state theory fails to predict the isotope effects observed experimentally. However, an extensive computational study using different methods showed that there is a possibility that the solvent could be catalyzing the product formation, explaining the observed KIEs. Other experimental and theoretical studies are still in progress in order to fully understand the selectivity and isotope effects for this reaction.

Poster # 12

Synthesis and Characterization of Lewis Acidic Antimony(V) Species

Nicolas Capra (SUNY Oneonta)

Chemistry REU: Biological, Green, and Materials Chemistry Research

Research Advisor: Dr. Francois Gabbaï

Lewis acidic materials play important roles in catalytic bond activation and chemical sensing. Coordination of electron-rich heteroatoms to Lewis acids increases the susceptibility of adjacent carbon atoms to nucleophilic attack, making them primary candidates for the catalysis of carbonyl and ring-opening mechanisms. Substitution of Lewis acidic centers within chromophores has produced a number of powerful sensors for various Lewis bases, including fluoride anion. Antimony(V) metal centers can exhibit strong Lewis acidity within a variety of tunable organic frameworks. One such compound, *diphenyl antimony trichloride* (Ph_2SbCl_3), is highly Lewis acidic and resistant to hydrolysis and degradation in air. We have characterized the binding behavior of Ph_2SbCl_3 with fluoride anion via 1H and 19F NMR and obtained preliminary evidence for the activation of carbonyl bonds by coordination with the Lewis acidic Ph_2SbCl_3 center. Synthetic methods to substitute Ph_2SbCl_3 within bicyclic frameworks have also been investigated in efforts to create new fluorescent sensors for Lewis bases and reactive oxygen species.

Poster # 13

Chemical Conjugation of Rare Earth Oxychlorides Nanoplatelets to Hybrid Organic-Inorganic Perovskite Nanoplatelets for Solid-State Lighting Applications

Freddy A. Rodriguez Ortiz (University of Puerto Rico at Cayey)

Chemistry REU: Biological, Green, and Materials Chemistry Research

Research Advisor: Dr. Sarbajit Banerjee

Surface modification of inorganic nanocrystals (NCs) has attracted a great attention in numerous applications ranging from developing optical and electronic devices to cellular imaging and biological sensing. The strategies developed thus far for achieving surface-functionalization of inorganic NCs can be mainly categorized into ligand exchange of the original surface capping ligands with bifunctional groups and encapsulation of the hydrophobic surface of as-synthesized NCs with amphiphilic polymers. Here, we adopt these two strategies and demonstrate the surface-functionalization of Eu0.10La0.90OCl nanoplatelets (NPs) through ligand exchange utilizing L-cysteine or polymer encapsulation with octylamine-modified poly (acrylic acid), respectively. We further demonstrate NPs cross-linking of the surface-functionalized Eu^{3+} doped LaOCl NPs with hybrid organic–inorganic perovskite NPs in an amide coupling reaction using the 1-Ethyl-3-(3-dimethylaminopropyl) carbodiimide (EDC). The use of EDC as a coupling reagent provide an inexpensive, nontoxic, and efficient route to direct condensation of the free carboxylic acid group on the surface of Eu^{3+} doped LaOCl NPs and a free amine group on the surface of the hybrid perovskite NPs. Chemically cross-linked products were characterized by Fourier-transform infrared (FTIR), transmission electron microscopy (TEM) and spectrofluorometry. In particular, high resolution TEM image of cross-linked NPs shows stacking of Eu0.10La0.90OCl NPs and aggregation of hybrid perovskite NPs. The emission photoluminescence spectra of cross-linked NPs by polymer encapsulation show the emission of both NPs while energy transfer seems to take place from the energy donor hybrid perovskite to energy acceptor Eu^{3+} doped LaOCl. The results suggest that we can have a better well-defined morphologies and photoluminescence emission of cross-linked NPs on the basis of polymer encapsulation approach, which provide the novel design and application of future solid state lighting.

Poster # 14

A New Way to Catalyze the Reduction of Oxygen into Hydrogen Peroxide

Universite de Lajeune, Sebastien (ENSCMu, Universite de Haute Alsace)

Chemistry REU: Biological, Green, and Materials Chemistry Research

Research Advisor: Dr. Francois Gabbaï

Triaarylmethylium cations are generally stable species which undergo reversible reduction to produce the corresponding radicals. Owing to their open shell electronic structures, these radicals are reactive. In particular, they react with O_2 to form the corresponding peroxide. This chemistry has also been shown to occur with bis(methylium) species. In this case, reduction of the dication by two electrons followed by reaction with O_2 results in the formation of the peroxide whose formation should be favored by the bimolecular as opposed to termolecular nature of the reaction. The formation of the peroxide can also be followed electrochemically using cyclic voltammetry. In this project, we have decided to determine if the chemistry displayed by these bis(methylium) cations toward oxygen in the presence of a reducing agent could be the basis of a system for the electrocatalytic reduction of O_2 into hydrogen peroxide. This idea has been explored by studying the cyclic voltammogram of several dication under O_2 and in the presence of an acid whose role is to liberate H_2O_2 and regenerate the dication. To assess the importance of the preorganization of the two elelctroactive methylium units in a single molecule, we have also compared the behavior of the selected dications with that of a model mono-methylium system. Our results demonstrate that these cationic systems are effective electrocatalysts for the reduction of O_2. Surprisingly, however, we found that the use of a dication is not essential since a higher catalytic current was observed with mono-methylium species, albeit at higher acid concentrations.

Poster # 15

Antimony(V) Derivatives as Oxidation Catalysts

University of Laurent, Mazarine (ENSCMu, University of Haute Alsace)

Chemistry REU: Biological, Green, and Materials Chemistry Research

Research Advisor: Dr. Francois Gabbaï

Molecules that activate dioxygen (O_2) are attracting a great deal of attention not only as mimics of biological oxygen transport systems but also as catalysts for oxidation reactions. While high valent main group compounds may be potent oxidizing agents, we have decided to investigate a class of antimony(V) derivatives which can are known to reversibly react with oxygen in order to determine if these derivatives could be used to catalyze oxidation reactions. This idea has been tested using triphenylphosphine as the substrate. Using NMR (nuclear magnetic resonance), the oxidation of PPh_3 (triphenylphosphine) to $OPPh_3$ (triphenylphosphine oxide) has been investigated under both thermal and photolytic conditions with antimony (V) derivatives as catalysts. Our finding indicate that UV irradiation greatly accelerate these catalytic oxidation reaction when carried out under air. However, the best results are obtained upon thermal activation of the system using a high boiling solvent such as toluene.

Poster # 16

Covalent Immobilization of Graphene on Patterned SAMs for Investigation of Frictional Properties

Morgan Grandon (Truman State University)

Chemistry REU: Biological, Green, and Materials Chemistry Research

Research Advisor: Dr. James Batteas

To help reduce the amount of energy lost at sliding interfaces, such as in the production of electricity, it is imperative to minimize friction and wear. This is challenging because nanoscopic surface roughness generates regions of high contact pressures and shear forces that enhance the adverse effects associated with friction and wear. Graphene, a two-dimensional sp^2-hybridized carbon material, is a promising solid lubricant for such harsh environments because of its high mechanical strength. The frictional properties of graphene depend on its interactions with the underlying substrate. To control these interactions, self-assembled monolayers (SAMs) can be used to alter the surface chemistry. The study here explores the impact of van der Waals adhesion vs. covalent binding interactions between graphene and the supporting surface. This is done utilizing a mixed SAM of octadecyltrichlorosilane (OTS) and a perfluorophenyl azide (PFPA) templated through particle lithography. The composition of the SAM was confirmed using attenuated total reflectance Fourier transform infrared spectroscopy (ATR-FTIR). Single-layer graphene was mechanically exfoliated on the patterned SAMs and was identified by a combination of Raman microspectroscopy and atomic force microscopy (AFM). Friction force microscopy (FFM) was used to investigate the frictional properties of the composite surface. Preliminary results showed that graphene overlaid on the patterned SAMs had lower friction than exposed OTS or PFPA, however, there was no discernible difference between the covalently bound and the van der Waals adhered graphene under low loads (5 nN).

Poster # 17

Chemical Cross-linking of the Human Fe-S Assembly Complex

Luis Macias (Houston Baptist University)

Chemistry REU: Biological, Green, and Materials Chemistry Research

Research Advisor: Dr. David Barondeau

Iron-sulfur (Fe-S) clusters serve as protein cofactors in essential biological processes such as enzyme catalysis, electron transport, and monitoring of intracellular conditions. *In vivo* Fe-S cluster assembly is a complex biosynthetic process. Recent evidence suggests major differences between the well-understood bacterial and eukaryotic Fe-S assembly systems. In humans, the structural core of the mitochondrial Fe-S assembly system (SDA) is composed of NFS1, ISD11 and ACP and interacts with the accessory proteins ISCU2, FDX2 and FXN to synthesize Fe-S cluster intermediates for transfer to acceptor proteins. Structural and mechanistic details for the eukaryotic Fe-S assembly complexes are still poorly understood. Here, we applied two strategies to obtain structural information for these assembly complexes. First, chemical cross-linking experiments were performed to identify interacting residues across protein-protein interfaces. Subunits in the SDA complexes, both in the presence and absence of ISCU2 and FXN, were covalently attached using the amine-to-amine crosslinker BS3 and the carboxyl to amine crosslinker EDC. The crosslinked products were digested either in solution or in gel, by either trypsin or chymotrypsin and analyzed by LC-ESI-MS/MS to identify interacting residues. SDS-PAGE was used to optimize the crosslinking conditions, and to analyze and digest the crosslinked products. Second, we explored structural details of the SDA complex through co-crystallization trials with the substrate cysteine. Overall, these results may assist in understanding structure-function properties for this critical biosynthetic system and elucidating how defects in the core component and accessory proteins are associated with human diseases such as Friedrich’s ataxias and ISCU myopathy.

Poster # 18

High Temperature Stability and Sintering of $CsPbBr_3$ Perovskites

Rachel Downing (Western Carolina University)

Chemistry REU: Biological, Green, and Materials Chemistry Research

Research Advisor: Dr. Matthew Sheldon

In the last few years, both hybrid organic-inorganic and completely inorganic lead halide based perovskites have been of strong interest to the chemical research community. Both types of perovskites exhibit strong optical emission tunability due to the behavior and interchangeability of the halides. Lead halide based perovskites also demonstrate high photoluminescent quantum yields. Despite the large amount of attention given to the optical characteristics of these perovskites, little is known about their structural properties. Both cubic and orthorhombic structures have been suggested as the stable room temperature condition of the perovskites. In this work, we synthesize and study the inorganic perovskite nanocrystal, cesium lead bromide ($CsPbBr_3$). Through structural studies, we confirm orthorhombic as the room temperature stable solid-state phase of $CsPbBr_3$ and map its phase up to 200ºC. Sintering of the nanocrystal occurs around 160ºC. Despite becoming a bulk material, it is observed that $CsPbBr_3$ maintains its orthorhombic characteristics up through 200ºC.

Poster # 19

PIB-Bound Pybox Ligands

Morgan Gulley (Monmouth College)

Chemistry REU: Biological, Green, and Materials Chemistry Research

Research Advisor: Dr. David Bergbreiter

The goal of this project was to prepare chiral chelating ligands that could be coupled to a polyisobutylene (PIB). The product ligands and their metal complexes would then be phase separable, recoverable catalysts for organic reactions. These materials would be greener catalysts because PIB is a non-toxic, non-polar, commercially available polymer that is soluble in non-polar solvents such as heptane and insoluble in polar solvents such as dimethylformamide (DMF) or ethanol. While we did not complete the synthesis of the desired chiral Pybox ligands, we were able to prepare precursors that did have PIB groups attached. We were able to use these precursors to test the hypothesis that the PIB-bound species will be phase separable in thermomorphic solvent mixtures. These trace analyses used 1H NMR spectroscopy, studying leaching of the ligand by comparing the intensity of ligand peaks to the 13C satellite peaks for DMF and showed that leaching of ligands was ca. 10 wt% in a heptane/DMF mixture. Future studies will examine other solvent mixtures to further reduce this leaching and will include completion of the synthesis of the chiral Pybox ligands and catalysts.

Poster # 20

Synthesis and Analysis of Superparamagnetic Bridged Lanthanide(III) Complexes

Tia'Asia James (University of Arkansas at Pine Bluff)

Chemistry REU: Biological, Green, and Materials Chemistry Research

Research Advisor: Dr. Kim Dunbar

Single molecule magnets (SMMs) are a class of molecular compounds that manifest superparamagnetic behavior below a discrete blocking temperature. The development of research in the field of SMMs promises to engender essential advancements in diverse applications, such as data storage, molecular spintronics, and quantum computing. In this project, attempts to synthesize [Dy(hfac3]2(bptz), [Dy(hfac)3]2(Me4bpym), and [Dy(hfac)3]2(bmtz) (hfac=hexafluoroacetylacetonate, bptz=3,6-bis(2-pyridyl)-1,2,4,5-tetrazine, bmtz=3,6-bis(2-pyrimidyl)-1,2,4,5-tetrazine, Me4bpym=4,4',6,6'-Tetramethyl-2,2'-Bipyrimidine) are described. Synthesis of the neutral and radical form of these compounds will facilitate an understanding of the effects the radicals will have on the strength of the large spin-orbit coupling properties of dysprosium. Once both are synthesized, the neutral compound will be used as a comparison to the radical compound to compare their magnetic responses directly. [Dy(hfac)3]2(bptz) compound was structurally characterized by X-ray crystallography and its SMM properties were magnetically characterized by the SQUID magnetometry.

Poster # 21

Synthesis of Giant Molecular Rhodium-Based Gyroscopes as Potential Candidates for Further Study of Homeomorphic Isomerization

Zachary Patton (Transylvania University)

Chemistry REU: Biological, Green, and Materials Chemistry Research

Research Advisor: Dr. John A. Gladysz

Over the course of human history, gyroscopes have evolved from decorations to navigation instruments to technological devices responsible for the motion-sensing properties in tablets and smartphones. While several metal-based gyroscopes have been made, this project focuses on the synthesis of giant rhodium gyroscopes with dibridgehead diphosphines containing aryl ethers. Within the time frame of this project, $Br(C_6H_4)O(CH_2)_4CH{=}CH_2$(1, 83.4%), $P[(C_6H_4)O(CH_2)_4CH{=}CH_2]_3$ (2, 72.1%), and the trans-Rh(CO)(Cl)[$(C_6H_4)O(CH_2)_4CH{=}CH_2]_2$ (3, 46%) were synthesized. Future work involves alkene metathesis, which connects the phosphine chains to form the gyroscope cage Furthermore, treatment with PMe_3 should remove the rhodium from the gyroscope allowing the study of homeomorphic isomerization, a phenomena best described as molecular self-inversion.

Poster # 22

Biosynthetic Study of the Formation of the Azinomycin Epoxide Moiety and Assembling of Survivin-Thiaminase Constructs

Marta Antoniv (Hamilton College)

Chemistry REU: Biological, Green, and Materials Chemistry Research

Research Advisor: Dr. Coran Watanabe

The azinomycins, bioactive compounds produced by the bacteria Streptomyces sahachiroi, exhibit antitumor activity and show promise as anti-cancer agents. To continue previous investigation of the biosynthetic pathway to the azinomycin epoxide moiety, the understood precursor to the epoxide fraction was synthesized. Further studies will use the precursor molecule and the gene associated with azinomycin's epoxide formation to confirm the hypothesized synthetic pathway. Deeper understanding of the biosynthetic pathway of the azinomycins may develop a stronger vision for the development of anti-cancer agents. It is also of great interest to develop methods to selectively target cancer cells, which may be done by developing survivin-thiaminase constructs. The survivin gene is over expressed in a variety of cancers and acts by inhibiting cell apoptosis. We aimed to link the survivin gene promoter to thiaminase, an enzyme that degrades thiamin (vitamin B1), with the goal of over-expressing thiaminase. The over-expression of thiaminase leads to cell death via the degeneration of vitamin B1. This method leaves healthy cells untouched as normal cells do no express survivin. Survivin was digested from the vector pUC57 using Sal1 and EcoRI restriction enzymes. It was then linked to pTRE3G-thiaminase, but sequencing results have not yet confirmed the construct. Linkage of survivin to thiaminase presents a possible method for the selective killing of cancer cells.

Poster # 23

Ion Imaging of the Photodissociation of OCS At 230nm

James Johnstone (Abilene Christian University)

Chemistry REU: Biological, Green, and Materials Chemistry Research

Research Advisor: Dr. Simon North

OCS is an important sulfur-containing atmospheric molecule and is also commonly used for the study of gas phase reaction dynamics because of its simple structure. Previous studies have been carried out concerning the photodissociation of the molecule OCS using a wide range of dissociation wavelengths of UV light. Every study has shown the resulting CO fragment from the dissociation to be rotationally hot and vibrationally cold. This matches the predicted dissociation dynamics based on the bond length of the CO fragment which is static throughout the reaction. A recent study done at Texas A&M University concerning the photodissociation and ionization of OCS using 215nm light, however, found a significantly higher vibrational excitation than previous studies. This experiment looked at the photodissociation of OCS using 230nm light using Velocity Map Ion Imaging (VELMI) in an attempt to clarify these results. This study found evidence for higher amounts of V=1 CO fragments than had previously been seen at 230nm. Further study is needed to determine the origin of this vibrational excitation.

Poster # 24

Synthesis of Biphenyl and Terphenyl Precursor for the Use of Pi-Conjugated Macrocyclic Molecular Belts (cMMBs)

Troy Olson (University of Texas Rio Grande Valley)

Chemistry REU: Biological, Green, and Materials Chemistry Research

Research Advisor: Dr. Lei Fang

Pi-Conjugated Macrocyclic Molecular Belts (cMMBs) have the potential to open up exciting new opportunities in organic polymer chemistry. A new approach to synthesizing these cMMBs involves the utilization of polyphenyl molecules as molecular precursors. Through the use of various polyphenyls, the synthesis of cMMBs becomes a highly controllable reaction, allowing for the formation of anywhere from eight to fourteen aromatic ring belts. With the ability to control the size of the cMMB, polyphenyl precursors become the ideal mechanism for the synthesis of cMMBs. Results show that this reaction, when optimized, can yield twelve ring belts capable of acting as a host material for large carbon-based molecules.

Poster # 25

Gold Deposition of $CsPbBr_3$ Metal Halide Perovskite Nanoparticles

Joseph Otto (Texas A&M University)

TURC: Texas A&M Undergraduate Research in Chemistry

Research Advisor: Dr. Matthew Sheldon

Metal halide perovskites are a new and highly fluorescent material with a tunable band edge across the visible spectrum, and can be used for increasing the efficiencies of solar cells. We have accomplished gold deposition onto cesium lead trihalide perovskites via a slow injection method. The analysis and characterization of these gold deposited perovskites can be used to learn more about the characteristics of perovskites in general as well as the metal/semiconductor interface. Analysis of the perovskites after the gold deposition shows a broadened band edge and a quenched fluorescence, both of which are common characteristics of metal deposition in other semiconductor nanoparticle systems such as chalcogenides. The metal deposition can be seen by the contrast between the gold and perovskites in the images collected by Transmission Electron Microscopy (TEM). In the TEM images, preferential gold deposition on the corners and edges of the perovskites is observed, most likely due to the increased concentration of defect states on the ends of nanoparticles. Future work will focus on attempting the gold deposition procedure on other metal halide perovskites such as $CsPbI_3$ and $CsPbCl_3$ to further increase our knowledge of the metal halide perovskite system.

Poster # 26

Evaluation of Molecular Ion Emission from Gold Nanoparticle Impacts at Hypervelocity

Anita Vinjamuri (Texas A&M University)

TURC: Texas A&M Undergraduate Research in Chemistry

Research Advisor: Dr. Emile Schweikert

The Schweikert laboratory has pioneered a novel nano-ananlysis technique, where a solid surface is bombarded with a sequence of individual "nanoprojectiles" each containing a few to a hundred atoms of gold e.g. Au^{9+}, Au_{400}^{+4}. One impact at hypervelocity (~30km/s) causes emission of ionized fragments and molecules from an area of 10-15 nm in diameter and ~10 nm in depth. The ejecta from the nano-volume are identified with a reflection time-of-flight mass spectrometer. For nano-projectiles up to Au_{400}^{+4} (n/q=100) the intensity of the ion emission increases with projectile momentum. In this study we explode the ion emission from the impact of a still more massive gold projectile, specifically Au_{2100}^{+6} (n/q=350). The question at hand is, will molecular ion emission continue to increase or will fragmentation take over. Glycine and Gramicidin S were bombarded with both Au_{400}^{+4} and Au_{2100}^{+6} accelerated to 130qkeV, i.e. to 520 and 780 keV respectively. For both samples the average number of secondary ions emitted form n/q=350 vs n/q=100 is roughly double. In particular, the molecular ion yield (M-H) of glycine bombarded with n/q=100 and n/q=350 Au projectiles is 1.0 and 2.6 per impact respectively. The results indicate a promising future for larger projectiles such as 780keV Au_{2100}^{+6} for nanoscale analysis. This paper will describe how to promote the emission of larger projectiles as well as presenting the mass spectra and characterizing the secondary ion emission from impacts of 520kev Au_{400}^{+4} and 780keV Au_{2100}^{+6}.

Poster # 27

Self-Healing Ability of Ionically Bonded Multilayer Films for Gas Barrier Applications

Joseph Gerringer (Texas A&M University)

TURC: Texas A&M Undergraduate Research in Chemistry

Research Advisor: Dr. Jaime C. Grunlan

In the interest of creating an effective self-healing gas barrier, polymeric thin films were successfully deposited onto a polyethylene terephthalate (PET) substrate. These thin films were deposited using layer-by-layer (LbL) assembly techniques to form a bilayer (BL) of polyethyleneimine (PEI) and poly(acrylic acid) (PAA). This ionically bonded, nanometer thick film exhibits a high glass transition temperature (Tg) and high modulus of elasticity. To aide in film growth, the pH of all PEI and PAA solutions were adjusted to 10 and 4 respectively. As a result, film thickness grew exponentially as a function of bilayer number. Due to the hydrophilic nature of these polymers, swelling was observed when measuring film thickness in water. In addition, this multilayer film exhibited self-healing properties after undergoing mechanical stress. After stretching a coated piece of PET to 5% of its original length, micrometer wide cracks appeared on the surface of the film. Subsequent exposure to high humidity yielded a film with no cracks and higher optical transparency. Due to the densely packed structure of this film, their oxygen transmission rate (OTR) prior to stretching was below the detection limit (0.005 $cm^3/(m^2/day)$). Although OTR data has not yet been obtained for the healed film, the original film should out perform the healed film. Nanocoating films of this nature could be quite useful for food packaging, various optical lenses, and gas separation membranes.

Poster # 28

Substitution and Catalytic Chemistry of Gyroscope-Like Complexes Derived from Cl–Rh–CO Rotators and Triply trans Spanning Di(triarylphosphine) Ligands

Cameron Swisher (Texas A&M University)

TURC: Texas A&M Undergraduate Research in Chemistry

Research Advisor: Dr. John A. Gladysz

Gyroscopes are important devices used to maintain orientation which have been applied in many modern gadgets such as cell phones, drones, and space stations. Molecules which resemble the connectivity and geometry of toy gyroscopes have been synthesized using a variety of metals and ligands as rotors and molecular cages as stators. In this project, the synthesis of the "giant" gyroscope trans-Rh(CO)(Cl)[P(p-$C_6H_4O(CH_2)_{14}O$-p-$C_6H_4)_3P$] and its potential as a catalyst for hydroformylation reactions are explored. Gyroscope precursors $Br(CH_2)_6CH{=}CH_2$ (1, 32.7%) p-$BrC_6H_4O(CH_2)_6CH{=}CH_2$ (2, 80.0%), P[p-$BrC_6H_4O(CH_2)_6CH{=}CH_2]_3$ (3, 72.6%), and trans-Rh(CO)(Cl)[P(p-$BrC_6H_4O(CH_2)_6CH{=}CH_2)_3]_2$ (4, 23%) were synthesized. Future work will focus on the metathesis and hydrogenation reactions which are the final steps in synthesizing the gyroscope. Gyroscopes with alkyl chains as protective spokes have had moderate success as catalysts for hydroformylation of 1-octene. Consequently, gyroscopes with bigger and more rigid aryl linkers will be screened as catalysts for hydroformylation. Furthermore, treatment of the final gyroscope product with PMe_3 should result in the empty dibridgehead diphosphine. This molecule's tendency to homeomorphically isomerize (turn itself inside-out) will be also be studied and discussed.

