The University of Texas
Rio Grande Valley
College of Sciences

2019
College of Sciences
Annual Research Conference

Friday March 29, 2019
The University of Texas
Rio Grande Valley
1201 W. University Dr.
Edinburg, TX 78539

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College of Sciences

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Annual Research Conference

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Edinburg (EHPE II 118)
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Organizing Committee:
Co-Chair Dr. Mohammed Farooqui
Co-Chair Dr. Karen Martirosyan
Co-Chair Dr. Jason Parsons
Dr. Frederic Zaidan
Dr. Alexis Racelis
Leonardo Vazquez

Conference Technical Team:
Maria Lisa Trevino
Jackelyn Melgar
Odessa Gutierrez
Angeles Puente
Arleen Garza

Conference Program

8:00 – 9:00 AM Registration & poster setup **EHPE2**

9:00 AM – Dr. Parwinder Grewal, UTRGV Executive Vice President for Research, Graduate Studies, and New Program Development, Overview of Research and Graduate Programs

Keynote sessions:
Chair: Dr. Karen Martirosyan
Associate Vice President for Research Enhancement

9:10 AM - Engil Pereira - Soil Heterogeneity Shapes Microenvironments and Microbial Habitats

9:30 AM - Rupesh Kariyat – Using Chemical Ecology to Dissect Plant-herbivore Interactions Affecting Invasive Plant Success

9:50 AM - Jason Parsons – Photocatalytic Destruction of Simazine Using Zinc Oxide-Graphene oxide composite nanomaterials under visible light

10:10 AM - Alexey Glazyrin and Eduardo Ramirez – Packings of Spherical Particles

10:30 AM - Josef Sifuentes - Research Opportunities in Mathematics and Statistics

10:45 AM - Yuanbing Mao – The Central Science at UTRGV's Department of Chemistry

11:00 AM - David Hicks – Research Highlights in School of Earth, Environmental, and Marine Sciences

11:15 AM - Soma Mukherjee - UG and Graduate Research opportunities at the department of Physics and Astronomy

11:30 AM - Kristine Lowe - Biology Research at UTRGV: One Size Does Not Fit All

11:45 AM - Alexis Racelis – Community Engaged Scholarship and Learning in the College of Sciences.

12:00 PM – 12:45 PM LUNCH

12:45 – 2:00 PM Poster Session (EHPE2 118)
Chair: Dr. Jason Parsons

2:00 PM – 4:00 PM Student Oral Presentations (EHPE2 118 / 142)

4:00 PM – 5:00 PM AWARDS CEREMONY (EHPE2 118)
Chair: Dr. Karen Martirosyan

Oral Session 1 - OS1
Chair: Dr. Frederic Zaidan
Location: EHPE2 118

2:00 PM - Briante Najev, Comparison of snail communities of the lower Rio Grande Valley of Texas in urban and wild areas

2:20 PM - Edgar Vasquez, Nutrient Manipulation as a Tool For Thorn Forest Restoration

2:40 PM - Jasleen Kaur, Invisibles having visible impact- Arbuscular mycorrhizal fungi improves defense against insect herbivores in cover crops

3:00 PM - Eleazar Hernández, Influence of environmental phenomena in the reproductive cycle of Atlantic sea urchin in the southern Gulf of Mexico

3:20 PM - Michael J. Carrillo, Theoretical and Experimental Study of Cyclobutanecarboxylic Acid

3:40 PM - Jennifer Baez, Exploring allelopathy of native woody species as potential approach for thorn forest restoration: a test on inhibition of germination and emergence

Oral Session 2 - OS2
Chair: Dr. Ahmed Touhami
Location: EPHE2 142

2:00 PM - A. Gribovskiy, Time domain simulation of gravitational waves propagation through 3G detectors.