Poster # 29

Clay Based Hydrogen-Bonded Stretchable Gas Barrier

Michael Floto (Texas A&M University)

TURC: Texas A&M Undergraduate Research in Chemistry

Research Advisor: Dr. Jaime C. Grunlan

The utilization of 'nano brick wall' technology, attributed to impermeable clay platelets, and the elastomeric behavior of a hydrogen-bonded assembly was successfully executed to create a film with high gas barrier and high stretchability. Layer-by-Layer assembly was used to deposit bilayers of poly(ethylene oxide) (PEO), and a mixture of poly(acrylic acid) (PAA) and montmorillonite (MMT) clay, with an initial primer layer of polyethylenimine (PEI) onto a substrate. The interaction between acidic PAA and oxygen rich PEO provided flexible hydrogen bonding between the layers to bind them together to form a stretchable assembly. An effective alignment of MMT clay platelets in the film creates a tortuous path for the gas molecules, making it difficult to diffuse through the film. A higher weight percent of MMT in solution results in thicker and denser films, thus a better gas barrier, but also results in more cracks in the film after stretching, thus compromising the gas barrier. The most effective combination of MMT and PAA was determined to be 25% MMT and 75% PAA in 1 weight percent of solution. A 10 BL film of PEO and PAA/MMT25% (240nm) exhibited an oxygen transmission rate (OTR) 80X lower than that of an uncoated substrate. For the film stretched by 10 and 20%, SEM showed no cracks on the film, indicating retention of gas barrier. OTR results for the stretched films are still being processed. This effective combination of stretchability and high gas barrier can be used in application of a high gas barrier elastomer.

Poster # 30

Novel Cationic Antimony Containing Compounds and their Catalytic Reactivity in Organic Reactions

Nilanjana Pati (Texas A&M University)

TURC: Texas A&M Undergraduate Research in Chemistry

Research Advisor: Dr. Francois Gabbaï

Organoantimony (V) compounds, especially cationic are known to be highly lewis acidic species. In this research, the reactivity of several antimony containing cations is explored. Organoantimony compounds were synthesized using both lithiation and grignard reactions. The catalytic reactivity of these new reagents was tested through their implementation in various reactions including the Baeyer-Villiger oxidation and the cycloaddition of oxiranes with isocyanates. Our results show that while little catalysis is observed in the Baeyer-Villiger oxidation, some of the antimony derivatives that we have studied are potent catalysts for the cyclization of oxiranes and isocyanates intooxazolidin-2-ones.

Poster # 31

An Examination of the Optical Properties of Color-Tunable Rare-Earth Oxychlorides

Graciela Villalpando (Texas A&M University)

TURC: Texas A&M Undergraduate Research in Chemistry

Research Advisor: Dr. Sarbajit Banerjee

More than 40% of the world's energy consumption occurs within buildings and a significant fraction of these costs are associated with the lighting of interiors. The replacement of fluorescent compacts with solid-state light-emitting diodes (LEDs) is expected to bring about an almost five-fold reduction of energy consumption. However, there is a strong need to develop red, green, and blue phosphors that can be coupled with blue LEDs to generate white light. Rare-earth oxychlorides (REOCl) show great promise as color tunable phosphors given their ability to readily accommodate multiple luminescent centers. These compounds crystallize in a structural motif that alternates cationic (REO) and anionic (Cl-) layers and allows for efficacious energy transfer to luminescent rare-earth dopant atoms. These compounds are further characterized by a low maximum phonon cutoff energy and exhibit high chemical stability. An ongoing challenge that is the focus of my research is the development of synthetic methods for the controllable incorporation of multiple luminescent centers within the oxychloride lattice. The synthesis of solid-solution REOCl nanocrystals has been performed using the non-hydrolytic sol—gel condensation of trivalent rare-earth alkoxides and rare-earth chlorides. Luminescent centers have been incorporated by substituting a desired molar equivalent of the dopant rare-earth chloride (Eu^{3+}, Eu^{2+}, and Tb^{3+}) with the rare-earth chloride (Gd^{3+} or La^{3+}) precursor. The prepared nanocrystals have been characterized via X-ray diffraction, transmission electron microscopy, spectrofluorescence, and inductively coupled plasma-mass spectrometry. The judicious incorporation of dopants allows for precise control over the emission wavelength, lifetime, and photoluminescence intensity of the obtained materials.

Poster # 32

The Synthesis and Characterization of Quinacridone Pigment for Undergraduate Organic Chemistry Laboratory

Yun Zhu (Texas A&M University)

TURC: Texas A&M Undergraduate Research in Chemistry

Research Advisor: Dr. Lei Fang

This research has greatly improved the feasibility of a mini-scale synthesis of indenoquinacridone (IQA), which is an organic chemistry experiment for advanced undergraduate chemistry curriculum. A handful of crucial organic chemistry concepts in lecture courses, such as imine condensation, imine-enamine tautomerization, aromatization, and Friedel-Crafts acylation, were involved in this synthesis process. The colorful nature of this synthesis process and the final product makes this experiment a visual feast. Furthermore, due to the intact hydrogen bonds in IQA, fascinating fluorescence changes can be observed in solution phase. In this research , optimized reaction conditions have been found and verified, ensuring a high conversion of the products in both sections without exceeding the time limit for a standard undergraduate laboratory class. Additionally, adjustments in mini-scale laboratory techniques, such as mini-column chromatography, have been made to train and improve students' experimental skills.

Poster # 33

Surface Functionalization of Mesostructured Surfaces for the Separation of Oil/Water Emulsions

Corbin Waters (Texas A&M University)

TURC: Texas A&M Undergraduate Research in Chemistry

Research Advisor: Dr. Sarbajit Banerjee

Steam-assisted gravity drainage has emerged as an important enhanced oil recovery method and involves the injection of steam to produce water/oil emulsions that must subsequently be separated to obtain crude oil fractions. The development of novel methods for separating and isolating hydrocarbons from the aqueous phase of well-head emulsions is an urgent imperative to reduce production costs and ensure water decontamination. In order to address the challenges of separating well-dispersed micron-sized emulsions obtained from steam-assisted gravity drainage, we have developed a robust hierarchical system for oil-water separation derived from zinc oxide nanotetrapods integrated onto a steel mesh substrate. The zinc oxide tetrapods suspend water droplets as per the Cassie—Baxter wetting mode by creating pockets of air that reduce contact between liquid and solid interfaces. The poster will describe the fundamental origins of the observed differential wettability phenomena and the fabrication of membranes for effectively separating water/oil emulsions.
The differential wettability results from a combination of hierarchical mesoscale topography as well as surface energy (tuned by surface functionalization). The use of siloxane chemistry allows for nanostructures to be tethered onto the steel meshes and is further used to enhance differential wettability (hydrophobic and oleophilic) characteristics of the system. Standardized testing suggests that the obtained systems are characterized by excellent mechanical and thermal stability. The obtained system provides a versatile and robust means for high-temperature separation of emulsions.

Poster # 34

Transcriptional Regulator, IscR, Receives [2Fe-2S] Cluster from Grx4

Laura Bily (Texas A&M University)

TURC: Texas A&M Undergraduate Research in Chemistry

Research Advisor: Dr. David Barondeau

Iron-sulfur (Fe-S) clusters are essential cofactors for the function of many proteins in various biological processes, such as photosynthesis and cellular respiration. In *Escherichia coli*, the synthesis of Fe-S clusters is driven by the proteins of the housekeeping ISC pathway, which is encoded by the isc operon. The first protein coded by the isc operon is IscR, which has been shown to be a transcriptional regulator. IscR, upon ligating a [2Fe-2S] cluster, binds to the iscR promotor and inhibits transcription of the isc operon (including IscU) and the synthesis of Fe-S clusters. IscU is responsible for building [2Fe-2S] clusters and then transferring these intermediates to carrier proteins such as Grx4 for eventual delivery to the hundreds of Fe-S target proteins. IscR regulation of Fe-S cluster synthesis may function through a kinetic mechanism in which Fe-S carrier molecules first deliver [2Fe-2S] clusters to target proteins and then to IscR, or a thermodynamic mechanism in which [2Fe-2S] clusters are readily exchanged and IscR has lower Fe-S cluster binding affinity than target proteins. In this study, we investigated whether IscR can accept [2Fe-2S] clusters from IscU, Grx4 (glutaredoxin), Fdx (ferredoxin) and HcAc (Rieske) using circular dichroism (CD) spectroscopy. Cluster transfer was monitored using CD spectroscopy, as each of these Fe-S proteins exhibits a unique visible CD spectrum when bound with a cluster. [2Fe-2S]-IscU was unable to function as a cluster source for transfer reactions to IscR. In contrast, [2Fe-2S]-Grx4 was found to directly transfer clusters to IscR. These results further support the role of Grx4 as an intermediate in cluster transfer reactions from IscU to target proteins, and suggests that IscR regulation may be under kinetic control.

Poster # 35

Calculation of Resonance States of Atomic Dianions using Complex Multi-Configuration Spin Tensor Electron Propagation Method

Genesis Hearne (Texas A&M University)

TURC: Texas A&M Undergraduate Research in Chemistry

Research Advisor: Dr. Danny Yeager

Electron resonances are binding interactions of electrons with atoms or molecules that have a finite lifetime. These resonances occur with free radical electrons that become temporarily bound in the potential well of atoms until they escape due to a phenomenon called quantum tunneling. Free radical electrons can be produced by radiation therapy used to treat cancer and are a primary cause of damage to healthy cells. Calculating the finite lifetime of these resonances can help to develop ways to prevent cell damage. Theoretical calculations of these lifetimes can be done utilizing a mathematical method called Complex Multi-Configuration Spin Tensor Electron Propagation (CMCSTEP). In our simulation we tested the resonance states of second row atomic anions, using CMCSTEP, by simulating the introduction of an additional electron, producing a dianion. This mathematical method allows the isolation of resonance states that exist within the complex space of the continuum. We were able to determine, through our calculations, the resonance energies of atomic anion-electron quantum interactions, compared to other published theoretical results using other mathematical methods. We are currently working on improving the accuracy of the life span predictions of these interactions using higher unoccupied orbitals.

Poster # 36

Key Considerations for the Design of Secure and Efficient IoT Architectures

Aden Muhammad (Texas A&M University)

CSE@TAMU REU

Research Advisor: Dr. Dilma Da Silva

The Internet of Things (IoT) is an amalgam of predating Internet and electronic technologies that promises to enable a seamlessly connected world. This technology has the potential to revolutionize various economic sectors such as transportation, healthcare, and manufacturing, to name a few. The sensitive nature and extensive reach of the purported Internet of Things presents the need for an assurance of both system security and efficiency. In this work, we identify and discuss the characteristics of IoT architectures that create security concerns; further, we conduct a comparative analysis of the functionality protocols most commonly found in IoT architectures and how design features that favor system efficiency often compromise the security of the entire architecture. Our analysis indicates inadequate treatment of security concerns in IoT system design. Ultimately, we draw upon our analysis to propose a methodology that would allow for more comprehensive analysis and treatment of most security concerns in IoT architectures.

Poster # 37

Testing Sketch Recognition Algorithms in Various Languages Using a Single Framework

Matthew Runyon (Texas A&M University); Jusung Lee (Texas A&M University)

CSE@TAMU REU

Research Advisor: Dr. Tracy Hammond

The purpose of this research is to develop a single framework for testing sketch recognition algorithms written in any programming language. A problem with testing sketch recognition algorithms is a lack of data to test. This is often caused by the algorithms being written in different programming languages and having different data structures to represent a sketch. In order to allow multiple projects to share test data, we implemented a standard data structure for storing data in a common non-relational database. We developed a web interface to query and test data from this database. We chose web browsers because they are widely used. The user testing an algorithm simply has to convert standard data to their data structure and send the request to their recognizer which can be in any language. Responses are recorded to test accuracy and speed. With the included metrics and a growing database of shapes, this framework greatly reduces time needed to test a sketch recognition algorithm while increasing the amount of test data available.

Poster # 38

Analyzing Chiral Condensate Dependence on Temperature and Density

Keighley Rockcliffe (Rensselaer Polytechnic Institute)

Cyclotron REU

Research Advisor: Dr. Jeremy Holt

Determining the thermodynamic properties of the chiral condensate, the order parameter for chiral symmetry restoration, gives insight into whether there are phase transitions in dense astrophysical objects, such as young neutron stars. The chiral condensate is the scalar density of quarks in the ground state, and its presence violates chiral symmetry. Chiral effective field theory is used to study the behavior of the scalar quark condensate with changing temperature and density of neutron matter. Two-body and three-body chiral nuclear forces were employed to find the free energy and its dependence on the pion mass at lower temperatures. With increasing temperature (up to 100 MeV), the chiral condensate is strongly reduced, indicating a fast approach to chiral symmetry restoration. Chiral restoration seems to be hindered, however, at higher densities (around 0.2 $fm^{(-3)}$). The role of the different perturbative contributions and their change with temperature and density was extracted. Although the dominant contribution is the noninteracting term in the perturbation series expansion, nuclear interactions are important particularly at high densities where they delay chiral symmetry restoration.

Poster # 39

A Study of the Quality of CsI Detectors and Pulse-Shape Discrimination of Scintillators for Alpha Particles, Gamma Particles, and Neutrons

Kaitlin Salyer (University of Notre Dame)

Cyclotron REU

Research Advisor: Dr. Grigory Rogachev

Scintillators are materials that fluoresce when struck by a particle with high energy, which can then be measured by different types of detectors. This project studied the capabilities of two different scintillators, Cesium Iodide (CsI) and p-Terphenyl. First, the resolution of a CsI detector was investigated by exposing only very small areas of its surface at a time to an alpha source. Second, the abilities of p-Terphenyl to detect alpha particles, gamma particles, and neutrons were analyzed through pulse shape discrimination. p-Terphenyl is of particular interest because it will be used in the Mitchell Institute Neutrino Experiment at Reactor (MINER) at Texas A&M University for measuring background data. The information learned from conducting these tests will be useful in understanding and expanding the limits of the experiments in which these detectors will ultimately be used.

Poster # 40

Reconciling Giant Resonance Data

Ashton Short (Angelo State University)

Cyclotron REU

Research Advisor: Dr. Dave Youngblood

Isoscalar Giant Resonances (GR), which are shape oscillations of the nucleus involving highly collective motion of the nucleons, are of particular importance because they can tell us bulk properties of a nucleus, such as its compression modulus. The quantities needed to obtain these bulk properties are the strengths and energies for each resonance. Where distinct peaks are apparent in the data, most researchers have carried out Gaussian fits to obtain the energies of the resonances. A large amount of data has been obtained, and analyzed in this manner over the years by several groups including the TAMU group. A group working at Osaka University in Japan have also obtained data on many nuclei, but used fits to a Lorentzian or Breit-Wigner shape to obtain the energies and strengths. The aim of this project was to gather the results from the Osaka group, digitize the published multipole distributions, and fit the peaks with Gaussian distributions to allow direct comparison with the TAMU work, as well as earlier works. The Osaka group also published primarily radiative strength distributions, while the TAMU group publishes energy-weighted-sum-rule (EWSR) strength distributions which can be used to obtain energy moments. The radiative strength distributions from the Osaka group were converted to EWSR strength distributions and the energy moments were then calculated for comparison to the TAMU work. The accompanying graphs show the original and modified Osaka results and compares them to other works.

Poster # 41

Universal Parameterization of Dilepton Rates

Jacob Abajian (Trinity University)

Cyclotron REU

Research Advisor: Dr. Ralf Rapp

Dilepton emission from strongly-interacting matter is a key source of information about the evolution of strongly interacting matter produced in heavy-ion collisions (HIC). However, the calculations of dilepton emission rates from first principles are usually rather involved, and therefore not typically accessible for application in HIC evolution models for comparison with experiment. Thus, an accurate parameterization for these rates would be invaluable for the development of the theory behind the dilepton spectra. In this work, such a parameterization was produced for emission of dileptons by in-medium ρ mesons. This was achieved by first producing a parameterization for the in-medium ρ meson propagator that included contributions to the ρ meson self-energy from $\pi\pi$ resonances. Contributions from in-medium meson interactions and baryon interactions were then included. These parameterizations were generated for ρ meson invariant masses from 0 to 1600 MeV and momenta from 0 to 5000 MeV, at temperatures ranging from 100 to 180 MeV.

Poster # 42

Assembling, Cleaning, and Testing a Unique Prototype Open-ended Cylindrical Penning Trap

Kassie Marble (Tarleton State University)

Cyclotron REU

Research Advisor: Dr. Dan Melconian

A new experimental beamline containing a prototype cylindrical penning trap has recently been constructed at the Cyclotron Laboratory at Texas A&M University. The new beamline will enable precision experiments that enhance our understanding of the limits on non-SM processes in the weak interaction through the measurement of the β-ν correlation parameter for T = 2, 0^+→0^+ superallowed β-delayed proton emitters. The prototype TAMU TRAP consists of an open-ended cylindrical penning trap of diameter of 90 mm with gold-plated electrodes of oxygen free high conductivity copper to prevent oxidation. The trap's electric quadrupole field is provided by a SHIP TRAPS RF electronic circuit to the four segmented electrodes at the center of the trap while the trap's 7 Tesla magnetic field is provided by an Agilent 210 ASR magnet. A discussion of the assembly of the TAMU TRAP, the experimental setup, and alignment of the beamline will be presented. The method used to test the prototype penning trap using an ion source, Faraday cups, and micro-channel plate (MCP) detectors will also be discussed.

Poster # 43

Theoretical Predictions of Giant Resonances in 94Mo

Matthew Golden (Ohio Northern University)

Cyclotron REU

Research Advisor: Dr. Shalom Shlomo

We approximate nuclear wave functions using thirty-three common Skyrme interactions found in the literature for 94Mo. We calculate the strength functions and the Centroid Energies of the Isoscalar Giant Resonances for all multipolarities L0, L1, L2, L3. We compare the calculated Centroid Energies with the experimental value; we also study the Centroid Energy and any correlation it may have with the Nuclear Matter properties of each interaction.

Poster # 44

Studying the Nuclear Pairing Force Through the 26Mg(18O,16O)28Mg Reaction

Zachary Elledge (Wayne State Univesrity)

Cyclotron REU

Research Advisor: Dr. Gregory Christian

A new Silicon Detector called Tiara is being installed in one of the cyclotrons at Texas A&M. Tiara will be used to study nuclear pairing. The specific reaction that will be studied is the 26Mg (18O, 16O) 28Mg reaction. That is a Magnesium-26 beam impingent on an Oxygen-18 target resulting in a recoiling Oxygen-16 and Magnesium-28. The purpose of this is to find information about nuclear pairing. Nucleons have similar properties to electrons in that they obey the Pauli exclusion principle. This nuclear spin pairing give arise to interesting effects for nuclei with more neutrons than protons. To study this we can add two neutrons to the Mg-26 nucleus. A higher 26Mg (18O, 16O) 28Mg cross section will give a stronger nuclear pairing force because they are more easily accepted by the nucleus.

Poster # 45

Precise Measurement of αT for the 39.76-keV E3 transition in 103Rh: Further Test of Internal Conversion Theory

Vivian Sabla (Middlebury College)

Cyclotron REU

Research Advisor: Dr. John Hardy

This project was an extension of a series of precision measurements of internal conversion coefficients (ICC) to the 39.76-keV, E3 transition in 103Rh. The goal of these measurements is to test the theoretical ICC calculations, with special attention paid to the role of the atomic vacancy caused by the conversion process. Our previous measurements demonstrate that the atomic vacancy must be considered in theoretical calculations, and our aim in this work is to extend the applicability of this statement to Z=45, the lowest atomic number we have yet to measure. A sample of 103Pd was activated by thermal neutrons at the Texas A&M TRIGA reactor for ~5 hours. Decay spectra were then acquired for 22 days, starting 3 weeks after the source activation in our HPGe detector which is precisely efficiency calibrated. We made sure to identify all impurities in our 103Pd sample in order to correct for any contamination that might affect the energy regions of interest to us. The ratio of x-rays to 39.76-keV gamma rays was used to extract the total ICC, αT, after we carefully corrected our peak areas based on the weak impurities found. Our preliminary result yields αT(39.76)=1434(39). This value is statistically closer to the theoretical calculation in which the atomic vacancy is considered, αT(hole)=1404, than the theoretical value that ignores the vacancy, αT(no hole)= 1389. This is consistent with our previous measurements which demonstrated that the atomic vacancy must be considered in ICC calculations.

Poster # 46

Thallium Extraction From Hydrochloric Acid Media into a Deep Eutectic Solvent Using Bis(2-ethylhexyl) Phosphate

Kate Tran (Eastern Kentucky University)

Cyclotron REU

Research Advisor: Dr. Cody Folden

The chemical properties of superheavy elements are relatively unknown due to their short half-lives and difficulty of production. In preparation for a future experiment to study the chemical properties of element 113, separation techniques have been used to study the behavior of its homologs, In and Tl. Previous work studied the liquid-liquid extraction of radioactive Tl-201 ($t_{1/2}$ = 3.04 d) from various concentrations of HCl into a mixture of menthol and lauric acid that formed a so-called deep eutectic solvent (DES). This work focuses on the effects of adding an extraction agent, bis(2-ethylhexyl) phosphate (HDEHP), to the DES on the efficiency of thallium extraction. The extraction of Tl(I) was generally poor both with and without HDEHP added. In contrast, In-111 ($t_{1/2}$ = 2.80 d) showed significant extraction using HDEHP added to the same DES. This difference in behavior could potentially be exploited in a future experiment on the chemistry of element 113.

Poster # 47

Profiling Cesium Iodide Detectors and Using Pulse Shape Discrimination to Identify Alpha Particles, Neutrons, and Gamma-Rays

Emily Hudson (Swarthmore College)

Cyclotron REU

Research Advisor: Dr. Grigory Rogachev

The purpose of this research was to investigate the properties of detectors that are to be used in future experiments. First, we investigated the properties of a cesium iodide detector. We placed a mask over the front of the detector and used an alpha source to measure the energy and frequency of alpha particles passing through various holes in the mask. From that, we found the detector's resolution for each hole or area we tested. In the second part, we investigated the pulse shape discrimination capabilities of a plastic scintillator, another type of detector. We used the scintillator to detect alpha particles, neutrons, and gamma rays and applied various analysis techniques to identify each type of particle by their waveforms.

Poster # 48

Prospects for the ORNL/TAMU Barium Fluoride Array

Austin Townsend (Stephen F. Austin State University)

Cyclotron REU

Research Advisor: Dr. Mike Youngs

Understanding the symmetry energy in the nuclear equation of state is essential to understanding properties such as the structure of a neutron star or its gravitational collapse, leading to supernovae. It has been suggested that to better constrain the symmetry energy one can use the bremmstrahlung gamma rays emitted from the hot, dense nuclear matter in the early stages of heavy ion collisions. These gamma rays have the potential to provide a cleaner probe than the more traditional hadronic probes. To measure these bremmstrahlung photons, barium fluoride scintillation crystals were chosen for their ability to detect photons across a large energy range and for their inherent pulse shape discrimination properties. This summer, the detectors of the TAMU/ORNL barium fluoride array were tested in preparation for such an experiment. Signals from each detector were recorded individually for cosmic rays and radioactive source events. The full waveforms were digitized with flash ADCs. A selected set of detectors was assembled and tested with beam from the K500 cyclotron. With this in-beam data, waveform integration parameters may be optimized. Results from the testing of these detectors with flash digitizers will be presented.

Poster # 49

Monte Carlo Simulations of Freeze-out with Momentum Constraints in High Energy Nuclear Collisions

John Harrison (South Dakota School of Mines and Technology)

Cyclotron REU

Research Advisor: Dr. Rainer Fries

A Monte Carlo simulation can be used to model freeze-out from high energy collisions. Existing Monte Carlo freeze-out algorithms usually do not account consistently for all conservation laws, such as the conservation of momentum or the conservation of energy. This poster will document the author's work during his REU program, to develop a Monte Carlo simulation modeling the freeze-out from high energy nuclear collisions imposing momentum conservation. We briefly explain the sampling algorithm that exactly enforces momentum conservation for non-relativistic Maxwell-Boltzmann distributions and test how it performs as an approximation to relativistic Bose-Einstein and Fermi-Dirac systems. Once completed, our simulation could provide important insights into the behavior of quark gluon plasma and high energy collisions.

Poster # 50

Optimization of MEMS Scanning Mirror Design for Increased Reliability in Medical Imaging Applications

Veronica Knisley (Texas A&M University)

Engineering Technology & Industrial Distribution REU: Mechatronics, Robotics, and Automated System Design

Research Advisor: Dr. Jun Zou

Microelectromechanical systems (MEMS) devices are used in a variety of fields because of their small sizes and fast response. Micro scanning mirrors are one such device, which can be used in medical imaging probes for the detection of many types of diseases. The first objective of this project was to determine the failure mechanism for one such mirror and also its scanning behavior in a clinical setting. A newly-assembled mirror with the original design was run in cycles of use and inactivity. A laser tracing method was used to monitor changes in scanning over time. The mirror failed because of weakened adhesive. Trends observed during testing revealed that the probe's scanning behavior might change when the adhesive weakens and that the mirror should be dried between uses. Based on these findings, the second objective is to improve its reliability for underwater operation by redesigning the mirror's "cap" component. In the future, a reliability test will be performed on the new design to verify the improvement in preparation for clinical use.

Poster # 51

Design, Interface, Evaluation, and Telecontrol of Articulated Robotic Arm Using Joystick

Gopika Ajaykumar (University of Texas at Austin)

Engineering Technology & Industrial Distribution REU: Mechatronics, Robotics, and Automated System Design

Research Advisor: Dr. Sheng-Jen "Tony" Hsieh

Telecontrol is an important tool in robotics education because of its ability to make robotics accessible to the public. One method of telecontrol that enhances ease of access to robotics is web control. Unfortunately, much of the telecontrol research involving web access thus far has concentrated on computer-focused forms through which users can enter coordinates. Moreover, the problem of reducing the latency inherent in web control is rarely addressed. This study describes the design and construction of a more intuitive system in which a user can control and view a MICROBOT TeachMover articulated robotic arm. The user achieves telecontrol remotely through a web interface using a joystick rather than a form. In this architecture, the web interface runs on an Apache server with the server-side code written in PHP. JQuery's AJAX function communicates the client's joystick coordinates to the server, and MySQL connects the data from the server to a Visual Basic .NET program. The Visual Basic program performs the kinematics calculations and serial communication functions necessary to move the TeachMover. A Panasonic BL-C111 camera provides a live video feed for remote visualization. The time measurements taken at each stage of the system demonstrate that the system architecture enables web control of the TeachMover with minimal time delays between client and server and is ideal for educational purposes.

Poster # 52

Dynamics and Control of a Skid-Steered Mobile Robot

Colin Shi (Rice University)

Engineering Technology & Industrial Distribution REU: Mechatronics, Robotics, and Automated System Design

Research Advisor: Dr. Won-jong Kim

Skid steering is a popular drive mechanism that uses differential wheel rotation to control vehicle motion. One useful application can be found in mobile robots that help users with everyday household tasks. In this research, a human following control system is developed. A Kinect sensor is used to sense user input and to enable users to interact with smart devices via motion control. The robot's ability to maintain a steady following distance from the user and turn towards the user's direction is used to assess the control system's translational and rotational performance. Test data shows that the various control systems developed are able to achieve stability with similar rise times and varying degrees of accuracy. We conclude that feedback control provides adequate system stability despite design differences. However, improvements to the software used to accurately identify the user can be made to enhance the reliability of the human following program.

Poster # 53

Design and Simulation of a Lab Scale Down Hole Drilling Rig

Aakash Bajpai (Universty of Maryland)

Engineering Technology & Industrial Distribution REU: Mechatronics, Robotics, and Automated System Design

Research Advisor: Dr. Xingyong Song

As the demand for energy rises, so does the need for resources and the means to extract them safely and efficiently by means of down-hole drilling. These large mechanical systems often encounter obstacles; the drillstring of the drilling rig encounters lateral, torsional, and axial vibrations which can cause serious damage and possibly failures to a system. To minimize these effects, control algorithms are developed and then tested on lab-scale drilling rig models. This paper develops the systematic method of part selection, design, and simulation of a customizable lab-scale drilling system. The physical parameters are created in SOLIDWORKS® and the system is simulated using MATLAB Simulink®. The goal of the project is to reproduce physical behavior of drilling systems using a lab scale model for further research on understanding and mitigating detrimental effects.

Poster # 54

Simulations for Non-Mechanical Stimuli on Compliant Flexible Structures

Christopher Hines (Gonzaga University); Anastasia Muliana (Texas A&M University)

Engineering Technology & Industrial Distribution REU: Mechatronics, Robotics, and Automated System Design

Research Advisor: Dr. Anastasia Muliana

In this study, simulations are performed using finite element analysis software to discover qualitative variations and deformations of thin bilayer structures using heat. The differences in various models are: shape, material, aspect ratio, and thickness. The findings in this study were meant to be kept simple in that the materials are isotropic and ideally bonded together. Under heat, the structures are thin so the conduction of that heat was ignored. A structures deformations hinges mostly upon its aspect ratio being high, thickness being low, and the position of them on a flat pattern. The design qualities are qualitatively explored in this research.

Poster # 55

Arduino-Based Infrared Remote Control for Smart HVAC System and Sensory Fusion Techniques

Elizabeth Molitor (South Dakota State University)

Engineering Technology & Industrial Distribution REU: Mechatronics, Robotics, and Automated System Design

Research Advisor: Dr. Sheng-Jen 'Tony' Hsieh

Energy-efficient maintenance of human comfort and health is an important quality of heating, cooling, and air conditioning (HVAC) systems. Comfort is influenced by environmental and personal factors, including ambient temperature, relative humidity, mean radiant temperature, metabolic rate, clothing, and air speed. HVAC systems may be inefficient without appropriate design for comfort. Many current systems rely on a single temperature set point or a PID control algorithm, which allows individuals to make adjustments, but those systems cannot learn habits or preferences of specific users. The NEST learning thermostat is a new residential system that tracks temperature adjustments and makes future adjustments based on the temperature schedule it has learned from user input. In this study, a prototype system which controls a window air conditioning unit was built. One Arduino microcontroller collects temperature and humidity data, processes data from an infrared array to determine occupancy, and emits infrared signals to control the AC unit. This study suggests that using an infrared array is preferable to traditional motion sensors for occupant detection. The performance of this system and individual components was evaluated, along with the adaptiveness of the prototype. Sensor fusion was used in this study to make temperature control decisions, and a Support Vector Machine (SVM) simulated a user specific control system. This study analyzed the Predicted Mean Vote (PMV) model and the New Effective Temperature method. Results suggest human comfort can be improved with a system that relies on individual user preferences in a SVM to optimize control decisions.

Poster # 56

Prototyping and Evaluation of Interactive and Customized Interface and Control Algorithms for Robotic Assistive Devices Using Kinect and IR Sensor

Grace McFassel (The George Washington University)

Engineering Technology & Industrial Distribution REU: Mechatronics, Robotics, and Automated System Design

Research Advisor: Dr. Sheng-Jen "Tony" Hsieh

Robotic assistive devices are popular in research and medical fields for their potential to automate tasks or to improve the quality of life of disabled users. They may be used for physical therapy, as exoskeletons, teleoperation devices, or to assist users in tasks in their home. Common methods for controlling these devices use either broad and difficult to maintain gesturing or peripherals such as mouse pointers or joysticks which are not designed for the task required of them. In addition, these devices often are not adaptive to the user, and can only be minimally customized. This paper proposes a fusion of IR camera data for stress detection with Kinect body tracking to develop a customizable control method for a robotic limb. Devices such as the Microsoft Kinect have seen use in physical therapy applications but only some use in teleoperation. In addition, studies have shown potential in using infrared imaging to detect human stress. The objectives of this study are to design and build an interactive interface and adaptive control system and to evaluate its performance. Stress detection using IR was tested using a Compix 222 and neural networks to categorize emotional states. Kinect v2 accuracy and reliability was tested by comparing joint positions to detected angles and perceived output angles. Our work suggests that IR imaging and the Kinect v2 show potential to make a real-time adaptive system in which a control program can adapt its output when it detects stress from its user.

Poster # 57

Camera Calibration and an Android Mobile Application that Captures and Stores Images to the Cloud

Zachary Smith (Auburn University)

Engineering Technology & Industrial Distribution REU: Mechatronics, Robotics, and Automated System Design

Research Advisor: Dr. Dezhen Song

Storage constraints are a common issue associated with data collection, especially large image files. This research work eliminates local storage constraints on mobile devices by developing an Android mobile application capable of accessing the cloud. Mobile devices are well suited for this issue thanks to their ability to wirelessly access the internet, which translates into the ability to store essentially unlimited information in the cloud. This specific project targets Dropbox. Mobile robots, for example, could easily collect and store image data into Dropbox with no concern for local storage bounds. Image data collected by this app are used to find the intrinsic parameters of a camera through camera calibration. Then, extrinsic parameters are computed and analyzed to find good predictions for the location of the camera.

Poster # 58

Series Elastic Actuator for a Powered Walking Gait Cycle in Robotic Prosthetics

Samuel Nadell (Washington University in St. Louis)

Engineering Technology & Industrial Distribution REU: Mechatronics, Robotics, and Automated System Design

Research Advisor: Dr. Sheng-Jen "Tony" Hsieh

The Series Elastic Actuator, which consists of a motor in series with a spring, can be used as a simplistic model of the human calf muscle, which contracts and relaxes with elasticity. The SEA has extensive applications in robotic prosthetics and bipedal robots by improving power efficiency during walking gait and stability over unknown trajectories. This project involves designing and building an SEA prototype for use with robots in Texas A&M's Human Rehabilitation Group, studying its biomechanical advantages, and analyzing its effects on power efficiency. Four experiments give insight into the characteristics of SEA motion and power use and prove that the SEA prototype can be implemented into a robotic prosthetic to drive a powered walking gait cycle.

Poster # 59

Smart Irrigation System with On-Demand Sensor Array Using Dynamic Real Time Growth Model and Microcontroller

Daniel Budolak (University of Illinois at Chicago)

Engineering Technology & Industrial Distribution REU: Mechatronics, Robotics, and Automated System Design

Research Advisor: Dr. Sheng-Jen "Tony" Hsieh

Agricultural consumption of fresh water sources is a serious concern as water resources become more scarce. Irrigation systems need to be more efficient to meet the demand of high crop yield and low water use. Current systems use a variety of field data, water balance equations, and farmer knowledge to schedule irrigation. These are prone to the overuse of irrigation. Also, most recent methods of wireless sensor systems are limited by the amount of sensor nodes for field data or unclear areal images and scarce soil probes. As such, precision agriculture has not been practically realized. This paper addresses both issues by designing a smart irrigation system with a robust irrigation control and sensor array. A functioning analytical model with valve timing control was developed. It uses a growth model and crop water stress index to water plants only when necessary. This optimizes yield and water saving potential. For increased robustness, a water line and field monitoring system was developed to give warnings if line pressure and soil parameters were outside the desired range. A sensor array design was also proposed to achieve a practical method for site specific agriculture. The proposed system uses a single sensor array to gather necessary field data at any length along a center pivot irrigation system.

Poster # 60

Atomistic Modeling of Dislocation Interactions with Disordered Ni_3Al Precipitates in Ni-Base Alloys

Ta Duong (Texas A&M University)

Engineering Undergraduate Summer Research Grant (USRG) Program

Research Advisor: Dr. Michael J. Demkowicz

This research aims to understand the possible changes in mechanical properties of nickel(Ni)-base alloys arising from the disordering of γ' precipitates. The interactions between dislocation and Ni_3Al precipitates were simulated at zero temperature (static modeling) and room temperature (molecular dynamics). An edge dislocation was created in a ~20 x 20 x 10 nm simulation box of pure fcc Ni with periodic boundary conditions along the dislocation line and Burgers vector direction. Shear deformation was introduced by an incremental displacement of atoms in two loading layers, causing the dislocation to move. Different types of spherical Ni_3Al precipitates (radius of 1, 2, 3 nm; L12 ordered and disordered) were placed ahead of the moving dislocation to study their pinning effect. Our work sheds light on the effect of radiation-induced precipitate disordering on the mechanical properties of Ni-base alloys, allowing us to assess the potential for using Ni-base alloys in nuclear energy applications.

Poster # 61

Ceramic Waste Form for Nuclear Waste Storage

Sean Simonian (Texas A&M University); Kevin Savabi (Texas A&M University); Nicholas Whitty (Texas A&M University); Kulraj Chatha (Texas A&M University); Colby Thordsen (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Sean McDeavitt

When fission occurs in a nuclear reactor, atoms are split into new elements, called fission fragments. Many are unstable and spontaneously decay, emitting radiation. Fission products become nuclear waste which must be managed in some way. In our research we bound atoms of cesium, strontium, barium and rubidium into a ceramic waste form. These particular waste elements are highly radioactive - contributing most of the heat generated in spent nuclear fuel. Our goal was create a new ceramic and analyze the product to determine how effectively it contained the waste products for different waste loadings. We mixed bentonite clay and nitrate salts containing stable isotopes that simulate radioactive waste, forming mixtures with 35, 40, and 45 percent waste loading. Water was added to the mixtures then heated, stirred, pressed into pellets, and sintered in a furnace to form a solid ceramic. Archimedes density measurements, Light Flash Analysis, Differential Scanning Calorimetry, Thermal Gravimetric analysis and Scanning Electron Microscopy were performed to characterize the waste form and powder precursors. Leach testing will also be carried out to determine the ceramic's effectiveness as a waste form. The objective of this work is determine the maximum waste loading possible with the clay derived ceramic and model the waste form's thermal behavior.

Poster # 62

Stratigraphic Interpretatin of the Cenomanian to Turonian Eagle Ford Group in South Texas Using Well Logs

Eduardo Alvarez (Texas A&M University); Alex Brown (Texas A&M University);
Alden Griffin (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Roy Conte

The Eagle Ford group is a hydrocarbon rich unconventional play in South Texas. It is uncomfortably bounded by the Austin Chalk above and the Buda Limestone below. The stratigraphy of the Eagle Ford group varies along local tectonic features, being relatively thicker in the Maverick Basin and relatively thinner over the San Marcos Arch region. The Eagle Ford group is divided into two formations, the Upper and Lower Eagle Ford. The Upper and Lower Eagle Ford formations are further subdivided into Upper and Lower members respectively (Donovan et al., 2015). Our study is focused on identifying these four members by using well log data from Atascosa, Wilson, Karnes, and Frio counties. Well log data used in our interpretation includes but is not limited to, gamma ray profiles and measurements of deep resistivity. We generated models to analyze the stratigraphic features of the group including a 3D stratigraphic model of the group and a strike and dip cross sectional representation. After careful evaluation of our data and models clear trends of high variability in thickness of members were identified, specifically when local tectonic features are within close proximity.

Poster # 63

Strategies for Understanding Cooperativity in Bimetallic Complex Molecules: A LEGO Approach for Building Informative Molecules

Manuel Quiroz (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Marcetta Y. Darensbourg

Nature provides guidance for the construction of biological catalysts known as enzymes. Metalloenzymes perform myriad chemical processes of importance to life. Many of these contain two metals in their catalytically active sites. Chemists strive to understand how these two metals cooperate to catalyze difficult transformations such as CO_2 or N_2 fixation and reduction. A building-block approach is the basis of our synthetic strategy that has produced a series of bimetallic molecules with spectroscopic reporter units on each metal center. These complexes have been isolated and characterized in the solid state by x-ray diffraction and in solution by appropriate spectroscopies: infrared, electron paramagnetic resonance (EPR), and nuclear magnetic resonance. A particular target has been bimetallics based on vanadium in a tetradentate S-N-N-S binding environment. We ask whether the vanadyl cation, a $V{\equiv}O_2$+ unit, remains paramagnetic when bound to a second metal or if the second metal influences the odd electron signal. Likewise [(N2S2)V≡O] have been bound to three different reporter (LEGO) units: $(\eta 5\text{-}C_5H_5)Fe(CO)^+$, $W(CO)_5$, and $Ni(dppe)^{2+}$. The $(\eta 5\text{-}C_5H_5)Fe(CO)^+$ showed an efficient bidentate binding through the bridging dithiolates of $[(N_2S_2)V{\equiv}O]$; while two $W(CO)_5$ units were bound to each of the bridging sulfurs in an anti-periplanar/transoid orientation. The reaction of the $Ni(dppe)^{2+}$ however led to metal exchange in which the vanadyl cation was replaced by a Ni^{2+} cation within the N_2S_2 macrocycle. The bimetallic building approach will be further investigated with other paramagnetic reporter units that might lead to a subtle tuning of electronics between the two metal centers.

Poster # 64

Detection of Metal Concentration in Combustion Emission Using Laser Induced Breakdown Spectroscopy

Kevin Campbell (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Waruna Kulatilaka

Certain metal particles are added to propellants and explosive materials to enhance their combustion characteristics. Because of the high temperatures present during combustion, these metals can vaporize and create hazardous conditions for the operators and the environment in general. It is desirable to have a method of detecting the presence of such harmful metals in the environment so that the risks involved can be quantified and mitigated. A promising technique for detecting trace amounts of metals in the gaseous emissions of combustion is laser-induced breakdown spectroscopy (LIBS). In LIBS, a high-energy, short duration laser pulse is used to create a localized plasma which decomposes the compounds in the probe volume into individual atoms and radicals. The electrons of the resulting atoms are in extremely high-energy states. As these ions return to neutral states, they emit a unique spectrum of light dependent on the elements present. This emission light can be dispersed into respective frequency components using a spectrometer and can be used to identify the atomic constituents present. The initial experiments involved identifying specific LIBS emission lines of various solid metal samples. The laser power dependence and emission lifetimes were measured using a miniature fiber-coupled spectrometer and also a high-resolution spectrometer coupled to a time-gated intensified charge-couple device (ICCD) camera. Also, micron-size metal particles were added to sample propellant strands in carefully controlled concentrations. Theses strands burn at a high enough temperature to vaporize the metal particles so that their gas-phase emissions can be characterized using the LIBS technique.

Poster # 65

Optimizing the Drell-Yan Trigger for the STAR Forward Meson Spectrometer

Jackson Pybus (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Carl Gagliardi

Theoretical calculations predict that the transverse single-spin asymmetry for Drell-Yan dilepton production in proton-proton collisions is equal in magnitude and opposite in sign to that for semi-inclusive lepton-proton deep inelastic scattering. Verifying this prediction has been identified as a critical test of our current understanding of factorization in high-energy collisions. The STAR Collaboration at RHIC is planning to measure this spin-asymmetry for forward-rapidity Drell-Yan electron-positron pairs in 500 GeV proton-proton collisions in Spring, 2017. The electron-poistron pairs will be detected with the STAR Forward Meson Spectrometer (FMS). We studied the efficiency of the FMS trigger system to detect Drell-Yan events. We found that the current logic is less efficient for those events that carry the greatest spin sensitivity. We have developed an alternative logic scheme that will significantly increase the efficiency while being easy to implement. We are also studying the implications of the new scheme for measurements of transverse single-spin asymmetry for forward J/Psi production. The new trigger logic will be described.

Poster # 66

Chemistry Under Extreme Conditions: The Synthesis of Gold Adducts in Massive Gold Cluster Impacts on Solids

Gabriel Shuffield (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Emile A. Schweikert

Hypervelocity impacts (19-36 km/s) of nanoparticle projectiles can produce non-equilibrium temperatures of more than 10,000 K in under 100 ps in a 5-10 nm radius at the surface. While brief and confined, these extreme conditions lead to unusual and interesting chemistry. Previous work showed that adducts can be formed by fragments of the projectile and sample target at their impact interface and surrounding plume. These “manufactured” ions are not representative of the sample’s stoichiometry. It is thus crucial to gain insight into “chemistry on the fly,” to properly assign the ejecta to moieties present in the target or arising from recombination. We show here the differences in Au_n^q+ projectile impacts where n/q = 100 with 520 keV of kinetic energy and n/q = 350 with 780 keV of kinetic energy. Despite lower impact velocity we see that adduct formation is increased greatly using the n/q = 350 projectile (increased by factors of 4.3 and 8.4 for AuCN- and $Au(CN)_2$- from L-histidine), though the free ligands are only formed in marginally higher amounts (increased by a factor of 1.15 for CN- from L-histidine).

Poster # 67

Design, Fabrication and Characterization of Microjet System for Electronic Cooling

Moisés Armando De los Santos Jiménez (Universidad Tecnológica de Tabasco)

CANIETI

Research Advisor: Dr. Jorge L. Alvarado

Current electronic systems are in need of embedded cooling subsystems to maintain desirable device temperature below a certain limit. Current cooling techniques rely mainly on 2D or surface cooling, which are insufficient in terms of thermal management. Therefore, a 3D microjet cooler has been designed, fabricated, and tested to determine its level of heat transfer effectiveness. Three prototypes have been designed using SolidWorks, then printed using a 3D printer. Results show that fully embedded microjet cooler can indeed manage thermal loads of electronic systems adequately.

Poster # 68

Development of Nickel-Palladium Catalysts for Organic Cross Coupling Reactions

Zachary Martinez (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Marcetta Darensbourg

The synthesis of many sophisticated organic molecules, whether in the agrochemical or pharmaceutical fields, will at some point require the formation of carbon-carbon bonds from different precursors. The importance of such approaches is emphasized in the 2010 Nobel Prize in Chemistry awarded for "palladium cross-coupling catalyzed synthesis". A goal of synthetic chemists is to reduce the amount of the expensive noble metal palladium used in such reactions. Our specific aim has been to develop a new catalyst system based on heterometallics of palladium and the abundant first-row transition metal, nickel; i.e., Ni-Pd complexes. Four novel metallodithiolate complexes based on a nitrogen/sulfur binding site for nickel were shown to complex with palladium, producing S-bridged Ni-Pd bimetallics in a butterfly-like configuration. These complexes are redox active, stable in air, and on silicon gel (for purification). They were found to be highly active catalysts for Suzuki/Miyaura cross coupling reactions. We explored the scope of the Ni-Pd catalysts and optimized catalytic conditions, finding that a palladium/diphosphine/NiN 2 S 2 derivative, at 1% catalyst loading, gave a 99% isolated yield of a particular biaryl derived from iodobenzene and phenylboronic acid. Acknowledgement: Funding for the project: The National Science Foundation and the R. A. Welch Foundation

Poster # 69

Development and Analysis of Molecular Catalysts for the Electrochemical Reduction of CO_2

Emily Brackhahn (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Micheal Nippe

Electrocatalysts involved in CO_2 reduction can potentially reduce the levels of atmospheric CO_2 while simultaneously producing a sustainable energy source. Electrochemical reduction occurs when a chemical species gains electrons and as a result undergoes a chemical change. The desired site of reduction is the carbon atom of the CO_2 molecule as this process could produce reduced carbon compounds that can be used as combustible fuels. Molecular catalysts act to mediate this process by lowering the energy needed to make the reaction occur. In this experiment, molecules modeled after a widely known electrocatalyst known as Lehn's catalyst were modified by attaching specific groups of atoms, or functional groups, to the molecules and the corresponding effect on catalytic activity was studied. The first complex studied was Lehn's catalyst, the parent compound. The next complex studied was Lehn's catalysts functionalized with electron donating methyl groups. The third complex studied was a phenanthroline based complex functionalized with electron withdrawing imidazolium groups. To synthesize these molecules, functional groups were attached to organic compounds which were then complexed to Rhenium(I) metals. The complexes were analyzed for electrocatalytic activity by studying their redox behavior using cyclic voltammetry, a method in which a range of electrochemical potentials are applied to a system and the resulting change in current is measured. The second complex with the more electron donating groups displayed less efficient electrocatalytic activity as compared to the parent compound while the third complex is still being synthesized. Data from these experiments can help lead to the development of an efficient process for CO_2 reduction.