2:20 PM - Carlos Trevino De Leo, Microfluidic synthesis and characterization of Multiferroic Material BiFeO3

2:40 PM - Mojgan Dehghani, Bright conical diffraction in 1D PT symmetric lattices

3:00 PM - Hisham Abdou, Tuning the optical properties of doped BaZrO3 microcubes by varying excitation wavelength: Site Selective spectroscopy

3:20 PM - Palash Kumer Roy, Historical Overview of the Gravitational Waves Detection through Seminal papers

3:40 PM - M. S. Hossain, Classification of Four-class Motor Execution based Hybrid Brain-Computer Interface using ECOC classifier

ORAL PRESENTATIONS

OS1 -1

Comparison of snail communities of the lower Rio Grande Valley of Texas in urban and wild areas

Briante Najev, Alison Schofield, Jeff Nekola, Ben Hutchins, and Kathryn E. Perez
Department of Biology University of Texas Rio Grande Valley

The lower Rio Grande Valley (LRGV) of Texas and Mexico has one of the highest rates of urbanization in the world and the last remaining Tamaulipan Thorn forest of Texas. In LRGV, most faunal urban ecology research focuses on vertebrates. We used snails as an example of an invertebrate fauna that resides in wild Tamaulipan Thorn forest and the urbanized habitats of the cities in the region (yards) to determine if these urbanized habitats can provide a refugium for native invertebrate fauna. We found diversity measures for the urban snail communities (n=84; mean species richness = 4.8; mean species evenness = 0.6; mean Shannon-Wiener diversity index = 0.8) were not significantly different compared to wild sites (n=26; mean species richness = 5.03; mean species evenness = 0.6; mean Shannon-Wiener diversity index = 0.7). We also found Urban yards are a safe haven for many introduced and synanthropic species but not most native species. The urban habitats in this study were traditional lawn-style yards; we propose a follow up study on “natural yards”, which are usually designed to benefit butterflies and birds, would provide additional useful data on the LRGV urban invertebrate fauna has any impact on the snail fauna.

OS1-2

Nutrient Manipulation as a Tool for Thorn Forest Restoration

Edgar Vasquez, Alejandro Fierro-Cabo Coauthor: Andrew McDonald
Department of Biology University of Texas Rio Grande Valley

The Rio Grande Valley (RGV) is one of the most bio-diverse regions of the United States. Natural habitats in the RGV have been degraded and lost through the conversion of thornscrub and other habitats to agricultural and urban land. Three exotic African grasses have taken advantage of the degraded state of the region and have spread throughout the area out-competing many native species. The dominance of the grasses lower biodiversity locally and can cause seedling mortality making reforestation difficult in areas where they are present. The exotic grasses are high nutrient demanding plants and this fact can be exploited for restoration efforts. Two parallel factorial experiments are being conducted to determine the effects of nutrient sequestration on subsequent thorn forest seedling survivorship and grass cover. Sorghum was planted at high density in one treatment and was allowed to grow to just before flowering when the above ground biomass of the sorghum was harvested. A subsample of the sorghum was analyzed for nutrient content and nutrient sequestration was estimated. Seedlings were then planted and a fertilizer treatment (starter solution) was applied to half of the seedlings. A leguminous plant, (*Ebenopsis ebano*) was used in the first experiment while a non-leguminous plant, (*Forestiera pubescens*) was used in the second. Invasive grass cover, seedling basal diameter, height, and leaf chlorophyll content are being monitored every four months, with seedling survival being assessed every six months. Our hypotheses are 1) grass cover will be lower in sorghum-treated plots with basal diameter, height, survival, and chlorophyll content being higher in non-sorghum treatments, 2) fertilized seedlings will have greater height, basal diameter and chlorophyll content, and 3) the leguminous seedlings will have higher survival, basal diameter, height and chlorophyll content due

to their nitrogen fixing rhizobia. Preliminary results will be presented and discussed.

OS1-3

Invisibles having visible impact- Arbuscular mycorrhizal fungi improves defense against insect herbivores in cover crops

Jasleen Kaur[1], Jesus Chavana[1], Alexis Racelis[1,2], Pushpa Soti[1,2] and Rupesh Kariyat[1]*
[1]Department of Biology, The University of Texas Rio Grande Valley. [2]School of Earth, Environmental and Marine Sciences, The University of Texas Rio Grande Valley

Beneficial plant–microbe interactions in the rhizosphere have been found to enhance plant growth and development. Arbuscular mycorrhizal fungi (AMF), a major group among these microbes, improves plant fitness through the establishment of mycorrhizal symbioses. Despite being successfully established in various natural and domesticated study-systems, relatively little is known on whether AMF has cascading effects on plant defense traits. To test this, we planted Sudan grass (*Sorghum drummondii*), a dry land tolerant species, either inoculated with AMF or left as control as a summer cover crop. We hypothesized that AMF will alter plant defense pathways in Sudan grass influencing the attractiveness of the species to beneficial and damaging herbivores, besides other potential benefits for growth and development. Our results suggest that while AMF inoculated plants had significantly better growth and establishment, they also experienced lower initial incidence and damage by the herbivore fall armyworm (*Spodoptera frugiperda*). In addition, our insect community trapping experiment revealed that AMF inoculated *S. drummondii* attracted more beneficial insects (predators and parasitoids) and less number of damaging herbivores. Taken together, our data suggests that AMF treated *S. drummondii*, can positively influence both growth and defense traits, and has the potential to be an excellent cover crop.

OS1-4

Influence of environmental phenomena in the reproductive cycle of Atlantic sea urchin in the southern Gulf of Mexico

Eleazar Hernández, Omar A. Vázquez, Md Saydur Rahman
School of Earth, Environmental and Marine Sciences, University of Texas Rio Grande Valley

Environmental phenomena such as tidal and lunar cycles act as external cues that stimulate the reproductive activity of marine organisms. The Atlantic sea urchin, *Arbacia punctulata*, is primeval species that inhabits in the Gulf of Mexico. In order to acquire a better understanding of the reproductive biology within this species, sea urchins were collected monthly from July 2016 to June 2017 and sampled weekly in accordance with the lunar cycle from May to July in 2017 in South Padre Island, Texas. Within this study, we also report the changes of nutritive phagocytes (somatic cells also called nutritive phagocytes) in gonad in relation to gonadal maturation of Atlantic sea urchin in the Gulf of Mexico. Monthly and weekly changes in gonadal characteristics were observed histologically. In male, the testicular lobule was densely packed with sperm from June to August. In female, on the other hand, mature eggs first appeared in some ovaries in May and numerically increased in June to July, and decreased in August. During gametogenesis, nutritive phagocytes in both sexes were depleted from June to August (mature phase). Histological observations revealed that the gonad developed synchronously in and/or around the new moon. Collectively, our histological analysis suggests that Atlantic sea urchin spawns synchronously according to lunar cycle and could spawn several times during the summer months in the Gulf of Mexico.

OS1-5

Theoretical and Experimental Study of Cyclobutanecarboxylic Acid

Michael J. Carrillo, Shervin Fatehi, and Wei Lin
Department of Chemistry, University of Texas Rio Grande Valley

There has been continued interest in the structure of substituted cyclobutanes. In this work, we measured the rotational spectrum of cyclobutanecarboxylicacid (CBCA) for the first time using a BrightSpec Fourier-transform microwave spectrometer. To aid in our analysis of the spectrum, we performed coarse potential energy surface scans (B3LYP/6-311 G) in the ring—COOH dihedral angle of both equatorially- and axially-substituted CBCA. These scans revealed a unique local minimum and a shallow, symmetrical double well at the global minimum, implying the existence of four distinct stable (yet facilely interconvertible) conformers. We re-optimized these conformers using both density functional theory and second-order Møller-Plesset perturbation theory with the aug-cc-pVTZ basis set and computed their relative energies, dipole moments, and rotational constants. We will present and discuss the corresponding assignments of features in the spectrum.

OS1-6

Exploring allelopathy of native woody species as potential approach for thorn forest restoration: a test on inhibition of germination and emergence

Jennifer Baez[1], Christopher Gabler[2]
[1]Department of Biology, [2]School of Earth, Environmental, and Marine Sciences
University of Texas Rio Grande Valley

A frequent impediment of restoration efforts are introduced species that become invasive. A promising approach to hinder aggressive exotic plants during restoration of terrestrial habitats involves allelopathic effects of few native species. Our observations in tamaulipan thorn scrub have pointed at several species with apparently strong allelopathic effects. Here we assessed potential chemical inhibition of germination and seedling emergence by Acacia shaffneri, and compared it to a close but apparently non allelopathic species, Acacia farnesiana. Live leaves and fine roots of both species were collected and dried to constant weight at 40°C, and then grinded to powder. Aqueous extracts were prepared with grinded dry plant material in five dilutions that were tested in a completely randomized design with five replications for a total of 100 experimental units. The experimental unit was a petri dish with 100 seeds of Sorghum bicolor over a layer of absorbent paper. The dishes were kept at room temperature and the paper moist with its corresponding extract dilution until the germination process was considered complete. Parameters describing the germination process (germinability, mean germination time, mean germination rate and synchrony of germination) will be compared between species, tissues and extract dilutions. On a parallel experiment, pots filled with soil were seeded with sorghum and covered with a thin layer of mulch made from these and other native woody species. Seedling emergence and initial growth will be assessed. Implications for the control of invasive African grasses in the context of thorn forest restoration will be discussed.