Poster # 70

External Short Behavior of Lithium-Ion Cells Using Constant Resistance Discharge

Conner Fear (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Partha Mukherjee

Lithium-ion batteries (LIBs) have been used for years in portable electronics. Recently, they have become increasingly important in large-scale energy storage applications, such as transportation. However, the frequency of accidents involving LIBs raises concerns over their safety and has incentivized research into battery behavior under abnormal conditions. The typical use of a LIB is to power some particular device by connecting an electrical load to both terminals of the cell and creating electrical current flow through the circuit. The electrical resistance for most applications is in the order of kOhms and MOhms. A commonly experienced abnormal condition for batteries is a short, which occurs when the two terminals of a battery come into contact with a minimal electrical resistance (~mOhms). This causes the cell to discharge at a high rate and, hence, at large currents, resulting in rapid heat generation in the wire as well as within the cell. In this work, an external short test using a commercial 18650 cell (Panasonic) was conducted by subjecting the cell to a constant resistance discharge with resistors of decreasing value (100, 10, 1, 0.1 0.01 Ohms). The internal damage of the cell was studied by conducting a Destructive Physical Analysis and by analyzing cell components via Scanning Electron Microscopy. Present results have shown that reducing the electrical resistance used to the discharge the cell leads to the development of higher temperatures within the cell. This issue, if not controlled, can cause the degradation of the electrodes and, in extreme cases, may lead to thermal runaway.

Poster # 71

Swelling Properties and Thermal Transitions in Layer by Layer Thin Films upon Exposure to Monovalent Ions

Ethan Dai (Texas A&M University); Kathryn Wilcox (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Jodie Lutkenhaus

In this study, we examine the thermal and physical properties of polymer thin films in response to exposure to various concentrations of the chaotropic salt KBr. Polymer films are assembled using Layer-by-Layer (LbL) assembly technique which utilizes alternate absorption of oppositely charged strong electrolytes (Poly (diallydimethylammonuium chloride) (PDAC) / Poly (styrene sulfonate) (PSS)). Quartz Crystal Microbalance with Dissipation (QCM-D) and Differential Scanning Calorimetry (DSC) were employed to analyze the LbL film properties. QCM-D reveals that PDAC/PSS LbL films undergo substantial swelling when exposed to KBr, and the degree of swelling changes with changing KBr concentration. Films examined by DSC are prepared using dip-assisted LbL assembly, dried, and rehydrated to the desired weight percent of aqueous KBr at various concentrations. Our results show that PDAC/PSS LbL films exhibit a Tg-like thermal transition that shows dependence on the both the species and concentration of the aqueous salt solution to which the films are exposed.

Poster # 72

4-Mercaptophenylboronic Acid Capped Gold and Silver Nanoparticles: Study of Response to Glucose in Varying Solution Conditions

Alexander Quinn (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Mike McShane

Gold and silver nanoparticles were capped with 4-mercaptophenylboronic acid (MPBA) and characterized primarily using Surface Enhanced Raman Spectroscopy (SERS) in solutions of varying glucose concentrations, salt concentrations, and pH. The concentration of MPBA during monolayer formation was also varied to determine its effect on acquired Raman signals. Different monolayers formed due to changes in MPBA concentration during incubation were confirmed with characterized with DLS and UV-VIS. DLS was also employed to look for aggregation. Both the silver and gold capped nanoparticles were found to exhibit Raman changes due to changed MPBA incubation concentrations, the addition of glucose, and changes in pH and were found to be very sensitive to their conditions and often did not give reproducible results. In general, it was difficult to establish a clear trend for the detection of glucose indicating that either a colloidal system is not well suited for glucose sensing or that much greater control of nanoparticle properties and the MPBA monolayers is needed for a colloidal system to work as a glucose sensor.

Poster # 73

Seeking Low Altitude Terrestrial Gamma-Ray Flashes via High Altitude Balloon

Nathaniel Peirson (Texas A&M University); Madeline McMillan (Texas A&M University);
Lucas Hastings (Texas A&M University)

Research Intensive Community for Undergraduates (RICU) Summer Program

Research Advisor: Dr. Sharath Girimaji

Terrestrial gamma-ray flashes (TGFs) are high energy radiation bursts originating from within Earth's atmosphere. These events have been correlated to lightning strikes, but differ from other strike resultant phenomena. The causal mechanism of TGFs is not fully known. Currently, the leading hypothesis suggests that these gamma rays are produced by the rapid deceleration of cascading relativistic electrons. This model allows TGFs to originate in lower regions (<11 km) of thunderstorms. However, due to atmospheric attenuation, orbital gamma-ray detection systems cannot determine whether such events occur; the existence of TGFs in lower regions of thunderclouds remains heretofore unconfirmed. This experiment uses an instrument payload carried by high altitude balloon to attempt to observe whether terrestrial gamma-ray flashes occur in the lower regions of thunderstorms, and determine the relationship, if any, of relativistic runaway breakdown to terrestrial gamma-ray flashes.

Poster # 74

Investigating a DEAH-RHA Helicase•Znf Cofactor System in Trypanosome RNA Editing

Zakaria Abu-Adas (Texas A&M University); Jonathan Yuen (Texas A&M University);
Benita Jacob (Texas A&M University); Naana Quagraine (Texas A&M University)

Research Intensive Community for Undergraduates (RICU) Summer Program

Research Advisor: Dr. Jorge Cruz-Reyes

Trypanosoma brucei is a unicellular parasitic protozoa most famous for its role in causing Sleeping Sickness, a disease prevalent in sub-Saharan Africa that can be fatal if left untreated. *Trypanosoma brucei* is also unique in its ability to edit mRNA post transcriptionally through large amounts of uridine (U) insertion and deletion. 12 of the 18 proteins encoded in the mitochondrial DNA undergo extensive RNA editing through this process. This editing occurs through the pre-edited mRNA binding to small 50-60 nucleotide long guide RNAs (gRNA) that contain the sequence complementary to the desired fully-edited mRNA. The process is facilitated by a holo-editosome composed of RNA Editing Helicase 2 (REH2) and over 30 associated proteins. One component of particular importance is REH2-associated cofactor 1 (H2F1), a protein consisting of eight zinc-finger domains that is implicated in the binding of two protein scaffolds, one containing mRNA and one containing gRNA. We have transfected strains of *Trypanosoma brucei* with various modifications made to the H2F1 protein in an effort to discern the role its numerous zinc fingers play in the formation and function of the editosome. Two of the strains constructed have truncated versions of H2F1: one with the C-terminus half removed (ΔC-term H2F1) and the other lacking the N-terminus half (ΔN-term H2F1). Assays will be performed to determine the structural integrity and helicase functioning in strains with these altered H2F1 proteins.

Poster # 75

Safety Impacts of Reduced Visibility in Inclement Weather

Michelle Zupancich (Texas A&M University)

Transportation Summer Scholars

Research Advisor: Dr. Das Subasish

The driver acquires most of the information while driving visually. However, most of the traffic crash reports do not document visibility conditions at the time of a crash occurrence at a high level of detail. This study investigated visibility level at the time of a crash to identify the increase in risk during periods of reduced visibility. The study method used the National Oceanic and Atmospheric Administration (NOAA) visibility scores to insert it in the reported crashes in Florida. From the logged weather events collected by the NOAA, the researchers isolated periods of normal visibility and comparable periods of reduced visibility in a matched-pairs study. The crash data was collected from the Roadway Information Database (RID) compiled for the Strategic Highway Research Program 2 (SHRP-2). The RID contains geometric, traffic, environmental and driver variables that allow associating the relationships between visibility and other factors. The findings indicate that the likelihood of a severe crash increases during periods of poor visibility, when despite the tendency for less traffic and lower speeds to prevail during these periods.

Poster # 76

Development of In-Service Performance Evaluations of Roadside Safety Hardware

Carlos Leyva (University of Texas at Arlington); Madilyn Mendoza (Arizona State University)

TTI ATLAS Summer Internships

Research Advisor: Dr. Chiara Silvestri-Dobrovolny

Current In-Service Performance Evaluations (ISPE) used by individual agencies don't allow studies to use a greater statistical population when studying the performance of roadside safety devices. A framework for a universal ISPE was created to allow for a greater understanding of the in field performance of roadside safety devices (RSDs). The crashworthiness and inventory applications of radio-frequency identification (RFID) tags was studied. RFID tags were placed on two barriers that underwent full-scale crash testing. After the functionality of the tags was verified after impact, it was concluded that the RFID system was ideal for ISPE inventory applications, despite technical difficulties caused by the installation of the tags. A data dictionary was compiled from a literature review of MASH standards and existing ISPEs. User profiles were identified and their corresponding data fields chosen. Finally, an outline for an updating, centralized database of RSDs was proposed.

Poster # 77

Effectiveness of End-of-Queue Warning Systems and Portable Rumble Strips on Lane Closure Crashes

Ezekiel Hsieh (University of Texas at Austin)

TTI ATLAS Summer Internships

Research Advisor: Dr. Jerry Ullman

The Texas Department of Transportation has been deploying work zone intelligent transportation systems (ITS) in an effort to reduce the number of work zone crashes along the I-35 corridor. Road construction lane closures on I-35 are typically performed at nighttime when traffic volumes are lower but driver awareness is often reduced. The two systems evaluated were temporary portable rumble strips (TPRS) alone and end-of-queue warning systems (EOQWS) combined with TPRS. EOQWS consist of portable changeable message signs linked to radar speed sensors to proactively warn drivers of queueing and slowed conditions ahead. TPRS alone were deployed for work zone lane closures where no queues were expected, and both EOQWS and TPRS were deployed for lane closures expected to cause queueing. The effectiveness of these systems was evaluated over four years of deployments and compared to one year of no deployments. Both TPRS alone and EOQWS with TPRS were found to cause a significant reduction in the number of crashes under queued conditions, 60% and 54%, respectively. Additionally, the percentage of crashes that resulted in injuries was significantly reduced.

Poster # 78

Pedestrians & Bicyclists at Stop-Controlled Intersections

John Raker (Ohio Northern University)

TTI ATLAS Summer Internships

Research Advisor: Dr. Karen Dixon

The purpose of this research is to see if pedestrians and bicyclists cause more crash conflicts in 4-way stop controlled intersections, a crash conflict being defined in this study as “when a pedestrian, bicyclist, or vehicle make an abrupt stop or swerve in order to avoid a crash.” This hypothesis is based around the theory that the more conflicts at a given intersections the more crashes will occur. Our data was collected from 9 different sites, creating over 20 hours of video from which we pulled all of the necessary variables. With some initial analysis the data shows that the more pedestrians that use a particular intersection the percentage of vehicle violators goes down, but the percentage of conflict seems to increase until it hits a peak at around 700 Veh/Hr. Another trend that is observed show a more linear relationship, that the number of conflicts without pedestrians or bicyclist present seems to increases with the traffic flow volume. It was discovered through some statistical analysis of our data that the number of crash conflicts and actual crashes are not independent of each other.

Poster # 79

Text Mining Crash Narratives

Mary Weber (University of Michigan)

TTI ATLAS Summer Internships

Research Advisor: Dr. Eva Shipp

Text narratives of records often contain useful information. This project's goal was to programmatically identify crashes within the domain of farm equipment narratives (FEN). The program seeks to accurately select FEN from a FEN-only database as well as a mixed domain database of crash narratives. By applying a semantic tagger tool and word cloud tools to the FEN-only database, plus researching agricultural terminology, a list of relevant terms and phrases was compiled. The program compares each narrative to the designated list and moves it from the starting directory to 1 of 2 other directories, based on whether its first match was a term or phrase. When completed, any narratives still in the starting directory are assumed to be outside the desired domain. A database of only FEN had a 71.3% accuracy rate, with the undetected narratives containing no indication that they are FEN. A database of mixed domain narratives had the same result, but also included 6 non-FEN misidentified as FEN, of which 4 could be cross-classified as FEN. Moving forward, the goal is to identify modifiable factors associated with certain types of crashes by recognizing patterns among them.

Poster # 80

Behavioral Study on Pedestrian's Decisions at a Midblock Crossing

Madison Graham (Texas A&M University)

TTI ATLAS Summer Internships

Research Advisor: Dr. Kay Fitzpatrick

Many factors can affect the behavior of a walking individual. The number of pedestrians has increased over the past decade, but so has the number of pedestrian crashes. Studying pedestrian behavior is a way to obtain a better understanding of the choices people make. This study provides an examination on pedestrian's walking path choices at marked and unmarked crosswalk locations along a roadway segment heavily used by new students and their families attending their summer conference. Crossing behaviors for 2,676 pedestrians were collected along with behavioral characteristics and physical features (such as age and gender). An influential factor for pedestrian's crossing behavior was the behavior of the group or individual ahead of that pedestrian. It was found that 51 percent of the pedestrians crossing midblock followed other pedestrians that also crossed at an unmarked midblock location. It was also determined that if a train was present, use of the underpass increased to 70 percent, compared to only 13 percent of the pedestrians using the underpass when the train was not present.

Poster # 81

Work Zone Crashes Involving Concrete Barrier Impacts

Garima Gupta (University of Michigan)

TTI ATLAS Summer Internships

Research Advisor: Dr. Gerald Ullman

Portable concrete barriers are commonly used to prevent and mitigate traffic intrusions into work zones; however, the consequences and characteristics of traffic crashes into portable concrete barriers in work zones are not well known. National fatal crash data, and crash data and narratives for work zones from construction on I35, were analyzed to determine factors associated with concrete barrier work zone (CBWZ) crashes. Analysis indicates wet road conditions and urban principal arterial roadway types associate with higher CBWZ crash rates than expected. Factors including large truck involvement, roadway grade, and attempted avoidance maneuver, do not seem to be related to CBWZ crash rates. Results show injury severity levels of CBWZ crashes are consistent with other types of work zone crashes. Additionally, injury severity levels for all I35 crashes, and specifically concrete barrier crashes, were lower during construction than before construction. Concrete barrier crash rates were the same before and during construction on I35. These results can aid in improved guidelines for concrete barrier use in work zones to maintain worker and road user safety.

Poster # 82

An Evaluation of the Effectiveness of the Pedestrian Intersection Safety Index to Predict Pedestrian Fatalities in Florida

Jack Cordes (University of North Carolina at Chapel Hill)

Cyber-Health GIS REU

Research Advisor: Dr. Daniel Goldberg

In 2014, 4,884 pedestrian fatalities occurred in the United States and 12% of those occurred in Florida. Most pedestrian fatalities are avoidable and many state and local agencies are concerned with improving traffic safety. The Federal Highway Administration developed a Pedestrian Intersection Safety Index (Ped ISI) in 2006 that produced a model to determine the dangerousness of crosswalks to help identify priority intersections for intervention. Using data from the Fatality Analysis Reporting System, the Florida Department of Transportation, and the US Census Bureau, this study evaluates the effectiveness of the index to predict pedestrian fatalities at intersections from 2004-2014. We calculated a Ped ISI for 9,999 intersection approaches, 72,530 intersections with appropriate equation constraints, and 120,714 intersections total. Pedestrian fatality incidents were assigned to the nearest intersection within 150 meters of their location resulting in 1,168, 2,167, and 3,479 incidents respectively over the study period. We conducted a regression analysis between the Ped ISI and the frequency of pedestrian fatality incidents per intersection. The results indicated an R squared value of 0.046 ($p < 0.001$), 0.015 ($p < 0.001$), and 0.019 ($p < 0.001$) respectively. A geographically weighted regression did not improve results. Our results show that the Ped ISI did not perform well in determining dangerousness of intersections in terms of actual fatality data. We caution state and local transportation agencies from using the Ped ISI as an indicator of the likelihood of pedestrian fatality occurrence.

Life Sciences, Biomedical Sciences, Liberal Arts and Education

3:00 PM – 5:00 PM

Poster # 1

The Bard's Bibliography: Maintaining the Digital World Shakespeare Bibliography

Eryn Lyle (Texas A&M University)

World Shakespeare Bibliography

Research Advisor: Dr. Laura Estill

Bibliographies are essential tools for researchers, especially in the information age; they make it easier to track down full citations, find papers and research on specific topics, and cross-reference works. The purpose of this research is for a team of undergraduates, graduate students and professor-editors to maintain a composite digital bibliography, The World Shakespeare Bibliography (WSB), of all research done from 1960 to the present on Shakespearean studies. The ultimate goal is to gather, analyze and redistribute information so researchers can quickly assess current human knowledge. All Shakespeare-related publications are reviewed and categorized in the WSB, with my work to create data sheets of missing entries and errors, search academic publishing sources for Shakespeare-related scholarly work, and compile the data for a final review by a higher-up team member before final publication. This research poster will describe the workflow of the maintenance of a digital humanities (incorporating both the humanities and technology) bibliography. The results provided scholarly references, which are maintained in the powerful WSB database and allow researchers worldwide to quickly access a historical record of theory and ideas. The significance of this work is the ultimate creation of more and similar digital humanities systems that can be used to understand human patterns, assess theories, and create scholarly insight. It is recommended that future digital humanities bibliographies, like WSB, be created which include non-academic writing such as blogs, websites, or audio/video references where a wider general public might have insightful approaches not yet realized.

Poster # 2

Lexical Stress Assignment for Visually Presented Words and Pseudowords by English Readers: An Experimental Investigation

Dana Choe (A&M Consolidated High School)

Independent Research Project

Research Advisor: Dr. Jyotsna Vaid

Lexical stress refers to emphasis placed on a particular syllable in a polysyllabic word which signals the intended meaning of the word. (Emphasis on a different syllable would convey a different meaning.) Different factors are thought to influence stress assignment, including acoustic cues, syllable structure, and orthographic cues. The present study focused on orthographic cues of stress assignment for visually presented words. Previous work has suggested that certain English word endings cue part of speech (noun vs. verb), which in turn cues the stress pattern of the word. In the present study, we sought to test this claim by presenting a group of English-speaking monolingual adults with a set of English pseudowords with different word endings associated more with nouns (and thus more likely to be stressed on the initial syllable) or verbs (which tend to receive non-initial stress). For each pseudoword, participants were asked to indicate where they thought the stress should be placed and provide confidence ratings. In addition, a baseline measure of stress judgment was obtained by performing the same test with real English words, presented visually. Finally, a list of Spanish-like pseudowords was presented, to explore how English-speaking monolinguals would assign stress to words in an unfamiliar language. The results are currently being analyzed and will be discussed in the context of previous studies with monolinguals and bilinguals.

Poster # 3

Investigating Teaching Strategy Differences in Dual One-way and Two-way Programs in Bilingual Classrooms: A Case Study

Silvia Garza (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Beverly Irby

The general purpose of this research was to investigate the most effective teaching methods and strategies that support children's language proficiency in Spanish and English in a central Texas public school district. A secondary purpose was to analyze surveys that measure teachers' perspectives regarding the strategies used in their personal experience as bilingual educators in dual language programs. There are various strategies and methods that bilingual teachers use to help early elementary students succeed in language proficiency. Every teacher adopts different strategies that work best for the students according to their needs; therefore it might be difficult to recognize the best method. By investigating specifics surveys, and assessment results, I obtained quantitative data that pointed to which method gives the best results for students to succeed in Spanish and English language proficiency. I was also able to analyze and report qualitative, descriptive data about each program type within the schools and the most successful methods that are being used according to teachers' perspective. This research provides valuable data about the techniques that are being used in today's school programs and the impact they have to early elementary students. It also provides a specific number of the most successful strategies from current teachers' perspective that work best for bilingual learners that can be implemented by future teachers.

Poster # 4

Investigating Peer and Parental Involvement Through Social Media to Motivate and Scaffold Informal Science Learning

Stephen Spencer (Texas A&M University); Kristen Freeman (Texas A&M University); Momoreoluwa Adesanmi (Texas A&M University); Humam Daas (Texas A&M University)

Research Intensive Community for Undergraduates (RICU) Summer Program

Research Advisor: Dr. Sharon Lynn Chu

This project will investigate the effects of peer and parental involvement through social media to motivate and scaffold informal science learning for elementary school students. Interest in pursuing STEM-related careers has historically been low, especially for children from minority populations. Studies show that not only out-of-school involvement in science is important to sustain the child's interest in science and to foster deeper learning, but also that the extent of parents' interest in their child's education correlates highly with academic performance. We are interested in understanding how social media may enable parents to interact with their children as the latter explore and learn about science in their daily life. Our research involves the design and development of a social media portal that allows first, elementary school students to record personally-relevant science stories and second, peers and parents to interact with the recorded stories. The evaluation of the portal will be done on a small scale with a group of elementary school students from minority populations. Results of this project will be sent for publication to conferences in human-computer interaction and educational technologies.

Poster # 5

The Role of Type Six Secretion in a Plant Growth Promoting Rhizobacterium

Jeroen Versteegen (HAS University of Applied Sciences)

J1 Student Intern Visa

Research Advisor: Dr. Elizabeth Pierson

The Type VI Secretion System (T6SS) is one of the multiple protein secretion systems possessed by Gram-negative bacteria. The T6SS is a membrane spanning nanomachine that resembles a bacteriophage tail. Mechanistically, the T6SS contracts and injects effector proteins into bacterial or eukaryotic cells. These effector proteins are involved in interactions between microbes, but also have been implicated in host-pathogen interactions. Much research has focused on the role of the T6SS in the virulence of human pathogenic bacteria, but the presence of T6SS in a diversity of Gram-negative bacteria suggests broader functionality in bacterial fitness. The plant-growth promoting rhizobacteria *Pseudomonas chlororaphis* 30-84 encodes two T6SS, H1- and H2-T6SS. This study focused on characterizing the expression of the H2-T6SS by cloning the promoter region of the first gene of the tail component upstream of the lacZ and gfp reporter genes in a very stable plasmid. To determine when H2-T6SS is transcribed, the beta-galactosidase activity of plasmid-containing *P. chlororaphis* 30-84 cultures grown under various conditions was measured. Of the conditions examined in this study, none resulted in changes of H2-T6SS gene expression. Future experiments will elucidate the role of quorum sensing, the effect of nutrients, and plant exudates on transcription of the H2-T6SS in P. chlororaphis 30-84.

Poster # 6

Impact of Interstitial Flow on Adipocyte Differentiation and Function

Ben Boyett (Texas A&M University) Evon Looper (Texas A&M University); Naveen Menon (Texas A&M University)

TAMHSC COM Summer Undergraduate Research Program

Research Advisor: Dr. Joseph Rutkowski

The obesity epidemic in America is characterized in part by pathological expansion of adipose tissue. This leads to hypoxia and inflammation in the adipose tissue, as well as a more fibrotic interstitial space, because the expanded fat tissue does not have a corresponding growth in angio and lymphangiogenesis as adipocytes expand. We hypothesize that this inflammation and fibrosis is due to the lack of interstitial flow between blood vasculature and lymphatic vasculature in expanded adipose tissue. Goals of the study were to achieve adipocyte differentiation in 2 and 3 dimensions, to design 3 dimensional flow systems compatible with interstitial flow, and to quantify changes in adipocyte biology through gene expression and function through metabolic flux analysis. It was found that we could differentiate adipocytes, both in 2 and 3 dimensions using both type I collagen or a thiol-crosslinked hyaluronic acid (HA) matrices. We were also able to develop an initial system representing physiologically-relevant levels of interstitial flow by using transwell plates and micro-fluidics chambers. It was found that adipocytes tolerate both matrices well, but preferentially perform better in the HA matrix regarding expression of adipocyte differentiation markers. With interstitial flow, adipocytes exhibited decreased markers of inflammation in the HA matrix. These results provide the basis for future studies that will involve a more customizable flow chamber with regards to geometry, flow rates, and matrix composition, as well as the application of primary isolated cells, which will allow us to identify mechanical mediators of adipocyte biology in obesity.