OS2-1

Time domain simulation of gravitational waves propagation through 3G detectors

A. Gribovskiy and M. Rakhmanov
Department of Physics and Astronomy, University of Texas Rio Grande Valley

Intensive development of gravitational waves interferometry techniques and huge effort of LIGO and Virgo collaborations made the detection of gravitational waves

possible. Currently only compact binary inspiral gravitational waves were detected, even though there are other possible types of gravitational waves and sources. This discovery increased interest in larger, more sensitive interferometers with higher sensitivity and further detection range, also known as 3G detectors. Sensitivity improvement of future gravitational wave detectors can allow detection of new types of sources, for example core collapse supernova. According to previous extensive numerical simulations, a gravitational wave signal emitted during the core collapse can have frequencies up to 2 kHz. These frequencies approach the free spectral range frequency of Fabry-Perot arms of 3G detectors. At this regime gravitational wavelength becomes comparable with the arm length and the long wavelength approximation, which is usually implied for analysis of current gravitational wave detectors, does not work. Therefore, it is necessary to develop new approaches for interferometer design optimization, gravitational wave signal processing and calibration. To understand behavior of gravitational wave interferometers outside of the long wavelength regime we developed time domain model of a detector. In this model we calculate propagation of the electromagnetic field from mirror to mirror in presence of variable gravitational wave. We demonstrate how different types of gravitational waves propagate through an interferometer and how the output signal of such interferometer distorts the gravitational wave. This model can help understand restrictions on gravitational wave spectrum that long arm interferometers have and provide necessary information for optimization of the arm length. Moreover, this model can help to develop methods for restoration of the original waveform from the output of an interferometer, as well as improve signal localization with the network of gravitational wave detectors.

OS2-2

Microfluidic synthesis and characterization of Multiferroic Material $BiFeO_3$

Carlos Trevino De Leo and Karen S. Martirosyan
Department of Physics and Astronomy, University of Texas Rio Grande Valley

Multiferroics materials inherently shows both electric and magnetic polarizations that are highly suitable for spintronic and other magnetoelectric devices. Potential ground-breaking applications include the capability of creating a four to six-state memory element, hard drives with information written electrically (lower power input) and magnetically (non-destructive), electrical control of ferromagnetic properties, and the creation logic devices among others. Multiferroics may guide to more compact, quick, energy-efficient data-storage technologies. Bismuth Ferrite $BiFeO_3$ is a perovskite type metal-oxide semiconductor that display both antiferromagnetic and ferroelectric ordering at room temperature due to its two differing Fe-O bond lengths. Materials based on bismuth ferrite are currently capable to produce the strongest spontaneous polarization among known multiferroics materials. Barriers with present production methods include the need of a high temperature ~800°C, high pressurization systems (~3.5-10 GPa), and it is produced in most cases with relevant traces of secondary phases. Microfluidic synthesis used as an alternative method eliminates the grievance of the pressured system by a micro- channel system made of Polyetheretherketone (PEEK) with a Young's modulus of 3.6 GPa. The PEEK material can withstand the stress exerted, since the tubbing cross-section measures 0.28 mm, (smaller cross-section = less force per unit area). Microfluidic processing has the advantage of controlling the volume passing through the medium with high precision, since it provides a laminar steady flow through its channels. Multiferroics $BiFeO_3$ was produced using typical reagents of Bismuth (III) Nitrate Pentahydrate and

Iron (III) Nitrate Nonahydrate that were used as precursors. Both compounds were dissolved in Nitric Acid (pH 0-1) and reacting it in stoichiometric quantities with Sodium Hydroxide in a closed PEEK system up to 150°C through the whole process. XRD patterns revealed a perovskite structure once the product was sintered at 700°C for 60 min.