Poster # 7

Mechanical Effects of Engineered Matrices on Adipocyte Biology

Ben Boyett (Texas A&M University) Evon Looper (Texas A&M University); Naveen Menon (Texas A&M University)

TAMHSC COM Summer Undergraduate Research Program

Research Advisor: Dr. Joseph Rutkowski

Obesity, one of the leading causes of preventable morbidity worldwide, is defined as the expansion of adipose due to increased cellular lipid uptake. In some instances this enlargement is pathological and can lead to increased inflammation and the formation of excess connective tissue, fibrosis, in the interstitial gaps of adipose tissue. A model, which replicates the environmental conditions that adipocytes face in fibrotic tissue, is not well defined. The primary aim of this study was to establish a 3-dimensional static system to imitate the experimental design of our study was tailored to examine the effects of different matrices and the influence of matrix rigidity on adipocyte biology. Our hypothesis is that adipocyte biology is dependent on matrix type and stiffness. Four different matrices were used in this investigation: rat-tail collagen type 1, HyStem-HP (hyaluronic acid, cross-linked commercial matrix), methacrylated gelatin hydrogel (GelMa) and polyethylene glycol polymer hydrogel (PEG). These different mediums, in which fibroblasts were implanted and differentiated, allowed for testing the adipocyte gene expression of inflammatory, adipogenic and vascularization markers in different matrix compositions and matrix rigor. The analysis of the accrued experimental data suggests that adipocytes tolerate the different matrices similarly. However, the data also suggests that an increase in matrix rigidity inclines the adipocyte functionality to a beige fat form, while expressing comparable values of adipocyte inflammation and vascularization. The results of this study will permit for further examination into replicating the conditions that adipocytes face in obesity- induced fibrosis models.

Poster # 8

Mapping Genetic Factors Underlying Diverse Diet Response in an F2 Population of Mice

Aaron VanWettering (Texas A&M University)

TAMHSC COM Summer Undergraduate Research Program

Research Advisor: Dr. William Barrington

In the past few decades the trend in diet recommendations have been centered around population statistics rather than individual data. There exists a possible discrepancy where an individual may not respond to a specific diet as the population data suggests. Based on metabolic health studies conducted in this lab, it was found that when two strains of mice were exposed to the same diet, opposite effects were observed in regards to their metabolic health. One of the strains studied C57BL/6J, when fed a Western diet, consisting of high carbohydrate and high fat, experienced increased adiposity levels as well as negative effects to their glucose tolerance and fasting serum insulin concentrations. The FVB/NJ mice, when subjected to the same Western diet, had a relatively normal phenotypic response. Both strains were then fed a ketogenic diet. The C57BL/6J showed no significant increase in adipose levels whereas the FVB/NJ mice experienced just the opposite. A F2 population from these two parental strains was derived in order to identify the genes involved in the differing obesity susceptibility. By genetically mapping the underlying factors that lead to a specific phenotype observed, an individualized diet based model could be developed for optimum nutrient and health.

Poster # 9

Effects of an EGFR Inhibitor on Cholesterol

Nataly Gomez (Texas A&M University); Breanna Loberger (Texas A&M University)

TAMHSC COM Summer Undergraduate Research Program

Research Advisor: Dr. David Threadgill

Although cholesterol is essential for normal metabolic function, excess serum cholesterol is indicative of metabolic syndrome and can lead to cardiovascular disease. Studies have shown a correlation between a Western diet (high in fat and sugar, low in fiber) to risk factors common to metabolic syndrome, heart disease, and cancer. The drug used in this experiment, AG1478, inhibits epidermal growth factor receptor (EGFR), a transmembrane receptor involved in cell growth and proliferation signaling. In a previous study, it was shown that C57BL/6J mice on a Western diet had improvements in their cardiovascular profiles, particularly in total serum cholesterol, after a two-month exposure to AG1478. We hypothesized that the EGFR inhibitor increases HDL and decreases LDL cholesterol levels in a genetic background-dependent manner. To test our hypothesis, four strains of mice (A/J, C57BL/6J, BALB/cJ, and FVB/NJ) were given one of three doses of the inhibitor incorporated into a Western diet chow. Control mice were given Western chow without inhibitor. HDL, LDL, and total cholesterol were isolated from blood serum of mice after four months on the diets. Significant differences between the strains in the control group were observed, confirming the influence of genetic background on serum cholesterol. Gender differences within the strains were observed, which could be caused by variations in estrogen levels and adiposity, two factors known to impact serum cholesterol levels. Strain-specific changes in cholesterol profiles (total, HDL, and LDL) across drug doses suggest genetic-background mediated differences in response to EGFR inhibition. These results are further supported by ANCOVA statistical analysis, in which dose, strain and gender correlate with cholesterol levels, while adiposity showed little correlation.

Poster # 10

Identification of Dopamine's Influential Properties on Lymphatic Vessels

Senthil Sakthivel (Texas A&M University); Brandon Gallagher (Texas A&M University);
Sara Uddin (Texas A&M University); Vanessa Winklepleck (Texas A&M University);
Kate Hajdu (Texas A&M University)

DeBakey Undergraduate Research Program

Research Advisor: Dr. Ranjeet Dongaonkar

The lymphatic system plays a crucial role in interstitial fluid balance—it collects and transports fluid and proteins lost to the interstitial space from blood capillaries to the circulation system. Once thought to be a passive process determined by pressure gradients, lymphatic transport is an active process determined by spontaneous contractions of lymphatic vessel segments. Although lymphatic vessels look like blood vessels, they function as pumps like cardiac ventricles. Lymphatic muscle provides the ability to generate pressure to pump lymph, fluid and proteins inside the lymphatic vessels, from the low-pressure interstitial space to high-pressure veins of neck. Presence of valves helps maintain one-way flow. Furthermore, it is understood that lymphatic pump failure against elevated central venous pressure decreases lymph flow leading to edema, excess accumulation of fluid and protein. However, no effective treatments for lymphatic pump failure exist. Recent studies have reported that dopamine at low concentrations has chronotropic as well as inotropic effects on the heart. The resulting increases in cardiac contractility and heart rate have been reported to increase cardiac output, increase mean arterial blood pressure and decrease central venous pressure. However, how dopamine affects lymphatic pump has yet to be studied thoroughly. Therefore the goal of the project is to evaluate our hypothesis that dopamine enhances lymphatic pump function. To test this hypothesis, we will quantify the effects of various concentrations of dopamine on contraction frequency, strength and active lymph flow of bovine mesenteric lymphatic vessels.

Poster # 11

Implications of Long-term and Short-term Perturbations of Blood Volume and Mean Arterial Pressure on Wall Stress and Contractility

Fazal Dalal (Texas A&M University); Wesley Fuertes (Texas A&M University);
Hanifa Mohiuddin (Texas A&M University); Hyunjin Lee (Texas A&M University)

DeBakey Undergraduate Research Program

Research Advisor: Dr. Randolph Stewart

Cardiovascular disease is the leading global cause of death, accounting for more than 17.3 million deaths per year. Thirty-six percent of those are the result of heart failure. Disease progression in a failing heart is characterized by changes in contractility of the left ventricle (the primary pumping chamber of the heart). Also, ventricular wall stress is recognized as a stimulus for growth and remodeling of the ventricle. Computational modeling demonstrates a causal relationship in that changes in the strength of ventricular contraction results in changes in wall stress; however, this relationship is dependent on the model assumptions concerning blood volume and mean arterial pressure. Many vascular properties affect ventricular pressure, and thus walls stress, but it is difficult to experimentally alter each property independently to characterize the impact on wall stress, therefore investigators have used mathematical modeling to characterize these properties. Most computational approaches model interaction of the ventricle with the systemic arterial system, and assume that systemic blood pressure is not regulated. Therefore the purpose of the present work was to develop a mathematical model that includes the entire cardiovascular system to predict wall stress when blood pressure is regulated.

Poster # 12

Genotype and Utrophin Correlates in Golden Retriever Muscular Dystrophy Dogs

Madison Rigsby (Texas A&M University); Sarah Jacobson (Texas A&M University);
Ashtin Turner (Texas A&M University)

Aggie Research Scholars

Research Advisor: Dr. Peter Nghiem

Introduction: Duchenne Muscular Dystrophy (DMD), an X-linked disorder that affects 1 in 5,000 male births, is caused by various mutations in the DMD gene, resulting in reduced to absent dystrophin protein. DMD is characterized by skeletal and cardiac muscle deterioration, eventually leading to death by the 30's. Currently, there is no viable treatment or cure. Most clinical trials have focused on replacing or delivering a truncated dystrophin protein, while others have turned to compensatory molecular pathways. *Methods:* In this study, we utilized the canine DMD model, golden retriever muscular dystrophy (GRMD), and performed two analyses: 1.) A comprehensive database analysis for disease specific markers and 2.) Age-related utrophin expression, a structural and functional homologue of dystrophin, using western blotting. *Results:* Out of 1,101 dogs evaluated in our colony, there were 392 GRMD, 229 carriers, 373 normal, and 127 unknown genotypes. Normal dogs had reduced utrophin expression with age, while GRMD dogs had peak expression at certain age groups, suggesting a compensatory mechanism was involved. *Conclusion:* There were a reduced number of GRMD dogs compared to normal/carrier dogs due to neonatal death in the affected group. This study contributes to further research on utrophin as a possible treatment for DMD patients.

Poster # 13

Effects of Exercise on Porcine Mesenteric Lymphatic Muscle Contraction

Vinay Khanijow (Texas A&M University); Kelly Dang (Texas A&M University); Ali Eldouh (Texas A&M University); Woojung Kim (Texas A&M University); Megan Nicholson (Texas A&M University)

DeBakey Undergraduate Research Program

Research Advisor: Dr. Ranjeet Dongaonkar

Exercise has been reported to enhance lymphatic function and increase the longevity of vessels. With a lack of exercise, there has been shown to be a significant decrease in intestinal function. Mesenteric lymphatic vessels drain excess intestine fluid and transport fats throughout the body. Minimal exercise can cause a significant amount of fat build up within vessels and can decrease lymphatic pumping throughout the vessels. In addition, lymphedema can develop as well causing major problems throughout the lymphatic system. Recent studies investigating the effect of aerobic exercise on small vessels have reported increased lymphatic muscle function. However, effects of aerobic exercise on large vessels have yet to be investigated thoroughly. Therefore, the hypothesis of this study is that aerobic exercise increases lymphatic muscle contractility. In order to test this hypothesis, we will gather pigs that have been exercised for a few months and analyze the ability of lymphatic vessels to generate tensions at different pressures and compare the data to pigs that have not exercised. Upon successful completion, the study is expected to yield findings that are able to support the importance of exercise for patients in regard to the lymphatic system. In addition, the study is anticipated to provide additional knowledge to supplement the current understanding of lymphatic mechanisms.

Poster # 14

Prediction of Occurrence of Down Syndrome in Unborn Babies Using Blood Borne Biomarkers and a Linear Discriminant Analysis Classifier

Srinidhi Narayanan (College Station High School)

Independent Research Project

Research Advisor: Dr. Alan Dabney

Downs Syndrome (DS), also known as Trisomy 21, is a human genetic disorder caused by the presence of an extra copy of the 21st Chromosome. The most notable consequences of this disorder are physical and mental disabilities, affecting over 90% of all individuals with the disorder. In the U.S. alone, approximately 6,000 babies are born with DS each year. Thus, being able to better predict the occurrence of DS in unborn babies would have a substantial impact on the lives of many millions of people around the world. It has been demonstrated that certain blood-borne biomarkers from the expectant mothers can be used to predict whether a fetus will develop the disorder. We analyzed a dataset consisting of biomarker measurements for 12,942 expectant mothers in China; approximately 200,000 babies are born with DS each year in China. For each mother, ultrasound images were inspected by experts, and an assessment of whether the child has DS was made based on a technique that is proprietary to our commercial collaborators. Using the 12,942 as training data, we trained a linear discriminant analysis classifier, with biomarker measurements as predictor variables and ultrasound-based DS assessments as "truth." We used leave-one-out cross-validation to assess classifier performance, with our model exhibiting an estimated misclassification rate of about 10%.

Poster # 15

Population Variability and the Teratogenic Effects of Exposure to 2, 3, 7, 8-Tetrachlorodibenzo-p-dioxin During Pregnancy

Amy Cooper (Texas A&M University); Shelby Zumwalt (Texas A&M University);
Malynn Anne Ilanga (Texas A&M University)

Independent Research Project

Research Advisor: Dr. David Threadgill

2, 3, 7, 8-tetrachlorodibenzo-p-dioxin, also known as TCDD, is a toxicant that causes carcinogenic and deleterious effects on various tissues and organs throughout the body. It is of great concern when exposed during pregnancy. The heterogenetic nature of maternal and fetal susceptibility to dioxin varies in response, including an overall increase or decrease in risks of fetal malformations. We aim to incorporate genetic variability found within the population in assessing exposure risks to dioxin during pregnancy. By using 20 different strains of pregnant female mice, we will mimic individual genetic types found in the population. Over a 10-day period, pregnant mice were exposed to different doses of TCDD (1, 10, 50, 100 ng/kg). Post exposure, we found that some strains showed no significant differences in implantation trends or the stage of embryonic development when compared to untreated controls. These mice were deemed resistant to all doses of dioxin. It was also found that in some strains high dose exposure led to a significant decrease in implantation rate and the number of viable embryos. Our data has shown inter-strain differences in the number of viable embryos and absorptions but there were no significant intra-strain differences. Ultimately the results of this study will emphasize the importance of including population heterogeneity in assessing toxicant exposure risks and potentially aiding in the underlying mechanisms and treatment.

Poster # 16

Poor Performance on Memory Tests Indicates Dementia of the Alzheimer's Type Before Measures of Other Cognitive Abilities

Joshua Fuller (Texas A&M University); Kandeel Ali (Texas A&M University);
Adam LaMasters (Texas A&M University); Jocelyn Morales (Texas A&M University),
Claudia Jimenez (Texas A&M University); Kristi Santiago (Texas A&M University)

Research Intensive Community for Undergraduates (RICU) Summer Program

Research Advisor: Dr. Steve Balsis

Objectives: 1) To statistically analyze the relationship between the four individual sub-domains of cognition (memory, executive function, visuospatial, language) and overall dementia of the Alzheimer's type (DAT) related cognitive decline. Method: Demographic and neuropsychological data were mined from 1056 in the Alzheimer's Disease Neuroimaging Initiative (ADNI). We used Item Response Theory to define a latent DAT continuum, estimate model parameters, and quantify the relationship between performance on the various neurocognitive assessments and overall DAT-associated cognitive decline. Results: Results suggest that performance on measures of memory indicates DAT before other cognitive abilities. The ability of memory measures to indicate DAT begins at mild levels of DAT-associated cognitive dysfunction (at approximately $\theta = 0$). Executive function and language provide the next greatest level of indication. Visuospatial assessment provides the least indication of DAT. Conclusion: Results indicate that performance on memory measures provides the greatest indication of DAT relative to other cognitive abilities.

Poster # 17

Inbreeding Effects on Demography and Population Trends of the Endangered Florida Panther

Chris Chen (Texas A&M University); Anna Cole (Texas A&M University); Kelsea Anthony (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Hsiao-Hsuan (Rose) Wang

There are over 30 species of wild cat that occupy over 90 countries of the world. However, habitat fragmentation leads to common occurrences of inbreeding and subsequent biodiversity loss. One subspecies of felid experiencing such inbreeding is the Florida panther (*Puma concolor coryi*). A subspecies of puma, the Florida panther historically resided in a large expanse of the southeast United States. Due to urbanization, the habitat has been reduced to two areas in southwest Florida: the Big Cypress Swamp and Everglades National Park and the two populations of Florida panthers are isolated. Physical and reproductive characteristics, such as cryptorchidism, have resulted from inbreeding. Hence, we developed a population model to analyze inbreeding effects. When mortality rates were changed to maximum values, the simulated Florida panther population was close to extinction after 25 years, while the population size reached over 1700 when the parameters were set to minimum values. When each stage mortality rate was altered individually while the others remained at baseline, the population size was ranged from 0 to 10 panthers after 25 years. The natality parameters, however, had much different results; when only natality was manipulated, the population ranged from 0 to 218. These results suggest that natality rates play an important role to sustain the population of Florida panther. Such a scenario can happen by increasing available genes in the gene pool, which happened with the 8 Texas cougars bred with the native Florida panthers.

Poster # 18

Big Data Analysis

Trang Le (Texas A&M University); Emily Bueno (Texas A&M International University);
John Getman (Texas A&M University); Michael Jiminez (Texas A&M University);
Gabriel Wang (Texas A&M University)

Research Intensive Community for Undergraduates (RICU) Summer Program

Research Advisor: Dr. Satish Bukkapatnam

Myocardial infarction (MI) and pericarditis (PC) are two cardiovascular diseases that affect three million and 200,000 patients in the US per year, respectively. Although they have similar symptoms, including sharp and radiating pain to the chest, MI is life threatening, whereas PC is short term and not as severe. Currently, PC patients are often inaccurately diagnosed with MI due to misinterpretation of the patients' electrocardiogram (ECG), which can cause incorrect prescription to the patients, consumption of unnecessary resources, and ineffective time usage of medical personnels. To reduce these avoidable costs, this project will create a classifier that can effectively differentiate between the two diseases using Big Data and Machine Learning. The process consists of digitizing paper ECGs from a healthcare provider in California, extracting vectorcardiogram (VCG) from the ECG, extracting four sets of features, classifying and predicting diseases, and validating classifiers. Data digitized from 45 paper ECGs using Windig were transformed into a vectorcardiogram (VCG), which contains three orthogonal leads x, y and z. From the ECG, VCG, octant and random walk features extracted from the VCG data, a classifier will categorize whether the patient is undergoing a myocardial infarction or pericarditis. After the classifier is validated, development of a user-friendly decision support software on smart phones can help medical personnels identify whether the patient needs emergency treatment.

Poster # 19

The Relationship Between Emotional Eating and Stress

Shelby Herrera (Texas A&M University); Cassidy Bartels (Texas A&M University); Deja Miller-Brooks (Texas A&M University); Kavya Murali (Texas A&M University)

Research Intensive Community for Undergraduates (RICU) Summer Program

Research Advisor: Dr. Sherecce Fields

Stress has been shown to be related to a number of health risk behaviors. It has been suggested that some individuals engage in eating as a stress reduction technique. The purpose of this study was to examine if there is a relationship between stress and eating habits in a sample of adolescents and emerging adults. Participants were 113 adolescents between the ages of 14 and 19. Participants completed a number of surveys and computer tasks, including the Weight Related Eating Questionnaire (WREQ) and the Perceived Stress Scale (PSS). Results indicated that there was a significant correlation between the emotional eating subscale of the WREQ and stress; individuals with higher levels of stress engaged in more emotional eating. The results of this study suggest a unique avenue of interventions for eating behaviors in adolescents and emerging adults.

Poster # 20

Remote Health Monitoring System for Chronic Disease Management

Jose Alfaro (Texas A&M University); Virgilio Godoy (Texas A&M University); Amogh Kulkarni (Texas A&M University)

Research Intensive Community for Undergraduates (RICU) Summer Program

Research Advisor: Dr. Michelle Alvarado

The purpose of this research project was to investigate various indicators of chronic illnesses and categorize them based on existing remote device technology. Chronic illnesses affect 133 million people in the United States, additionally, a significant number of them struggle to manage their illness on a daily basis. For this reason, understanding the diseases and monitoring them is crucial to improving the quality of healthcare for millions of patients, not only in the United States, but also around the world. After investigating the devices used to monitor chronic diseases, a reliable remote health monitoring system can be created. Through the use of medical journals, articles, and websites, we generated a cohesive list of chronic diseases, their indicators (i.e. blood glucose levels for diabetes), and remote devices used to monitor those illnesses. By the end of the 10 week research period, we were able to see the relationships between indicators of different diseases.

Poster # 21

Exploration of Polymer Capsules and Layer-by-Layer Films for Biomedical Applications

Haley Nelson (Texas A&M University); Miranda Molina (Texas A&M University);
Steven Strack (Texas A&M University)

Aggie Research Scholars

Research Advisor: Dr. Victoria Albright

The overall goal of this research is to create dual function skin grafts that can withstand human physiological conditions, promote healing, and release antibiotics to prevent infection in response to temperature stimuli. To provide antibacterial defense, polymer films will be deposited on a cell stimulating nanofiber mesh using the layer-by-layer (LbL) technique. A biocompatible, temperature-responsive, block copolymer will be used in the film as it can form temperature responsive micelles, which have the ability to contain antibiotics inside themselves and release the antibiotics at the physiological temperatures consistent with infection. We have studied how different deposition techniques, such as dip and spin coating as well as how different film compositions such as temperature-responsive and non-temperature responsive films, affect film growth on different surfaces and the stability in different salinity concentrations and pH ranges. In order to collect data, we use a variety of machines such as an ellipsometer to measure film growth, dynamic light scattering to measure micelles, and a UV-VIS spectrophotometer to measure drug release. Future tests include temperature-dependant swelling tests on micelle films, comparing stability of new films made with different polymers with current film stability, and contact angle measurement tests.

Poster # 22

Effects of Wildfire on Abundances and Morphological Characteristics of Green Tree Frog in Bastrop, Texas

Thanchira Suriyamongkol (Texas A&M University); Kaitlyn Forks (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Hsiao-Hsuan (Rose) Wang

Wildfires are natural phenomena that can impact native fauna by altering their habitats. In 2011, a large wildfire occurred in 2011 near Bastrop, Texas. Unfortunately, much of its Lost Pines habitats was destroyed, as a result of wildfire, and will take years to recover. The objective of this study is to compare the relative abundances and morphological characteristics of green tree frogs (Hyla cinerea) in burned areas with those in unburned areas near Bastrop to assess the effect of these fires on green tree frog populations in the area. Method: We analyzed weekly data on tree frogs distribution in GLR collected by Texas State University over the five-month period from June to October using PVC pipes placed around each of four ponds. Species trapped were predominantly Hyla cinerea. Results: Frogs were more abundant in unburned areas. However, statistically, the difference between the number of green tree frogs found in burned area and unburned area was not significant (P=0.0744).

Poster # 23

Analysis of the Telomere-Telomerase Interaction in *Arabidopsis*

Gabrielle Lessen (Texas A&M University)

Beckman Scholars Program

Research Advisor: Dr. Dorothy Shippen

The study of telomeres may provide significant insight into stem cell-related diseases and cancer. Telomeres are found on the ends of DNA chromosomes. They consist of repeating sequences of nucleotides and associated proteins and serve one main purpose—to protect chromosome ends from being perceived as damaged DNA and thus preserve the chromosome as a whole, much like aglets (the plastic tips of shoelaces) protect the ends of shoelaces from fraying and shortening. Multiple proteins are associated with telomeres. An essential enzyme for telomere function and maintenance is telomerase. Telomerase is responsible for telomere replication and maintains telomere length in the chromosome. Other proteins serve to physically protect chromosome ends and to control telomerase access to the end. Plants act as important tools in studying telomeres because they can withstand mutations in telomere-related components for several generations. This characteristic makes plants particularly useful in studying telomere dysfunction. In addition, the telomere biology of plants is highly conserved, and insight gained from studying plant telomere mechanisms can be extrapolated to other organisms. The purpose of this study is to investigate how telomere-associated proteins interact with each other, with the telomere, and with telomerase in plant cells. By identifying candidates for amino acid residues important for mediating the interactions between these proteins and introducing mutations to analyze the consequences of disruption of these protein interactions, this study aims to give insight to the individual roles of telomere-associated proteins, and to advance understanding of how telomeres provide stability for chromosomes.