OS2-3

Bright conical diffraction in 1D PT symmetric lattices

Mojgan Dehghani and Hamidreza Ramezani
Department of Physics and Astronomy, University of Texas Rio Grande Valley

Recently, the realizations of non-Hermitian systems with parity-time (PT) symmetric potentials have been extensively studied. Especially, in optical systems PT symmetry has demonstrated extraordinary optical properties which stem from non-Hermiticity of the system. In our project we study the electric field evolution at the phase transition point of PT 1D lattices which reveals the “bright” conical diffraction. Unlike previous proposed conical diffractions, the field intensity inside our observed cone is uniform and has its maximum value. Our 1D lattice composed an array of coupled optical waveguides consisting where the electric field amplitude evolves in it according to the Schrodinger equation. Around the exceptional point of our system, the band structure behaves linearly as a function of wave vector which results in the conical diffraction dynamics. In our numerical simulation we excite our PT lattice with a Gaussian wave-packet prepared around the exceptional point. The linear behavior of the dispersion relation in the vicinity of an exceptional point provides a linear group velocity which results in a conical diffraction of the initial Gaussian excitation. Interestingly enough, we observe that the cone generated in our system is bright, namely the intensity of the electric field is maximum and almost uniform around the center of the cone. This is in contrast to previously observed conical diffractions where the intensity inside the cone is almost zero.

OS2-4

Tuning the optical properties of doped $BaZrO_3$ microcubes by varying excitation wavelength: Site Selective spectroscopy

Hisham Abdou[1], Santosh K. Gupta[1,2], Yuanbing Mao[1,3]
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[2]Radiochemistry Division, Bhabha Atomic Research Centre, Trombay, Mumbai-400085, India .
[3]School of Earth, Environmental, and Marine Sciences, University of Texas Rio Grande Valley.

Materials with good light emitting property for white light emitting diodes (WLEDs) and X-ray induced photodynamic therapy (XPDT) have received significant attention in the recent years. Therefore, the design and development of stable phosphors with tunable color emission and efficient scintillation properties has been crucial. In this study, barium zirconate microcrystals doped with different concentrations of Eu^{3+} ions were synthesized using the environmentally benign molten salts method. The purity and structure of the obtained powder was systematically characterized using X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), Raman spectroscopy. Scanning Electron Microscopy (SEM) was used to study the morphology and the size of the samples. The optical properties of the synthesized microcrystals were investigated using time resolved Photoluminescence (TRPL), Radioluminescence (RL) and integrating sphere quantum yield (QY) measurements. Having the highest luminescence intensities and quantum yield, $BaZrO_3$: 2% Eu^{3+} samples showed the

most promising results. The actual site symmetry for Eu^{3+} ion in barium zirconate was also evaluated by calculating the Judd-Ofelt (JO) parameters in the $BaZrO_3$: 2% Eu^{3+} sample which revealed that the emission of the Europium ions at different excitation wavelengths is coming from two different sites with different asymmetric ratios. That indicated the ability of tuning its light's Red/Orange color ratio by varying the excitation wavelength, which is going to have a great impact on the development of red phosphor for WLEDs and microcrystalline scintillator for XPDT.

OS2-5

Historical Overview of the Gravitational Waves Detection through Seminal papers

Palash Kumer Roy, Malik Rakhmanov
Department of Physics and Astronomy, University of Texas Rio Grande Valley

The gravitational waves were detected on September 4,2015 by laser Interferometer Gravitational -Wave Observatory (LIGO) detectors. Gravitational Waves detected 100 years after Einstein prediction. Detectors were kept running almost 20 years to detect gravitational waves. Gravitational waves carry information about astronomical objects that generate them. The history of gravitational waves is very enriched. We depict the journey of development of the theory, the experimental attempts to detect gravitational waves and recent direct observation of gravitational waves. The theoretical ideas and disputes about Gravitational Waves begin with Einstein in 1916. Theoretical and experimental development toward detection, and finally subsequent successful discovery.

OS2-6

Classification of Four-class Motor Execution based Hybrid Brain-Computer Interface using ECOC classifier

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United International University, Dhaka, Bangladesh.