Poster # 24

Bacteriocidal Genes from Viral Dark Matter

Jennifer Tran (Texas A&M University)

Beckman Scholars Program

Research Advisor: Dr. Ryland Young

Antibiotics, discovered in the early 20th century, revolutionized the way we treat bacterial infections and nearly eradicated previously untreatable diseases like tuberculosis. However, indiscriminate overuse has led to a rise in antibiotic-resistant microbes, and researchers have recently found bacterial strains resistant to drugs of last resort, suggesting that we are on the cusp of post-antibiotic era. With an ever increasing incidence of antibiotic resistance in clinical settings, bacterial viruses, or “phages”, are being seriously considered as alternatives to chemical antibiotics. One type of phage, single-stranded RNA (ssRNA) phages, are the smallest viruses known, with less than 4000 nucleotides and typically 3 to 5 genes. Each has a single gene that, when expressed, causes the bacterial host cell to undergo lysis (burst). In fact, the lysis genes of two of these ssRNA phages have already been shown to block cell wall synthesis in E.coli, and it is highly likely that other ssRNA phage lysis genes target different bacterial proteins. In the past, only a few of these RNA phages were known, but recently, over a hundred partial ssRNA phage genomes were isolated from environmental sample data. We identified potential lysis genes from these sequences using bioinformatics and have been synthesizing and testing these genes. We have found five that are lytic in E.coli and are working towards identifying their lysis mechanism. Understanding this lytic function would potentially allow us to find new targets for antibiotics or even develop new antibiotic strategies.

Poster # 25

High-Throughput Phenotype Data Browsers for *Bacillus subtilis* and *Escherichia coli*

Rebecca Berg (St. Cloud State University)

Biochemistry REU: Summer Undergraduate Research Program in Biochemistry

Research Advisor: Dr. James C. Hu

Complete genomes allow us to comprehensively study phenotypes through reverse genetic technologies for all annotated genes or any defined subset. “A Comprehensive, CRISPR-based Functional Analysis of Essential Genes in Bacteria,” by Peters et al. and “Phenotypic Landscape of a Bacterial Cell,” by Nichols et al. are two examples of such high-throughput studies for *Bacillus subtilis* and *Escherichia coli*, respectively. To make the data from these studies more accessible to the broader research community, we created a publicly accessible web page that can display the data based on a search query. Users can search the data by strain name, strain id number, strain target product or chemical condition. The web-page outputs the search query and further data from the studies such as chemical condition, fitness score, and correlation coefficient in a table format. This information is valuable in revealing strain similarities based on the pattern of gene-chemical fitness scores. As a result, gene function relationships can be inferred, revealing the gene networks in B.subtilis and E.coli.

Poster # 26

Identification and Characterization of Seven Novel dsDNA Phages Infecting Pandrug-Resistant *Acinetobacter baumannii* Clinical Isolates

Joseph Kreitz (Duke University)

Biochemistry REU: Summer Undergraduate Research Program in Biochemistry

Research Advisor: Dr. Ryland Young

Acinetobacter baumannii is an opportunistic pathogen of rising importance due to its resistance to many modern antibacterial agents. Although infections by *A. baumannii* have historically affected immunocompromised individuals to the greatest extent, the severity of bacteremias and other conditions caused by this organism has been on the rise due to the emergence of multidrug-resistant (MDR) and pandrug-resistant (PDR) strains throughout the nation’s hospitals. Consequently, an alternative approach to addressing this pathogen is needed. Here, we suggest that bacteriophage technology is a viable solution to this problem by identifying and characterizing seven novel virulent phages capable of infecting a range of clinical, PDR *A. baumannii* strains. After isolating these phages from environmental and sewage samples, as well as verifying them for purity, they were then shown to effectively lyse *A. baumannii* liquid cultures at several different multiplicities of infection. TEM imaging revealed striking morphological diversity among the phages, with all three families of the genus Caudovirales represented. After extracting the phage gDNAs, further characterization (which included multi-enzyme restriction digests, pulsed-field gel electrophoresis, and a host range assay) confirmed that all phages were indeed unique to one another and exhibited varying genomic characteristics. This work highlights the relative ease of isolating novel lytic phages against clinical isolates of *A. baumannii*, and suggests that this approach could serve as a viable alternative treatment option as more and more multidrug-resistant strains emerge.

Poster # 27

Progress Towards the Synthesis of New Benzofuran Derivatives Targeting a Polyketide Synthase for Inhibiting *Mycobacterium tuberculosis*

Alexandra Gittens (Vassar College)

Biochemistry REU: Summer Undergraduate Research Program in Biochemistry

Research Advisor: Dr. James C. Sacchettini

Multidrug-resistant tuberculosis (MDR-TB) is increasing, creating the potential for a world-wide epidemic. A need for a more effective solution is imperative. The drug-resistance and survivability of *Mycobacterium tuberculosis* (Mtb), the causative agent of tuberculosis, has been linked to the properties of its cell wall. By targeting Pks13, an essential polyketide synthase for cell wall synthesis, this wide-spread drug resistance in tuberculosis can be combatted. The focus of this project was to synthesize and purify anti-tuberculosis agents that target Pks13. Six benzofuran derivatives were synthesized using structure-based drug discovery and modern synthetic organic techniques. These compounds were tested in biological assays to determine their potency and effectiveness.

Poster # 28

The RNA Helicase H2F1 Cofactor in Trypanosome RNA Editing

Mary Grace Gagnon (Texas A&M University)

Biochemistry REU: Summer Undergraduate Research Program in Biochemistry

Research Advisor: Dr. Jorge Cruz-Reyes

Trypanosoma brucei (*T. brucei*) is a deadly kinetoplastid parasite which causes tens of thousands of deaths every year and depends on extensive RNA editing to survive the transition from its insect vector to the hostile environment of the human blood stream. Editing occurs in a large holo-editosome complex that includes an RNA editing helicase (REH2). The REH2 cofactor H2F1, a rare zinc finger RNA helicase cofactor with eight potential zinc fingers, is required for RNA editing. Our working hypothesis is that H2F1 controls the activity of REH2 and may specifically tether this helicase to the editing apparatus. To test our hypothesis, we are generating a series of H2F1 zinc finger mutations and modified a plasmid with the H2F1 gene in order to insert the mutations into the plasmid by In-Fusion cloning. These mutants are being transformed into *Escherichia coli* cells with the plasmids and the constructs are being confirmed through sequencing. The plasmids will be used to make recombinant H2F1. Recombinant H2F1 and REH2 (also made in our lab) will be tested for direct association *in vitro*. This will complement the expression of the same mutations *in vivo* through the use of a different plasmid in order to determine if the H2F1 cofactor binds REH2 directly and if its zinc fingers exhibit mRNA binding specificity.

Poster # 29

The Role of Protein Interactions in the Control of Photoperiodic Flowering in Sorghum Bicolor

Melissa Traver (Centenary College of Louisiana); Daryl Morishige (Texas A&M University);
Rebecca Murphy (Centenary College of Louisiana)

Biochemistry REU: Summer Undergraduate Research Program in Biochemistry

Research Advisor: Dr. John Mullet

In light of the world's steadily increasing food and energy demands, producing crops as efficiently as possible has become especially important. Sorghum bicolor, a cereal crop that already serves as a food source for millions worldwide, has more recently gained popularity as a bioenergy crop, due largely to its drought tolerance and ability to grow on marginal land. Whether sorghum is grown for food or fuel, understanding its maturation in response to day length is the key to optimizing yields. In the last decade, the genes underlying several loci that control flowering time in sorghum have been identified, including Ma1 as PRR37 and Ma6 as Ghd7. Moreover, an important role for Constans in sorghum has also been established during these studies. Though these proteins clearly contribute to photoperiodic regulation of flowering, the nature of each of their contributions to the overall pathway is not clear. These genes have all been shown to exhibit characteristic expression patterns in response to both light and the circadian clock, and one of these, Constans, has been shown to interact with certain Nuclear Factors (NF-Ys) in other species. Therefore, we have chosen to investigate the molecular mechanism by which these proteins influence flowering in sorghum by searching for protein interaction partners using a combination of gene expression studies to look for co-expression of potential partners, and yeast two-hybrid screens to test for interactions between these three proteins and other candidates, including Constans-like proteins and sorghum NF-Ys.

Poster # 30

Kinetic and Fluorescent Characterization of *Escherichia coli* Phosphofructokinase W311Y/F233W

Veronica Egging (University of Mary)

Biochemistry REU: Summer Undergraduate Research Program in Biochemistry

Research Advisor: Dr. Gregory Reinhart

The metabolism of glucose is the main source of energy for most organisms. The first committed step in Glycolysis is carried out by the homotetrameric enzyme phosphofructokinase or PFK. PFK catalyzes the phosphorylation of Fructose-6-phosphate (F6P) into Fructo-1,6-Bisphosphate(F-1,6-BP). This reaction can be allosterically inhibited with phospho(enol) pyruvate (PEP). *E. coli* PFK contains one native tryptophan at position 311 with fluorescence properties reporting on its immediate environment. The allosteric effect on a specific region of PFK can be investigated by detecting changes to the fluorescent properties for different ligand bound states. Using a double shift mutation W311Y/F233W the native tryptophan was removed and placed at 233 to report on the allosteric effect there.There was no significant change in the total fluorescence intensity with F6P binding, however upon PEP binding there was a 16% decrease the total fluorescent intensity but no additional change with the formation of the ternary complex (both ligands bound). The anisotropy decreased with PEP binding by 0.0045 and decreased with F6P binding by 0.0134, but increased 0.00705 upon formation of the ternary complex. The allosteric effect was seen in *E. coli* W311Y/F233W PFK through fluorescence anisotropy but not through total fluorescence intensity.

Poster # 31

Using Biomechanics to Optimize Quarterback Throwing Mechanics

Eric Matthews (Texas A&M University)

Biomechanical Enviroments Laboratories Undergraduate Research Program

Research Advisor: Dr. Michael Moreno

Interviews were conducted with middle school and high school football coaches to determine the common coaching points, foot patterns, and throwing routes that are being implemented by quarterbacks (QB) at the different levels of play. We then used Vicon Motion Capture technology, and AMTI force plates to investigate the throwing mechanics of the QB's with respect to the aforementioned coaching points. A custom marker set was designed - consisting of 4 markers per segment, in addition to the traditional marker placements seen in previous work – for use on the subjects during the trials. Each subject threw three different routes, each with a different foot pattern, to both sides of the field: A 5 yard hitch w/ no drop back, 20 yard corner route out of a three-step drop, and 12 yard comeback route out of a roll out. The common coaching points, from the interviews, that were focused on for data analysis were: the hip leading angle, elbow leading the hand, release time, orientation at ball release, consistency of throws, stride length and direction, and non-throwing arm motion.

Poster # 32

Using Motion Analysis to Determine the Efficacy of a Biodegradable Regenerative Implant for the Treatment of Long Bone Comminuted Fractures

Andrea Hernandez Quintana (Texas A&M University)

Biomechanical Enviroments Laboratories Undergraduate Research Program

Research Advisor: Dr. Michael Moreno

Comminuted fractures are a concern to the medical industry; especially when the fracture is longer than 2cm. The current forms of repair for critical size bone fractures include: autologous bone graft, allografts, and synthetic implants. Each present complications – such as risk of rejection, and impediment of tissue regeneration, both of which prevent the proper recovery of the patient. This study aims to evaluate the effectiveness of a cylindrical bone cuff, synthesized from a novel biodegradable polymer, which should allow for a well-integrated graft and promote hMSCs growth in the affected area – resulting in greater patient mobility during healing. We used a 12 camera Vicon Motion Capture System, HD video cameras, and 4-AMTI force plates to analyze the gait characteristics of 7 sheep who are to be implanted with the device. We can then compare the pre-operation, and post-operation gait of the animals, as well as the loading conditions on the injured leg, to see what effects, if any, the implant has on the normal walking function of the animal. We will calculate the stride length, pelvic tilt, cadence, and the hip and knee angles from the sheep's gait, as well as the percent of body mass weighted on each leg and the ground reaction forces.

Poster # 33

Identifying Asthma Rate Distribution in Harris County, Texas In Relation To EPA Toxics Release Inventory

Fadumo Ali (University of Minnesota Twin-Cities)

Cyber-Health GIS REU

Research Advisor: Dr. Daniel Goldberg

Environmental health concerns are a growing emphasis in and priority in public health policy. One of these growing public health concerns in the United States is chronic asthma amongst adults and children. Asthma is a medical condition in which an individual's airways become inflamed, then narrow, causing major or minor difficulty in breathing. Asthma can be a result of many factors in the natural or built environment. Prior research has linked high emission of toxic air pollution to cause asthma or worsen asthma symptoms. The Environmental Protection Agency (EPA) uses the Toxics Release Inventory (TRI) to manage and track specific toxic chemicals that are known to pose a threat to human health and the environment. With the TRI as a guide, our study identifies zip code level hospital discharges in Harris County, Texas due to asthma in relation to fugitive air emissions and point source air emissions. We hypothesize the total air emission will prove a positive correlation in relation to asthma rates. To test this hypothesis, we evaluated the relationship between asthma rates and total air emission using a linear regression and correlation coefficient analysis. Results showed that there was no correlation between the total air emission and asthma hospital discharge rates. These results were not what we hypothesized, but showed a possible correlation between asthma rates and other TRI reporting's. The results of this research show the importance of further research regarding asthma and toxic pollutants.

Poster # 34

Determining What Factors Drive Food Choices in Three Different Populations

Jilpa Shah (Loyola University Chicago)

Cyber-Health GIS REU

Research Advisor: Dr. Daniel Goldberg, Tracey Hammond and Jennifer Horney

A rising epidemic of poor dietary choices is influencing Americans' health including, 159 million people suffering from obesity, 12.1 million people annually visiting hospitals for heart disease, and 21 million people with diabetes. According to American Heart Association, a healthy diet is crucial for preventing diseases; however, making correct choices can be difficult. The importance of a healthy diet is undermined greatly, when retail food environment consists mainly of fast food places, restaurants that provide variety of foods with high calories and fat content compared to homemade meals. The goal of this work was to evaluate how cost, quality of fresh foods, nutrient content of foods, convenience to the stores/restaurants, types of available food sources, and the social environment affect food choices. Furthermore, seeing how these factors differ across demographic groups: college students, low income persons, and high income persons. In order to better influence healthy diets for people, it is essential to first understand the motivations behind each individual's food choices. Data was collected from a self-administered cross-sectional survey across various public parks in College Station and Bryan, TX, which included 35 respondents: 13 college students, 11 low income persons, and 11 high income persons. Results showed that each group has statistically significant different primary factors that determine their food choices, specifically that of cost and convenience, cost, and high nutrient content, respectively. These findings can serve as a data source for Public Health policymakers, nutrition interventionists, businesses, and even physicians can benefit while suggesting dietary habits.

Poster # 35

Aeronautical Decision Making (ADM) and Wearable Devices: An Application to Help Aviators Manage Fatigue

Daniella Edey (California State Polytechnic University)

Cyber-Health GIS REU

Research Advisor: Dr. Daniel Goldberg

The objective of this project is to evaluate potential designs for wearable technologies and associated applications in the context of Aeronautical Decision Making (ADM), or aviation specific risk assessment. This study will develop the design principles that will be used for future development activities to integrate physiological sensors (heart rate monitor) to create intervention approaches for alerting pilots and/or copilots of the wearer falling asleep. *Methods:* Recruitment e-mails were sent out to flight schools and professional aviator connections. The survey comprised of questions relating to device use, wearable devices, ADM tools, fatigue, and device alert design. Participants were also given the opportunity to partake in a phone interview on design aspects and features. The interview questions focused on current fatigue and ADM demands and application design. *Results:* All participants agreed fatigue is still an issue and held a positive view on wearable devices, however the main concern was privacy protection from the FAA and other entities such as insurance companies. They were also concerned about keeping the devices as minimally distracting as possible. Sleep tracking was the most popular feature aspect. Most participants suggested a combination of vibration and audio for the anti-sleep alert. *Conclusions:* The wearable device application design needs to be kept simple with privacy as a top priority. The combination of vibration and audio alert will be the most practical in the cockpit environment. Sleep tracking will need to be one of the main features.

Poster # 36

Investigating Navigational Wearables for People Living with Dementia

Jackie Byun (Smith College)

Cyber-Health GIS REU

Research Advisor: Dr. Daniel Goldberg

Six out of ten people with dementia will wander, which is not only dangerous for that person, but also causes significant stress to the caregiver. 5% of these persons are lost for more than a day or never found; even of those found quickly, many report to have felt frightened by the incident. In response, many caregivers resort to forbidding the person from going out alone or as frequently. This can result in further degeneration of the person's cognitive functioning and adaptability due to a lack of interaction with their community. Audio or visual smartphone navigation systems may be impractical for confused persons. Prior research has shown haptics to help successfully navigate military paratroopers, motorcyclists, and the visually impaired in situations where their eyes, ears, and hands are otherwise occupied, and their general situational awareness is compromised. We hypothesize that haptics will also prove capable of successfully navigating a cognitively disabled person during times of confusion. This project tests whether a vest with three vibration tactors located on the back can successfully navigate persons with mild to severe cognitive disability. We evaluated an elderly person's natural response to directional cues sent from the tactile signals on the back controlled by the navigational system. Results showed that participants were initially apprehensive of the new technology, but eventually navigated to the correct location without additional instruction from the researchers conducting the study. We expect this work to help drive effective personalized solutions to navigate users with cognitive decline.

Poster # 37

Identifying Potential Mosquito Breeding Grounds: Assessing the Efficiency of UAV Technology in Public Health

Jared Schenkel (Rutgers University)

Cyber-Health GIS REU

Research Advisor: Dr. Daniel Goldberg

Each year, more than one million people die from mosquito-borne diseases, as well as hundreds of millions being diagnosed with diseases transmitted from mosquitoes. Human ecology has played an essential role in the spread of mosquito-borne diseases. With standing water as a significant factor contributing to mosquito breeding, artificial containers disposed as trash, which may be able to hold water, provide suitable environments for mosquito larvae to develop. The development of these larvae further contributes to the possibility for the local transmission of mosquito-borne diseases in urban areas, including the emergent Zika virus. UAVs (Unmanned Aerial Vehicles) are systematically becoming more utilized in the field of geospatial technology. With higher pixel resolution in comparison to satellite imagery, as well as having the ability to update spatial data more frequently, UAVs have the capability to be an efficient means of mapping potential breeding grounds. Thus, evaluating the performance of a UAV in identifying artificial containers would aid in determining the future role of UAVs in public health, as well as contribute to monitoring local transmission of mosquito-borne diseases. By assessing the performance of a UAV against ground-truth GPS technology, we can determine if a UAV is equally efficient if not more efficient, in terms of time and accuracy. The results of the study will demonstrate that a UAV is faster than GPS technology in surveying a study area, but not as accurate in terms of identifying locations of artificial containers.

Poster # 38

The Feasibility of Using CASPER to Assess Risk Factors for Neglected Tropical Diseases

Christopher S. Smitherman (Texas A&M University)

Cyber-Health GIS REU

Research Advisor: Dr. Dan Goldberg and Dr. Jennifer Horney

Although over one billion people live at risk of neglected tropical diseases (NTDs) in poverty-stricken areas of Asia, sub-Saharan Africa, and Latin America, the degree to which they burden first world countries like the United States is currently unclear. Even though many NTDs such as dengue, leishmaniasis, and Chagas disease are not endemic to the United States, the possibility of their emergence is noteworthy, especially in states like Texas, which has high poverty levels and a large immigrant population. Despite the threat that emerging neglected tropical diseases may pose, little is known about the potential dynamics of their transmission in the United States. As part of an effort to establish active surveillance programs for NTDs in Texas, we hypothesize that CASPER, the Community Assessment for Public Health Emergency Response, is an effective method to assess risk factors for NTDs. After reviewing the potential risk factors for NTD transmission in Texas, a 42 question survey template for a CASPER focusing on risk factors for NTDs was generated. This survey is currently in the process of being vetted by subject matter experts at the state and federal level. Additionally, a literature review of past CASPERs was conducted to document its success in providing reliable household-level data quickly and in an inexpensive manner. Over the next year, CASPER will be utilized in three health services regions across Texas. The data generated by these CASPERs can be immediately actionable, guiding public health priorities to areas with high concentrations of risk factors.

Poster # 39

Identification of Health Disparities in Vision Care through Regression Analysis of Access

Katelyn Goodroe (Texas A&M University)

Cyber-Health GIS REU

Research Advisor: Dr. Daniel Goldberg

Due to the progressive nature of preventable vision loss, annual examinations are necessary to address early stages of diseases. While studies have focused on risk factors leading to preventable vision loss, little work has been done to understand prevalence of vision difficulty in regard to availability of services and factors such as age, health insurance, and poverty. This study demonstrates geographic trends in vision difficulty to broaden the understanding of disparities in vision care accessibility in the United States. American Community Survey 2014 5-Year Estimate disability data were analyzed using Urban Influence Codes and National Provider Identifier registry data for optometrists and ophthalmologists. We then investigated correlations between accessibility to eye care and prevalence of vision difficulties. Ordinary least squares analysis of county-level data of eye care providers and other factors produced the standard residuals for the model used to identify vision care disparities. Vision care disparities were identified in 107 counties of all twelve Urban Influence Codes classifications, and 37 counties displayed the opposite result by having less vision difficulties than the model predicted. This study focuses only on the first of three phases of addressing the disparities but lays out the groundwork for the next two phases by geographically identifying the locations of vision care disparities. Future work is necessary to understand why the model more accurately predicted vision difficulty in metropolitan areas versus noncore areas so more effective explanatory variables may be utilized to develop the model further.

Poster # 40

Creating a Model for Pacing Using Accelerometer Based Activity Recognition

Jose Elizondo (Texas A&M University)

Cyber-Health GIS REU

Research Advisor: Dr. Daniel Goldberg

In recent years there has been an increase in the affordability and accuracy of step counting smart technology. These advances have promoted research in sensor-based physical activity recognition, an area of study that aims to recognize the actions of a person using data obtained from smart technology. Current systems are able to recognize when someone is walking, running, and going up and down stairs. However these systems fail to recognize when a person is pacing, due to their inability to recognize different walking styles, causing a low rate of success when trying to monitor the behavior of a user. Pacing is one of many repetitive gestures that has been linked to clinical addiction or disorders like autism, and is often indicative of stress and distress. Failure to recognize these patterns can place a patient's physical health at risk due to self-harm and/or other dangerous behaviors. This research sought to define and test a statistically-based model of the activity of pacing such that machine learning approaches could be used to recognize this activity as it occurs in real-time. Streaming triaxial accelerometer data from the cell phones of test subjects were used to construct the model. Machine learning features were derived for this model which correctly classified the activity of pacing across sections of the observed test data. Our results will facilitate the monitoring of a person's activities in order to enable active interventions, and will educate caregivers – permitting more informed, individually-based, decision-making about the care and treatment of a patient.

Poster # 41

Exploring the Relationship Between Public Infrastructure and Race

Marisol Muniz (University of North Texas)

Cyber-Health GIS REU

Research Advisor: Dr. Daniel Goldberg

Interactions between the built environment and health have long been studied. Recent research has focused on how the built-environment may impact health, safety, and crime, among others. One important aspect of the built environment that warrants further research is public infrastructure. This is because public infrastructure is maintained by municipalities with local, state, and sometimes federal funding and must therefore be allocated in a manner that is equitable for its citizens. Inequitable allocation of funding for the construction and maintenance of public infrastructure can lead to potentially harmful disparities for certain city residents. There are various factors that may influence these disparities but one such factor that requires further research is race. This research explored the possible relationship between public infrastructure disparities and race by creating and implementing a visual survey to assess the condition of public infrastructure including characteristics such as pavement, sidewalks, street lights, and so on. Our results indicated that there were no statistically significant disparities in public infrastructure between different racial groups within the Cities of Bryan and College Station, suggesting that fair to poor quality public infrastructure is apparent for all residents.

Poster # 42

Antimicrobial Shape Memory Polymer Foam Hemostats

Calla Boyer (The Pennsylvania State University)

Engineering Undergraduate Summer Research Grant (USRG) Program

Research Advisor: Dr. Duncan Maitland

Around 1.5 million people die every year from uncontrolled hemorrhaging. To treat this condition, this work proposes to use antimicrobial shape memory polymer (SMP) foams as hemostats. Although the current standard of gauze and tourniquet technology has improved, it is ineffective in up to 80% of patients. Our aim was to synthesize effective formulations without altering the desirable properties of the foams: shape memory properties that can shape-fill and pack the wound, actuation temperatures around body temperature, and pore sizes around 1000 microns for rapid clotting. After incorporating cinnamic acid, a phenolic acid with antimicrobial properties into the bulk chemistry, we characterized the antimicrobial foams' pore sizes, densities, and glass transition temperatures to ensure that antimicrobial SMP foams can be designed with the same desirable properties. To test the efficacy of the incorporation of phenolic acids as antimicrobial agents, we conducted *E. coli* bacterial assay tests. While initial results showed promise suppressing bacterial growth, there have been challenges since introducing regular foam cleaning steps. Overall, the incorporation of antimicrobial properties into SMP foams lays the foundation for a device that could prevent millions of hemorrhage-related deaths each year.

Poster # 43

Development and Characterization of Radiopaque Shape Memory Polymer Foams

Kendal Paige Ezell (Texas A&M University)

Engineering Undergraduate Summer Research Grant (USRG) Program

Research Advisor: Dr. Duncan Maitland

Shape memory polymer (SMP) foams have been proposed for a variety of medical applications, including the embolization of brain aneurysms and peripheral occlusion of vascular malformations. While these devices provide significant advancements in treatment, such as increased volumetric filling and improved healing outcomes, one inherent limitation is a lack of visibility under fluoroscopy. Medical professionals rely on non-invasive material visualization to enable safe and effective device placement. Although metal markers can assist with device placement, it is still difficult to anticipate the interactions between the expanding polymer device and complicated vessel anatomy. Thus, there is a significant clinical need for the development of shape memory polymer formulations that can be observed under x-ray during expansion. Using a bulk synthesis method, a contrast agent was incorporated into the polymer composition in 15%, 20%, and 25% molar ratios to enhance x-ray visibility of the foams. This work outlines the synthesis and characterization of three radiopaque compositions necessary to achieve clinically relevant SMP foams. Foams were characterized using gel fraction, differential scanning calorimetry, mechanical testing, Fourier transform infrared spectroscopy, unconstrained expansions, scanning electron microscopy, and fluoroscopic imaging. The contrast agent loaded foams successfully demonstrated x-ray visibility, porosity, and mechanical properties that show promise for further development into clinically relevant SMP medical devices.

Poster # 44

Stress Angle Device: An *In Vitro* System for Reproducing the Mechanical Environment Associated with Regions Susceptible to Vascular Disease for the Study of Endothelial Cells

Felix Sierra (Texas A&M University)

Engineering Undergraduate Summer Research Grant (USRG) Program

Research Advisor: Dr. Michael Moreno

Atherosclerosis, a buildup of plaque on the arterial wall, is a leading cause of death in the developed world. Arterial bifurcations are susceptible to atherosclerosis, possibly due to altered flow patterns, in which flow becomes parallel, rather than perpendicular, to the circumferential stretch on the endothelial cells. There is a need to investigate the relationship between the orientation of mechanical forces and the physical and chemical changes in endothelial cells that lead to atherosclerosis. Therefore, our lab is developing the Stress Angle Device, an innovative parallel-plate flow chamber bioreactor that mimics vascular conditions. The lab's device substitutes a fixed, parallel plate with a rotating stage which securely attaches seeded endothelial cells to a strain mechanism without compromising the bioreactor. This allows the user to independently control the pulsatile fluid shear stress and cyclic uniaxial strain on the seeded cells while also setting the angle at which these two forces interact. The most recent prototype of the Stress Angle Device will enable the device to produce physiological levels of strain and fluid shear stress.

Poster # 45

Development of A Platform Technology for Biomarker Detection Using Surface Enhanced Raman Spectroscopy

Luke A. Oaks (Texas A&M University)

Engineering Undergraduate Summer Research Grant (USRG) Program

Research Advisor: Dr. Gerard L. Coté

Early, accurate diagnosis of life-threatening disease is a vital component of preventative medicine. However, limitations in biosensor sensitivity and specificity have confined progress in point-of-care (POC) blood-based diagnostics. Surface enhanced Raman spectroscopy (SERS) is a promising optical approach to POC diagnostics because of its capacity for simultaneously analyzing several biomarkers and detecting biomarkers at low concentrations. Herein, we propose to develop a SERS-based platform technology that utilizes a colloidal nanoparticle assay for early detection of disease via a disposable POC cartridge. In this system, isolated blood plasma will be introduced to an assay of functionalized nanoparticles for SERS analysis. This platform and assay structure could also be generalized to detect several biomarkers, including those for cardiac disease, blood toxins, and possibly even cancer. The overall system will be described and its potential for blood biomarker detection assessed.

Poster # 46

Reducing Drilling and Completion Costs Through Control and Rapid Monitoring of Microbial Activity in Well Operations

Alan Shepstone (Texas A&M University); Keith McLeroy (Ecolyse, Inc.); Tyler Hussey (Texas A&M University)

Global Petroleum Research Institute

Research Advisor: Dr. David Burnett

Most often oil and gas production requires the use of biocidal chemicals to reduce and prevent microbial growth and possible damages. Stimulation practices, such as hydraulic fracturing and enhanced oil recovery, are especially prone to bacterial contamination. Biocides can be effective with adequate dosages, residence times and monitoring. When effectively implemented, these practices can save money by preventing formation damage and reducing chemical loss from bacterial degradation. However, inappropriate biocide use can incur excessive costs that can significantly contribute to budget overruns. This paper addresses rapid, economic, field ready technology that can be used to determine bacteria content and monitor the effectiveness of biocides. This study applies this monitoring technology to biocide kill studies in order to improve operating practices and determine optimal dosage and retention time. From these kill studies, a selection protocol is developed to determine dosage and retention time in the field. Selection of the most effective biocide practices should be established upon the characteristics of the water source and the present bacteria loading. Current kill-study methods requiring the “wait-and-see” after several days of an incubation approach are ineffective for controlling bacteria. The need for an improved biocide selection protocol that can be conducted in a four-hour timeframe can be effectual in calculating the actual dosage required to meet the demand of the water. The research findings from this study demonstrates that rapid bacteria testing coupled with an onsite kill-study to determine effective biocide practices in a short time-frame can reduce the overall cost of biocide usage.

Poster # 47

Spatial Bias in Representational Drawing: The Role of Hand Dominance and Reading Direction

Yanichka Ariunbold (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Jyotsna Vaid

Spatial directional biases in figure drawing have been variously thought to reflect brain hemisphere differences, biomechanical influences (movement preferences related to handedness), and cultural influences (reading/writing-related directional scanning habits). A previous study reported that right-handed (but not left-handed) children showed a left placement bias in drawing a symmetrical object (a tree). The present study examined the performance of right- and left-handed English speaking adults who performed a tree-drawing task with their dominant hand and their non-dominant hand. The frequency of drawings in which the tree top was drawn more in the left plane or the right plane was analyzed by group and hand used. Preliminary findings show that both right- and left-handed participants using their dominant hand favored the left side of space in terms of figure placement. That is, the majority of drawings were given more weight on the left side of the frame. However, there was a tendency ($p = .09$) for left handers to be less left-side- focused when drawing with their non-dominant (right) hand, as compared to right-handers drawing with their non-dominant hand. These results, if confirmed in further testing, suggest that left handers are more susceptible to biomechanical factors than reading-direction in figure drawing, whereas right handers – who showed a consistent left space bias - may be more influenced by reading direction-related biases. These results are discussed in the context of previous studies on spatial directional biases in right and left handed readers with different reading/writing habits.

Poster # 48

Genetic Pest Management of Invasive Rodents

Jace Aloway (Texas A&M University)

Independent Research Project

Research Advisor: Dr. David Threadgill

Rodents are among the most common pests across the globe, particularly on islands where they threaten the natural habitat and unique biosystems. Invasive mouse populations must be eradicated in order to restore the balance of these affected ecosystems. Because of the ineffectiveness and off-target effects of rodenticides, we are exploring a genetic approach to invasive mouse eradication. In order to crash the mouse population, we are trying to create a strain of mice capable of producing only male prodigy. This will skew the sex ratio, leading to a crash in the target population. Sex reversal of female to male (e.g., an XX mouse that is phenotypically male and sterile) can be achieved by forcing the expression of key genes needed for male development or by deleting genes required for female development. The former can be accomplished by linking Sry, a gene sufficient to initiate male development, to a gene drive system such as the t-complex. The t-complex is a native mouse gene drive, which means that it will be passed on to most offspring (93.7% in our results) rather than to only half. The second method to cause sex reversal can be achieved by interrupting Foxl2, using CRISPR as an artificial gene drive. Placing CRISPR into the middle of the Foxl2 sequence will inactivate this gene. Both methods of sex reversal are being explored in this experiment.

Poster # 49

Tensile Testing Tissues: Designing a High Throughput Mechanical Analysis System for Biological Hernia Repair Meshes

David Franklin (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Michael Moreno

Ventral hernias affect more than 348,000 Americans each year, and incisional hernias as a complication of abdominal surgery cost over $3.2 billion annually, making them one of the most expensive surgical complications. Polypropylene meshes are commonly used in surgical repair; however, these meshes have well known problems with infection rates. Biological meshes made from decellularized collagen scaffolds drastically reduce the infection risk and are ultimately replaced by native tissue, leaving no device behind. These biological meshes, however, have insufficient mechanical properties and result in a high failure rate. In order to better understand the failure mechanisms of biological hernia repair grafts and improve the design process, selection, and testing of novel materials for hernia repair, we have designed a high throughput soft tissue tensile testing system. The system enables rapid, automated testing at physiological temperatures and in wet conditions. This technology will, when combined with novel material models, enable more comprehensive mechanical analysis of soft tissues, at a fraction of the cost of conventional systems.

Poster # 50

QTL Mapping in an F2 Population to Identify Genetic Factors Underlying Differential Metabolic Rate in Mice

Ahmed Elsaadi (Texas A&M University)

Independent Research Project

Research Advisor: Dr. David Threadgill

An individual's diet can have a profound impact on their physiology and susceptibility to disease. However, individuals can have highly varied responses to the same diet. A recent controlled study in humans demonstrated that identical dietary modifications can produce different responses. Similar results have been shown when evaluating dietary effects on serum cholesterol. Genetic variation is likely to be a strong contributor to different diet responses among individuals. However, little is known about which genetic factors impact diet response. Mouse studies in our lab have shown that there are strong strain-dependent effects to diet response. For example, C57BL6/J mice have a 12% increase in metabolic rate while on a high-fat ketogentic diet whereas the A/J mice have a 57% increase in metabolic rate on the same diet. Preliminary results have shown that mitochondrial uncoupling in the liver has contributed to that increase in metabolic rate. Mitochondrial uncoupling is the dissipation of protons across the inner mitochondrial membrane without any yield of ATP and can be observed through an increase in body temperature. To determine the genetic factors responsible for this great increase in metabolic rate within the A/J strain, we performed an F2 cross between the A/J and C57BL6/J strains. Two hundred and fifty F2 mice will be on the ketogenic diet for three months. Phenotypes such as body composition and body temperature will be evaluated. Quantitative trait loci (QTL) mapping will be used to identify regions of the A/J genome that are meaningfully associated with the responses to ketogenic diet. Ultimately, this project's purpose is to identify genes or pathways underlying the high metabolic rates of the A/J mice on a high-fat ketogenic diet.

Poster # 51

Post Mortem Interval of Cadaver Decomposition Islands

Katherina Kang (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Jacqueline Aitkenhead Peterson

Cadaveric material released into the ground during decomposition produces a fundamental impact on the chemistry and ecology of the soil below. This study examined the soil at 5 cm increments to a depth of 30 cm beneath seven human cadavers in Sam Houston National Forest, Huntsville, TX. Recent work has shown soil depth to be an important factor when estimating postmortem interval (PMI) from a soil cadaver decomposition island (CDI). In general researchers use soil samples 2-10 cm in depth. Soils were collected and dried prior to extracting using a 1:10 soil: water extraction. Extracts were analyzed for dissolved organic carbon (DOC), dissolved organic nitrogen (DON), NO_3N, NH_4N, PO_4P, pH and electrical conductivity (EC). Soil collected below the pelvis were significantly increased in all nutrients to a depth of 30cm. Using a background stepwise multiple regression analysis, the average concentration of nutrients from 0 to 30 cm produced an excellent model to predict PMI with an adjusted R squared (0.973; p=0.02). The over or under predictions of PMI ranged from +29 to -35 on cadavers that were 680 and 297 post mortem respectively. The independent variables used to estimate PMI in the model were a) whether or not the cadaver was exposed to scavengers and b) its NH_4N, PO_4 P, DOC, and DON concentrations.

Poster # 52

High-Frequency 3D Ultrasound Imaging for Accurate, Non-Invasive Assessment of Murine Liver Metastasis

Suzette Palmer (Texas A&M University)

Independent Research Project

Research Advisor: Dr. David Threadgill

Liver metastasis is a significant contributor to mortality associated with colorectal cancer (CRC), the second leading cause of cancer-related deaths in the United States. Preclinical mouse models have been developed to study CRC metastasis but they are generally limited to necropsy analysis due the technical difficulties of noninvasively studying the dynamic metastasis process. In a recent study, a high-frequency abdominal ultrasound has successfully identified and measured the diameters of individual liver tumors in mice following a mesenteric vein injection of a human colorectal adenocarcinoma cell line (HT-29). The overall volumes of liver tumors did not show significant increase over the time interval imaged using the HT-29 cells. We hypothesize that an extension of time, from 10 days to approximately 21 days will allow for more advanced and invasive liver metastasis. In this study, syngeneic murine colon adenocarcinoma cells (MC38) from C57BL/6 background were administered by splenic injection (s.c.). Liver and spleen were monitored using the Vevo-3100 high-resolution imaging system, every 2-3 days post-surgery. Splenic tumors and liver metastasis were identified and the diameter and volume were measured, using both 2-D and 3-D software. Around day 21, tumors were confirmed upon necropsy and measured with software for accuracy and precision. Preliminary results suggest that while 2D mode is sufficient for identification of tumors and diameter measurements, volumetric measurement and growth, analysis is more accurate with 3D-mode. The accuracy of liver metastasis measurement will be further improved with new software, such as 4D mode and how liver metastasis varies and develops in different CRC mouse models.

Poster # 53

The Use of Unmanned Aerial Remote Sensing for Studying Cotton Growth and Development

Hagan Smith (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Nithya Rajan

The purpose of this study was to determine if the spectral reflectance of cotton can be measured using aerial remote sensing The spectral reflectance in question refers to light of certain wavelengths reflected by the plant when sunlight hits. This data is recorded via a sensor attached to an unmanned aerial vehicle (UAV) that takes pictures of the field in both the visible spectrum and in infrared. The data for this study was collected using an advanced camera being flown by a UAV over a cotton (*Gossypium hirsutum*) field at the Texas A&M Brazos Research Farm. The reason for this is that while a handheld variant of this technology exists, it is cumbersome and inefficient as it can only measure one plot at a time by taking several readings the desired area. The UAV circumvents these issues as it is able to take photos of entire fields instead of in small pieces as is with the handheld. The pictures were analyzed by overlaying the different spectrums onto one another using the image analysis software ENVI. The middle two rows of each study plot are selected and analyzed using the region of interest (ROI) tool to determine the reflectance of each spectral band, in this case infrared, red, green, and blue. By relating the results to factors such as plant density, trends in the reflectance can be observed and recorded to determine the overall health of plants.

Poster # 54

Chromium VI - Induced Developmental Toxicity of Placenta is Mediated Through Spatiotemporal Dysregulation of Cell Survival and Apoptotic Proteins

John Z. Wu (Texas A&M University); Jone A. Stanley (Texas A&M University); Kirthiram K. Sivakumar (Texas A&M University); Joe A. Arosh(Texas A&M University); Sakhila K. Banu (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Sakhila Banu

Environmental contamination with hexavalent chromium (CrVI) is a growing problem both in the U.S and developing countries. CrVI is a heavy-metal endocrine disruptor; women working in Cr industries exhibit an increased incidence of premature abortion and infertility. The current study was designed to understand the mechanism of CrVI toxicity on placental cell survival/death pathways. Pregnant mothers were treated with or without CrVI (50 ppm K2Cr2O7) through drinking water from gestational day (GD) 9.5 – 14.5, and placentas were analyzed on GD 18.5. Results indicated that CrVI increased apoptosis of trophoblasts, vascular endothelium of the metrial glands and yolk sac epithelium through caspase-3 and p53-dependent pathways. CrVI increased apoptosis in labyrinth and basal zones in a caspase-3-independent manner via AIF, and through an ATM-p53-NOXA-PUMA-p27 network. CrVI downregulated cell survival proteins Bcl-2, Bcl-XL and XIAP in the placenta. CrVI disrupts placental histoarchitecture and increases cell death by spatiotemporal modulation of apoptotic signaling.

Poster # 55

Identifying Genetic Modifiers of PTEN Using The Collaborative Cross Mouse Panel

Amanda Lanier (Texas A&M University)

Independent Research Project

Research Advisor: Dr. David Threadgill

Tumor suppressor genes code for proteins that limit cellular proliferation and cancer progression, and are often exploited in cancer therapies. One such tumor suppressor gene, Phosphatase and Tensin homolog (PTEN), mediates cell growth through negative regulation of phosphatidylinositol 3-kinase (PI3K) dependent pathways. PTEN is frequently deleted or mutated in a variety of human cancers, and mice carrying a PTEN transgene (Super-PTEN mice) were found to be resistant to tumor formation. Even small changes in PTEN expression have been shown to influence cancer susceptibility and progression. We hypothesized that PTEN expression can be altered through modifier genes. To test whether PTEN modifiers exist, we are using the Collaborative Cross (CC), a panel of inbred mouse strains that has a similar amount of genetic variation as human populations. In CC- Super-PTEN crosses, we are utilizing an easily measured phenotype of Super-PTEN mice, reduced body weight, to identify CC strains that impact PTEN function. On average, weanlings carrying the PTEN transgene weigh 16% less than their wild type littermates. We have identified five strains in which pups carrying the PTEN transgene deviate significantly from this average. We are currently using quantitative trait locus (QTL) mapping to identify candidate modifiers of PTEN, as well as using several cancer models to confirm that altered PTEN weight phenotype correlates with changes in cancer susceptibility and progression. Ultimately, this research will demonstrate the use of the CC mouse panel to identify novel genetic modifiers and improve our understanding of PTEN regulation.

Poster # 56

Analyzing Daily Behavioral Data for Personalized Health Management

Randy Ardywibowo (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Xiaoning Qian

A solution that promotes healthy lifestyles outside of clinical settings is necessary to mitigate globally emerging health problems such as obesity. This solution shall fit each individual's needs and preferences and provide personalized activity plans, such as exercise routines and calorie intake. The rapid development of sensors and mobile applications enables such a solution, as these sensors and applications allow the continuous collection of human behavior data such as physical activity, food intake, and Body Mass Index (BMI). However, with such outburst of dynamic sensor data, several challenges arise in translating them effectively into personalized activity plans. These challenges come from the missing values and outliers often seen in the data. These data challenges result in modeling and computational difficulties that may lead to ineffective or undesirable activity planning. We explore existing analytic methods to address these challenges, and present SSMO, a dynamic system learning method that learns personalized behavior model from real-world sensor data while simultaneously estimating missing values and detecting outliers. We compare these methods, including SSMO, Principal Component Analysis through Conditional Expectation (PACE), and Functional Data Analysis (FDA), and other off-the-shelf missing value and outlier detection methods, showing that SSMO is superior to the other benchmark methods with better prediction accuracy for the future BMI trajectory. The formulation of SSMO has provided insight into developing a peer-shared learning method in the future.

Poster # 57

Consensus Template-Based Prediction of Beta-Sheet Contacts

Jason Souvaliotis (St. John's School)

Independent Research Project

Research Advisor: Dr. Christodoulos A. Floudas

Protein structure prediction aids in better understanding of many biological phenomena. When homologous structural templates are not available, protein structure prediction remains especially challenging. Beta-strands are a difficult structural type to predict since they make nonlocal contacts when forming beta-sheets. We have developed a novel approach for beta-contact prediction that utilizes multiple structural templates to improve accuracy when only distantly similar templates are available. The method uses conSSert to predict secondary structure and a modified version of HH-suite to identify structural templates. From the identified templates, the likelihood of a contact forming between beta-strand residues is computed. The method has been benchmarked using a set of 1452 known beta protein structures. Various schemes for scoring the predicted beta-contacts were analyzed based on the benchmark set.

Poster # 58

In Vitro Mechanical Studies of Implantable Truss Technology for Total Knee Arthroplasty

Zachary Todd Lawson (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Michael Moreno

Total Knee Arthroplasty (TKA) is a common treatment for patients with severe knee pain due to osteoarthritis, a condition characterized by the loss of articular cartilage or injury. Most patients that opt to proceed with a TKA procedure report effective pain mitigation; however, approximately 30% do not realize sufficient pain relief following the procedure. This post-operative pain is typically associated with fixation, integration, and mechanical complications that can lead to a loss of bone mass. In cases where the procedure is successful, a revision procedure may still be required as the lifespan of the device is limited to 10-20 years when problems with fixation culminate in total failure of the device. The proposed research will evaluate a TKA device that incorporates unique geometrical and mechanical properties that address the problems associated with initial and long-term fixation, as well as component wear. Consequently, this technology is expected to enhance the quality of life of the patient, as well as potentially eliminate the need for revision procedures.

Poster # 59

Comparative Virulence and Sequential Analysis of Two Plaque Variants of Theiler's Murine Encephalomyelitis Virus (TMEV) as a Model for Epilepsy and Multiple Sclerosis

Xiao Zhou (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Julian Leibowitz

TMEV, a murine single-stranded positive sense RNA virus, is used as a model for both multiple sclerosis (MS) and epilepsy, as it results in demyelinating encephalomyelitis in the CNS, resembling MS, in SJL mice, and epilepsy in C57BL/6 mice. Research was conducted on two plaque-purified variants of TMEV DA strain, C and D, which, along with exhibiting different plaque sizes in L-2 cells, have shown to cause varying levels of demyelination and epilepsy in mice. The purpose was to more closely examine phenotypic differences in C57BL/6 mice injected with TMEV, histologically analyze brain slides of mice to determine varying levels of neuronal damage, and to correlate it with differences in both the coding and non-coding regions of two genomes of DA-C and DA-D. DA-D, known to produce extensive demyelination despite its smaller plaque size, caused severe epilepsy in C57BL/6 mice, and extensive neuronal damage and encephalomyelitis as revealed by histopathology, as opposed to DA-C, which is significantly less virulent in both models. There is direct correlation between demyelination, encephalomyelitis, epilepsy, and virulence, as DA-D exhibits all in abundance, while DA-C demonstrates little, if any, of those characteristics. We have attempted to sequence the two genomes by RT-PCR sequencing using the reference plasmid pDAFL3 to optimize PCR conditions. To date one sequence difference and a number of mutations from the reference pDAFL3 sequence have been identified. These results provide valuable insight into the differences between DA-C and DA-D in order to further develop the models for MS and epilepsy.