Hybrid brain-computer interfaces (hBCI) utilize multiple modalities to acquire brain signals. This improves signal integrity by compensating the limitations of a single modality. Motor execution (ME) based hBCI (ME-hBCI) has been the focus of recent research. There have been major enhancements in the classification of binary class ME-hBCIs, however, classification of four-class ME-hBCI is yet to be done using multiclass algorithms. We present a successful four-class ME-hBCI classification using simultaneously recorded electroencephalography (EEG) and near-infrared spectroscopy (NIRS) from 15 healthy subjects (14 males and 1 female, Open Access Dataset). First, the functional NIRS (fNIRS) signals were extracted from the NIRS signals using modified Beer-Lambert law. The EEG and the fNIRS signals were then filtered using Butterworth bandpass filter before spatially filtering these with regularized common spatial filter (RCSP). Appropriate features were estimated from the filtered signals. Multiclass error-correcting output code (ECOC) classifier was used to classify the four classes of ME tasks (right hand, right arm, left hand, left arm). The results showed an increase of above 4% in terms of classification accuracy when the signals of two modalities were combined instead of using single modalities.

Poster Presentations

Biology

P1

Mutations in the para-sodium channel gene of a pyrethroid-resistant strain of *Rhipicephalus microplus* from Colombia

Adriana Pena[1], Guilherme Klafke[2], Jason Tidwell[2], Jenny Jovana Chaparro Gutiérrez[3], David Villar[3], Adalberto A. Pérez de León[4], Teresa Patricia Feria-Arroyo1
[1]Department of Biology, University of Texas Rio Grande Valley,
[2]USDA ARS Cattle Fever Tick Laboratory,
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[4]USDA-ARS Knipling-Bushland U.S. Livestock Insects Research Laboratory and Veterinary Pest Genomics Center

The southern cattle fever tick (CFT), *Rhipicephalus microplus*, is the vector for babe-siosis and anaplasmosis, which is one of the most economically important vectors of disease in the cattle industry. Pyrethroids have been heavily used as a method of control. As with any organism that is continuously challenged, these ticks evolved to be pyrethroid resistant in many populations throughout the world. CFT ticks from Colombia (Arauca strain) were reared at the USDA-ARS Cattle Fever Tick Research Laboratory in 2018 in order to characterize the mechanism of pyrethroid resistance. A major mechanism of pyrethroid resistance is target site insensitivity caused by mutations in the para-sodium channel gene. A qPCR high-resolution melt (HRM) analysis to detect mutations in the sodium channel gene was performed on 23 individuals from the F2 generation of the Arauca strain. The HRM curves generated from seven tick samples match those from previously described mutations associated with resistance. All the other individuals presented curves that did not match with any previously detected genotypes. Conventional PCR is used to amplify fragments from domain II and domain III of the para-sodium channel gene and will be sequenced to identify the presence of novel polymorphisms. Our results show that HRM analysis is a good method for screening samples for identifying novel mutations. Identification of novel mutations increases our understanding of the variability that is within the para-sodium channel gene that may lead to acaricide resistance within the *Rhipicephalus microplus* populations, and would allow Cattle Fever Tick Control Programs to plan accordingly

P2

Comparing Mesh Traps against Standard Traps to Avoid the Capture of Tamarixia radiata a biological control organism of the ACP

Gisel Garza[1], Genoveva Carriles[1], Richard Casares[2], Abelardo Rodriguez[1], Gabriela Sanchez[3], Mamoudou Setamou[4], Jon Dale[3], and Teresa Patricia Feria Arroyo[1].
[1]Department of Biology, University of Texas Rio Grande Valley, [2]Texas State University,
[3]Texas Citrus Pest and Disease Management Corporation, [4]Texas A&M University-Kingsville Citrus Center

The Asian citrus psyllid (ACP), *Diaphorina citri* Kuwayama is the vector of *Candidatus Libericacter asiaticus*, a bacterium that causes citrus greening disease (CGD). This disease makes citrus fruit unfit for sale and ultimately causes the death of the tree. CGD has no current cure and mitigation is primarily done by control of vector populations. Assessing ACP populations is an important step when preventing the spread and establishment of CGD. Currently standard ACP traps are used to assess ACP populations, but they often capture beneficial organisms that serve as biological controls of the ACP. Traps with mesh have been shown to successfully capture ACP, however there have been no assessments that compare the effectiveness of mesh traps against standard

traps in avoiding the capture of *Tamarixia radiata*, an important biological control agent of ACP. To compare how successful these two trap methods are in avoiding capturing T. radiata, data was collected from 17 independent citrus groves where both types of traps were placed in four separate corners (A, B, C, and D) of the grove at similar conditions. Data collected from April 2018 to November 2018 were used to compare the mesh traps against the standard traps at assessing ACP and T. radiata populations. There was no significant difference between the mesh and standard trap method at assessing ACP populations. However, mesh traps were more successful in avoiding T. radiata trapping. Qualitative observations show a decrease in the number of beneficial organisms captured in the mesh traps (e.g., lady bugs).