Poster # 60

***In Vitro* Mechanical Stress Stimulates Cholangiocyte Proliferation and Expression of Functional Markers**

Mary-Catherine Clark (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Shannon Glaser

Cholangiocytes are epithelial cells that line the biliary tree and are responsible for the regulation of bile composition. They predominantly do this by the addition of bicarbonate, the changing of water composition, and the secretion of some bile acids. Bile aides in the digestion of fats and allow for their absorption in the digestive tract. We have previously shown that in chronic cholestatic liver diseases, a link exists between bile duct injury, cholangiocyte proliferation and sub-epithelial fibrosis. Typically, chronic cholestasis is modeled through bile duct ligation (BDL) in both mice and rats. Mechanical stretch is an *in vitro* system that models general cholestasis in humans, similar to animal models of BDL. Thus the AIM of this study was to evaluate the effects of mechanical stress on cholangiocyte proliferative and functional responses. To do this, two adherent cholangiocyte cell lines, Mouse SV-40 Cholangiocytes and Normal Human Cholangiocytes, were lifted from T-75 flasks and plated on 6-well stretch membranes at 50,000 cells per well. Cells were stretched biaxially at various time points. Cells pellets and supernatants were then collected for various assays such as Western Blots, Immunofluorescence, PCR, and dead cell counts. The resultant data showed that when cells are exposed to biaxial mechanical stress there is an increase in proliferative gene expression, tight junction gene expression, and morphological changes. Therefore, our data suggest that mechanical stress provides an *in vitro* alternative for modeling general cholestatic liver diseases, thereby, saving researchers both time and money.

Poster # 61

Ex Vivo Evaluation of the CBLO Using a Novel Canine Stifle Model: Considering the Physiologic Biomechanical Environment

William Young (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Brian Saunders and Michael Moreno

Surgeries correcting damaged cranial cruciate ligaments in canines are some of the most frequently performed operations in veterinary orthopaedics, costing pet owners over $1.32 billion annually. The CORA Based Leveling Osteotomy (CBLO) is a new procedure developed by veterinary surgeon Dr. Don Hulse that improves on current surgical standards. To validate the CBLO's efficacy, Biomechanical Environments Laboratories and the Small Animal Clinical Sciences department have partnered together to create a more accurate *in vitro* limb press model by utilizing mechanical elements that recreate muscular forces on pelvic limbs extracted from cadavers. *In vitro* testing of cadaveric limbs allows the researchers to analyze the kinematics of the stifle (i.e. knee) with repeatable and controllable conditions. Prior *in vitro* studies show 18 mm tibial translation in ligament deficient stifles, while *in vivo* observations show only 10 mm. Our group believes the discrepancy is due to past models only accounting for a mere 2 of 29 muscle groups that influence the stifle. Our research aims to include more crucial muscle groups by determining the attachment point and relative force generated for each muscle. The final product will allow surgeons to test the CBLO alongside other orthopaedic procedures for the canine stifle.

Poster # 62

Effect of Ketogenic Diet on Endurance Running Performance in Males and Females of Two Genetically Distinct Mouse Strains

Andreea Radulescu (University of Surrey)

Professional Training Year

Research Advisor: Dr. David Threadgill

Proper nutrition is a key component of athletic performance. Traditionally, endurance athletes have used high-carbohydrate diets to maximize glycogen stores and fuel their performance. Low-carbohydrate, high-fat ketogenic diets, however, have recently gained popularity among endurance athletes to boost performance and fat loss. Athletes assert that adaptation to a low-carbohydrate diet can improve the body's ability to utilize fat stores by increasing its ketone utilization. The few human studies that analyzed the impact of low-carbohydrate diets on endurance performance show mixed results. However, these studies have very low sample sizes and only examined males. We found that a ketogenic diet can greatly increase endurance running performance in a genetic background- and sex-dependent manner. The study compared forced running performance of five C57BL/6J and FVB/NJ mice of each sex fed ad libitum Western or ketogenic diets for three months. Ketogenic diet-fed C57BL/6J female mice increased their running distance by 89% versus Western diet-fed mice. Male C57BL6/J mice, however, did not have a significant diet effect. FVB/NJ mice of both sexes improved running distance. Ketogenic diet-fed female FVB/NJ mice increased running distance by 70% and males by 49%. The results were independent of fat mass of the mice. Current studies are investigating whether sex-specific hormones are involved in the disparate effects of ketogenic diet on running performance in male and female C57BL/6J mice by ovariectomizing and castrating mice and comparing their forced running phenotype to sham surgery controls. Assessing the role of sex hormones in adaptation to a low-carbohydrate, high-fat diet will help identify the cause of the sex differences on endurance running performance leading to a better understanding of the role of ketogenic diets on exercise performance and the improving ability to identify individuals who might benefit from a ketogenic diet.

Poster # 63

Embryonic Lethality in Mice Expressing Conditionally-Stabilized Ctnnb1 Under Control of Tg(Vil-cre)997Gum

Ephraim Amiel Yusi (University of Surrey)

Professional Training Year

Research Advisor: Dr. David Threadgill

CTNNB1 (beta-catenin), which is degraded through a ubiquitin-dependent mechanism, is stabilized upon activation of the Wnt pathway and functions as a transcriptional co-activator of WNT-responsive genes. Ctnnb1 dominant-acting mutations can lead to constitutive Wnt signaling, cellular transformation, and ultimately colorectal cancer (CRC). In this study, originally designed to develop a model of CTNNB1-induced CRC, mice carrying both a conditional stabilizing mutation of the Ctnnb1 gene (Ctnnb1F(Ex3)) and a Cre recombinase whose expression is under the control of the murine villin 1 promoter (Vil-cre), believed to be specific to the colon and kidney, die during embryonic development. To isolate the embryonic time of death, pregnant dams were euthanized at various gestational time points. Embryos were inspected for gross abnormalities, and embryonic genotype was determined using PCR. We found that while no double-heterozygous mice were observed neonatally, the litters dissected at E10.5 were developmentally normal and exhibited Mendelian inheritance ratios, suggesting the observed embryonic lethality was not due to preimplantation defects. An increase in reabsorption sites was noted at E13.5 and some remaining embryos exhibited delayed development. Abnormal embryos were found to carry both the Ctnnb1F(Ex3) and Vil-cre alleles, suggesting placental defects. Identifying the molecular mechanisms underlying the cause of embryonic lethality will allow us to better characterize the role of canonical WNT signaling in placental development. Furthermore, Vil1 has been implicated in gut development and is expressed by E9, but has yet to be implicated in placental development. Ongoing efforts are focusing on the determining the exact cause of embryonic lethality in Ctnnb1F(Ex3),Vil-cre double mutants.

Poster # 64

Design of Shock Attenuating Shields Used to Aid in the Investigation of Blast Induced Traumatic Brain Injury

Josh VanCura (Texas A&M University)

Research Intensive Community for Undergraduates (RICU) Summer Program

Research Advisor: Dr. Michael Moreno

Over the course of the Iraq and Afghanistan conflicts, improvements in protective gear have decreased the prevalence of penetrating injuries soldiers commonly experience. Improved medical care has improved outcomes for many of these injuries. Despite, or perhaps because of this, the prevalence of traumatic brain injuries in soldiers has greatly increased, especially for those caused by explosive blast. This injury (bTBI) is still not fully understood, and has been estimated to affect as many as 20% of returning soldiers. Shock tubes are one of the most common experimental devices used to investigate bTBI in animal models. However, these devices have a number of drawbacks that can make the experimental environment challenging: shock tubes are usually not portable or compatible with MRI, they are usually located far from animal housing facilities, and they can pose a physical danger to both operators and equipment as well as an excessive noise level. We have designed a portable, MRI compatible shock tube that addresses the first three issues. However, the threat of damage and harmful noise levels still exists. In order to reduce this threat, we have designed a system of shock absorbing shields that will diminish the impact of noise and shock to levels suitable for sensitive equipment and operators.

Poster # 65

Effects of Shock Tube Configuration on Blast Wave Characteristics to Study bTBI

Charlene Morrison (Texas A&M University)

Research Intensive Community for Undergraduates (RICU) Summer Program

Research Advisor: Dr. Michael Moreno

Over the course of the Iraq and Afghanistan conflicts, improvements in protective gear have decreased the prevalence of penetrating injuries soldiers commonly experience. Improved medical care has also improved outcomes for many of these injuries. Despite, or perhaps because of this, the prevalence of traumatic brain injuries in soldiers has greatly increased, especially for those caused by explosive blast. This injury (bTBI) is still not fully understood, and has been estimated to affect as many as 20% of returning soldiers. To better understand the mechanisms behind bTBI, a portable, MRI compatible shock tube was designed to produce shock waves that replicate free field detonations of high explosives. The shock tube is constructed to contain high pressures of compressed air in a tank at one end. When this air is suddenly released, a shock wave is propagated down to the end of the tube, where it is characterized by a waveform similar to that observed in free-field explosions. To more accurately replicate these blasts, the shock tube can be reconfigured to alter defining characteristics of the shock wave created, such as blast overpressure, positive duration, and positive impulse. By exchanging segments of the shock tube with segments of different diameters, we can isolate the effects of different shock tube configurations on the defining waveform characteristics. This could allow improved control of waveforms produced by the shock tube and further investigation of the impact of individual characteristics of shock waves on bTBI.

Poster # 66

Evaluation of Sound Absorbing Materials for Use of Shock Attenuation to Aid in Investigation of bTBI

Carlos Reyes (Texas A&M University)

Research Intensive Community for Undergraduates (RICU) Summer Program

Research Advisor: Dr. Michael Moreno

Throughout the Iraq and Afghanistan conflicts, improved protective gear and medical care have decreased the prevalence of common injuries soldiers experience. Despite this, the prevalence of traumatic brain injuries has increased, especially for those caused by explosive blast. This injury (bTBI) is still not fully understood, and has been estimated to affect as many as 20% of returning soldiers. Shock tubes are one of the most common experimental devices used in the study of bTBI in animal models. However, they have several drawbacks that make the experimental environment challenging: shock tubes are usually not portable or compatible with MRI, they are usually located far from animal housing facilities, and they pose a physical danger and nuisance nose to operators and equipment. We have solved the first three issues by designing a portable, MRI compatible shock tube, but the threat of damage still exists. To reduce this threat, we have designed a system of shock absorbing shields that will diminish the noise and shock to levels suitable for equipment and operators. While the structure of these shields is important, their effect on noise and shock levels will be primarily due to the attenuation abilities of the material used. Three sound absorbing materials were chosen due to their ability to reduce low frequency sound, but they still need to be evaluated for how effectively they diminish shock waves. Once this is determined, the most appropriate material will be used in the shields to protect the testing environment for the study of bTBI.

Poster # 67

A Structure-Guided Fragment-Based Approach for the Discovery of Inhibitors Targeting Indole-3-glycerol Phosphate Synthase from *Mycobacterium tuberculosis*

Max Russo (Texas A&M University); Durga Thapaliya (Texas A&M University);
Manchi Reddy (Texas A&M University); James Sacchettini (Texas A&M University)

Sacchettini Laboratory Internship

Research Advisor: Dr. Manchi Reddy

Mycobacterium tuberculosis (Mtb) indole-3-glycerol phosphate synthase (IGPS) is an essential enzyme that catalyzes the fourth step of tryptophan biosynthesis. The absence of this pathway in humans makes its enzymes potential targets for novel antibacterial drugs. To investigate the structure and specificity of Mtb IGPS, we have solved high-resolution crystal structures of Mtb IGPS both in the apo form and in complex with its product, indole-3-glycerol phosphate (IGP), at 1.3 Å and 1.7 Å resolutions respectively. A helical portion of the active site, referred to as the I-helix, has been shown to be critical for substrate-product orientation and interaction. The limited information regarding the inhibition of Mtb IGPS led us to carry out a high throughput fragment screen to discover scaffold leads for the development of inhibitors. Three compounds, phenoxymethyl benzoic acid (PMBA), N-2-carboxyphenyl glycine (CPG), and 5-fluoroanthranilate (5FA), were identified to have a competitive inhibitory effect on Mtb-IGPS with IC50 values of 240 μM, 490 μM, and 320 μM, respectively. These compounds, discovered via fragment screening, contributed insights into intra-structural interactions that could be used to alter inhibitor binding for improved inhibition. The *in vivo* bactericidal activities of the three compounds were determined by whole-cell assays and represent promising leads for further inhibitor development.

Poster # 68

Identifying Marine Bacteria as Potential Sources of Antibiotic Natural Products

Aria Deluna (Texas A&M University)

University of North Florida REU in Coastal Biology

A natural product is a chemical compound made by bacteria for purposes such as securing resources (e.g. nutrients and space) that will allow the bacteria to thrive and reproduce. Many antibacterial and antifungal pharmaceuticals were created from natural products. Discovering and researching new bacteria and their natural products may lead to the discovery of new pharmacological agents. We hypothesize that marine bacteria may provide a favorable source of novel biodiversity and natural products. In this study, marine bacteria collected from the Florida Keys were identified. Samples of marine sediments were plated on agar plates containing nutrients and a salt content similar to marine habitats, then resulting colonies were streak plated several times to isolate individual bacteria strains. The bacteria were classified based on physical features found from Gram staining. Of 49 samples stained thus far, 33% of bacteria are Gram positive while 67% are Gram negative. To further identify these bacteria, samples are being subjected to polymerase chain reaction (PCR) to amplify a region of the 16S ribosomal ribonucleic acid (rRNA) gene. Comparison of these deoxyribonucleic acid (DNA) sequences with known sequences from the National Center for Biotechnology (NCBI) database will establish which known bacteria are most closely related to those isolated in the current study. Bacteria found to be significantly different based on their 16S rRNA gene sequence, from archived samples, will be analyzed further to see if they produce a natural product that would be of value as an antibacterial or antifungal agent.

Poster # 69

Simulated Effects of Human-Caused Disturbance on Population Trends of Florida Manatee

Paola Camposeco (Texas A&M University); Jasmin Diaz-Lopez (Texas A&M University)

Independent Research Project

Research Advisor: Dr. Hsiao-Hsuan (Rose) Wang

Florida Manatee populations had been dramatically declining due to various factors including perinatal mortality, habitat destruction and degradation, and human-related threats. Causes of manatee deaths can be broken down into 5 categories: watercrafts, crushed/drown by flood gate or canal lock, other human-related such as vandalism and entanglement, perinatal, cold stress, other natural such as disease, natural accident, and natural catastrophe. Three out of five of these categories are associated with human. Objective: Develop a population model of Florida manatee and estimate the effects of 5 mortality scenarios on the manatee population which include; all manatee deaths, cold stress, human-related threats, oil spill, and natural deaths. Methods: We conducted a literature review to obtain the basic demographic data available. Moreover, we added new data from synoptic surveys collected by the Florida Fish and Wildlife Conservation Commission. A stage-structure population dynamics model for Florida manatee was developed using STELLA 7.0.1. Using the total number of deaths and population size we were able calculate average mortality, and standard deviation from the 5 different mortality scenarios. We simulated each scenario with the worst, average, and better effects from each of their average mortality rates. Finally, the model ran for 30 years with an initial population of 2000 and carrying capacity of 5000, which projected the Florida Manatee population with the effects of each mortality scenario. Results: When comparing all 5 scenarios, the leading factors affecting the manatee population are natural causes followed by the cold stress, the oil spill, and then human related deaths.

Poster # 70

Isolation of RNA Bacteriophages

Nguyen, Branden (Texas A&M University); Zach Williams (Texas A&M University);
Aaron Rose (Texas A&M University)

Research Intensive Community for Undergraduates (RICU) Summer Program

Research Advisor: Dr. Ryland Young

The rise of antibiotic resistant “superbugs” is threatening medicine as we know it, making the development of new antibacterial therapies increasingly important. Bacteriophages (phages), viruses that infect bacteria, may offer a solution. Small single stranded genome phages employ a single protein to ki ll bacteria, and ssRNA phages in particular attach to specific pili on the bacterial surface. Studying how such phages kill host cells may offer insights towards novel antibiotic targets. Additionally, phages specific to a bacterial infection can be administered as a sort of natural antibiotic. Unlike popular broad spectrum antibiotics currently used, phages are strain specific and constantly adapting. Our team developed a new sizing method for more efficiently isolating small RNA phages, isolating phages against various strains of *Escherichia coli* and *Acinetobacter baumannii*. We have isolated two RNA phages against *A. baumannii* and will now sequence and annotate their genomes.

Poster # 71

Differences in Expression of the Sodium-Iodide Symporter (NIS) in Red Drum (*Sciaenops ocellatus*) and Zebrafish (*Danio rerio*)

Anthony Martillotti (Texas A&M University); Palak Paul (Texas A&M University);
Amanda Thomas (Texas A&M University); Alexis Hamberg (Texas A&M University)

Research Intensive Community for Undergraduates (RICU) Summer Program

Research Advisor: Dr. Duncan MacKenzie

Thyroid hormones are essential for normal vertebrate growth, metabolism, and development, and are unique in requiring iodine to function. To assure sufficient iodine supply for thyroid hormone synthesis, mammals utilize an integral membrane protein, the sodium-iodide symporter (NIS) to transport iodide from its environmental sources to cells of the thyroid gland. While this pathway of iodide uptake in terrestrial vertebrates has been established to be strictly dietary, and is mediated in the intestinal epithelium by the same NIS protein that concentrates iodine in the thyroid, the mechanism of iodine uptake in teleost fish remains controversial. The protein transporting iodine from the environment into the thyroid gland has not been characterized, and it has been suggested that a unique branchial pathway for uptake of iodine may exist. In this study, we used RT-PCR to determine whether a homolog of the mammalian NIS was expressed in the subpharyngeal (thyroid) region, digestive tract, muscle, and gill of two species of teleost fish, the red drum (*Sciaenops ocellatus*), a marine organism found in an iodine rich environment, and the zebrafish (*Danio rerio*), a freshwater organism found in an iodine poor environment. We found that nis is expressed in the intestine and subpharyngeal region of both species, and as well in the gill of zebrafish. This suggests that NIS serves as the iodine transport protein in the thyroid and peripheral tissues, but that the proposed branchial pathway for the uptake of iodide may be more important in animals living in iodine poor environments.

Poster # 72

Characterization of the Progeny from Crop Sorghum and the Common Johnsongrass Weed Interspecific Hybridization

Tri Tran (Texas A&M University); Anh Ha (Texas A&M University); Omar Salem (Texas A&M University)

Research Intensive Community for Undergraduates (RICU) Summer Program

Research Advisor: Dr. Muthukumar Bagavathiannan

Cultivated sorghum (*Sorghum bicolor*) and the common weedy relative johnsongrass (*S. halepense*) have the potential to outcross and exchange traits. Crop sorghum is an annual, diploid (2n=20) species, whereas johnsongrass is a tetraploid (2n=40) perennial species, capable of producing underground rhizomes. The ability for outcrossing between the two species presents challenges to the successful deployment of novel traits in crop sorghum. Although gene flow is known to occur between the species, little is known on the characteristics of the hybrid progeny. Because crop sorghum is a diploid and johnsongrass is a tetraploid, the hybrids are typically expected to be sterile triploids, but not always. Preliminary crosses conducted under controlled environment have also yielded viable tetraploids through unreduced gamete formation in crop sorghum. Little is known on the overall genotype and phenotype of such hybrids and frequency of occurrence, knowledge of which is critical for developing effective gene flow mitigation/management tactics. Experiments will be conducted to determine the ploidy (chromosome number), rhizome production potential, plant height and other growth habits, seed characteristics, among others. Additionally, simple sequence repeat markers will be used to characterize the genetic similarities among the hybrids and their parents.

Poster # 73

Ligand-Controlled Anisotropic Growth of Cesium Lead Halide Perovskite Nanocrystals

Christopher Galik (Texas A&M University)

TURC: Texas A&M Undergraduate Research in Chemistry

Research Advisor: Dr. Matthew Sheldon

Metal halide perovskites are a newcomer in the field of optoelectronic materials that are gaining an enormous amount of popularity as a solution-deposited material that can increase the efficiencies of solar cells. The cesium lead halide perovskite system is becoming especially more popular due to its bandgap energies and emission spectra being easily tunable over the entire visible spectral region. In addition, the cesium lead halide perovskite system has been demonstrated to possess a high photoluminescent quantum yield. For this research project, our goal was to understand the characteristics and nature of anisotropic growth in the cesium lead halide perovskite system through several syntheses. We wanted to achieve a nanorod crystal growth by manipulating the ligands of this system in the hopes of creating highly fluorescent dipoles with the potential for anisotropic emission. We were able to conclude that achieving anisotropic growth in the cesium lead halide perovskite system is dependent on the ligand system and the ratios of short and long chain ligands. We were able to create nanorod structures by substituting dodecylamine and acetic acid, a long-chain amine and a short-chain acid, for the normal ligands oleylamine and oleic acid, a long-chain amine and a long-chain acid.

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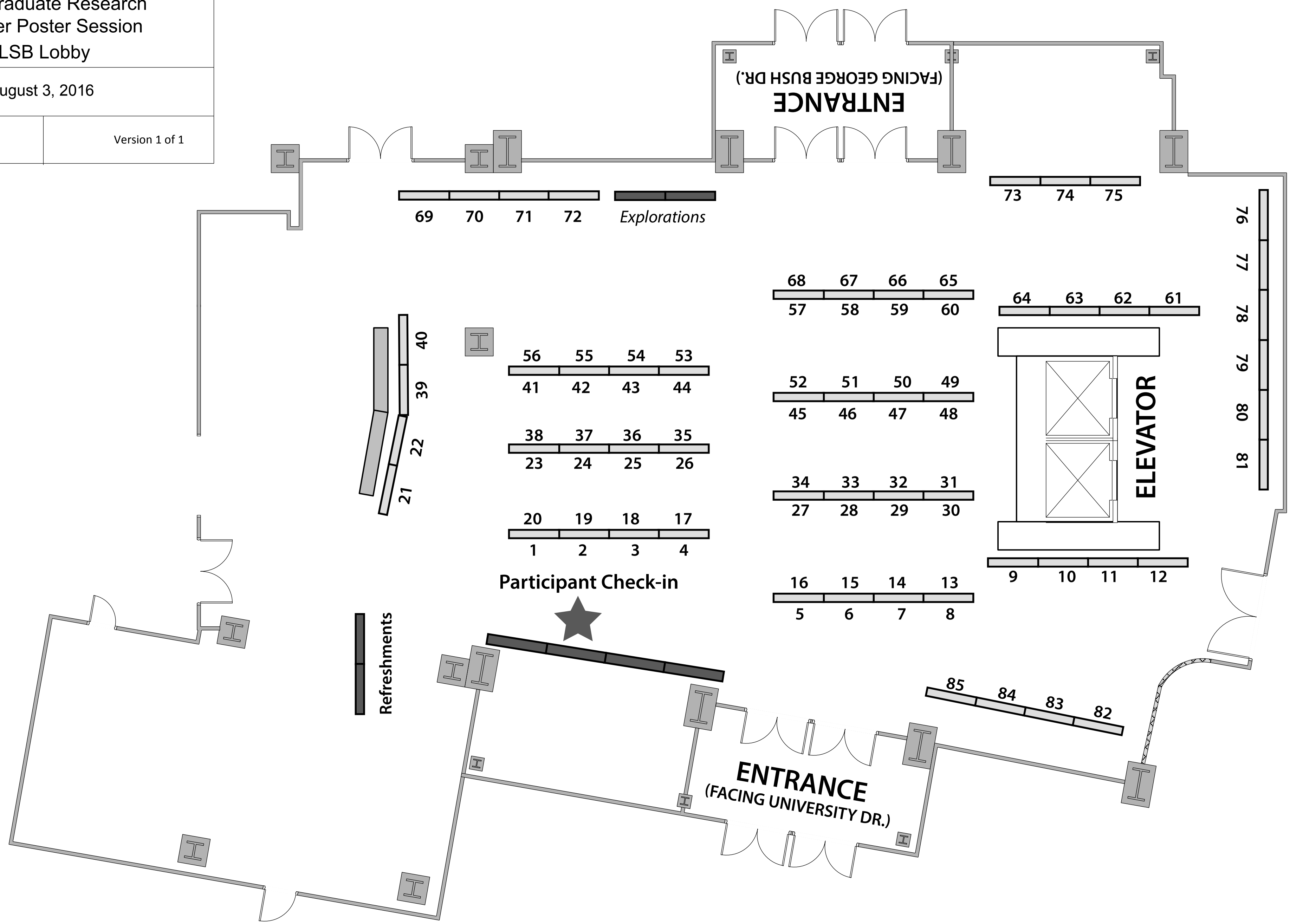

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