P3

Understanding herbivore-pollinator interactions using Silver leaf nightshade (*Solanum elaeagnifolium* Cav.) as a model

Jesus Chavana and Rupesh Kariyat
Department of Biology, University of Texas Rio Grande Valley

Silver leaf nightshade (*Solanum elaeagnifolium* Cav.) is a herbaceous perennial that is highly invasive worldwide. The species does extremely well, because it is versatile and can live in poor soil and nutrient conditions. In addition, it also has extraordinary defense mechanisms that include structural defenses such as trichomes and spines, and chemical defenses such as alkaloids and phenolics. We are currently exploring how herbivores, pollinators, and predators affect multi trophic interactions in the species, and using this as a model to understand insect community dynamics in natural and agricultural ecosystems. The main herbivores found were Texas potato beetle (*Leptinotarsa texana*), green peach aphid (*Myzus persicae*), tobacco horn worm (*Manduca sexta*), and flower weevil (*Trichobaris texana*).

P4

Examining the role of insect community dynamics in forest restoration success in La Sal Del Rey

Reyna Chavez, Bradley Christoffersen and Rupesh Kariyat
Department of Biology, University of Texas Rio Grande Valley

While forest restoration success has been well studied from both physiological standpoint, we still lack a clear understanding on how insect community dynamics (herbivores, predators and decomposers) affects seedling success and establishment in restoration programs. In addition, recent evidence also suggests that plant success can also be influenced by beneficial microbes such as mycorrhizal fungi. To examine the impact of these two factors in detail, we are currently working on a forest restoration program in the subtropical region of South Texas at in La Sal Del Rey, in collaboration with US Fish and wildlife, and a dutch innovative reforestation company called Land Life Company. The program has planted approximately 10,000 native tree seedlings in a factorial design with and without mycorrhizal fungi. From the group of 25 species planted, we selected the following species; Berlantiers Fiddlewood, Skeleton-leaf Golden eye, Brasil Bluewood, Huisachillo, Lotebush, Snake-eyes, Coma Saffron Plum, Wright's Acacia to take a closer look at the impact of herbivores and their natural enemies on their success. This preliminary study involved the observation of insect attractiveness of the seedlings and whether there is a variance among treatments and species. Our main hypothesis is that these seedlings will considerably vary in their susceptibility towards herbivores. In addition, we also hypothesize that mycorrhizal fungi will benefit the seedlings in establishment and will proved protection from herbivores. We are collecting data on insect damage and species associated insect communities using a combination of field observation and trapping methods. We plan to follow up these observations by profiling the physical and chemical defenses of these species using chemical ecology

and analytical chemistry methods.

P5

Using the brown dog tick, Rhipicephalus sanguineus, as a model system for biological control of the southern cattle fever tick, Rhipicephalus microplus

A. Vasquez[1], R. Kariyat[1], A. Vacek[1], J. A. Goolsby[2],
[1]Deapartment of Biology, University of Texs Rio Grande Valley,
[2]United States Dept. of Agriculture, Agricultural Research Service, Cattle Fever Tick Research Laboratory.

The cattle fever tick, R*hipicephalus microplus* is an exotic livestock pest in south Texas and northeastern Mexico. Although it has been eradicated in the U.S. it frequently re-invades from Mexico via stray livestock and alternate wildlife hosts. Classical biological control of *R. microplus* using tick parasitic wasps, *Ixodiphagous spp* (Hymenotpera: Encrytidae) from its native range in Southeast Asia may enhance eradication efforts since biological control insects could target cattle fever ticks on hosts such as nilgai and white-tailed deer that are difficult to treat with conventional pest management strategies. To better understand how to rear and evaluate the parasitic wasps from Asia, we are studying *Rhipicephalus sanguineus* which is a close relative of the *R. microplus* and is known to be attacked in Texas by *Ixodidphagous hookeri* Howard. This species of parasitic wasp that lays its eggs inside *R. sanguineas* nymphs and adult wasps emerge from engorged nymphs. We are following methods from a similar study in Brazil which found high levels of parasitism. In our study, *R. sanguineus* of all life stages were collected between May 2018 to January 2019 from dogs at the Palm Valley Animal Shelter (McAllen, TX). The numbers of tick nymphs and adults were recorded, and ticks were placed in vials and held at 27°C and 70% humidity for emergence of wasps. To date no wasps have been collected, which is surprising given that *I. hookeri* was originally described from Corpus Christi, TX. We plan to continue collections of ticks through May 2019. These techniques will be used to develop rearing techniques and evaluate host range of the Asian *Ixodiphagous* species.

P6

Exploring a Novel Antidote to Citrus Greening: Antibacterial Activities of Symbiotic Fungal Endophytes in *Citrus* and Related Genera (*Rutaceae*)

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Citrus greening disease, a bacterially-based (*Candidatus Liberbacter*), pathogenic infection of commercial *Citrus* species, threatens citrus industries both nationally and internationally. Efforts to control the disease have focused primarily on controlling the psyllid vector, but with little success. Our investigations approach the citrus greening challenge by focusing on the control of bacterial infections instead of the vector. We propose the employment of molecular techniques to detect potential endophytic fungal biocontrol agents in living materials of native and cultivated members of the citrus family (Rutaceae), with an aim to eventually test the antimicrobial activities of these fungal mutualists. Molecular probes have been undertaken to detect fungal genomes in fresh plant tissues of *Citrus, Amyris, Esenbeckia and Xanthoxylum*. We experimented with DNA extraction techniques and found that the initial use of Clorox to clean off extra-foliar fungal contaminants adversely affects our endophytic fungal extractions. Preliminary results indicate thus far that molecular signals of fungal endophytes are present in *Amyris madrensis*, *Xanthoxylum fagara* and *Esenbeckia berlandieri*. Future studies will refine our molecular techniques to adequately sample diverse communities of fungal endophytes. These techniques will eventually be employed to isolate and test the antimicrobial activities of individual fungal strains from the geographical origin of *Citrus* domesticates, Southeast Asia.

P7

Winners and losers in reforestation efforts: Identifying physiological traits contributing to species survivorship along a planting chronosequence

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A central question in ecology is how traits of species translate into performance of individuals given an abiotic and biotic environment. A chronosequence of reforestation sites offers a context within which to explore this question. The US Fish and Wildlife Service has been retiring and reforesting agricultural land in the Lower Rio Grande Valley (LRGV) for several decades. Here we propose a study to address the following specific questions: How does the species composition (also species diversity) change as a function of time since planting? Are there certain species which always tend to dominate? Are there certain species which tend to consistently 'lose'? What are the physiological traits of these species? We selected a study site, La Sal del Rey, where 26 years of documented annual reforestation offer a series of plots possessing similar soil and ecological characteristics, and differing only in time since planting, to conduct our study. We will begin surveys of tree species in plots that were reforested in a variety of years, from 1996 at the oldest to 2016 at the most recent. Overall survivorship and growth rates for a given plot will be estimated based on survey results and compared against documented planting rates. Any patterns in survivorship across tree species will be investigated on physiological grounds, with specific attention paid to those species that show notably above-average and notably below-average survivorship. The physiological traits under study will include those related to water uptake and loss, capacity to survive summer and multi-year drought, and photosynthetic rate and timing. Results of this study will not only highlight which physiological traits are most important for species survival, but will additionally inform species selection in future reforestation efforts in the LRGV.

P8

Impact of trichome variation in Tobacco Hornworm (Manduca sexta) caterpillar

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Trichomes are hair-like projections plants develop from their epidermis as a form of protection from biotic and abiotic factors that negatively affect their growth and development. Trichomes are usually classified as glandular or non-glandular depending on their structure and mode of action. Although there have been studies conducted to understand the effects of trichomes in general, there have not been studies conducted to examine whether trichome variation affects the growth and development as well as preference of herbivores like caterpillars. To observe the effects of trichome variation on the growth and development of herbivores, we removed the trichomes from the leaves of two plant species belonging to the Solanaceae plant family. We chose the species of plants according to the type of trichomes they produce, Solanum elaeagnifolium produces non-glandular trichomes while Solanum lycopersicum primarily produces glandular trichomes. The insect used in this study was, Manduca sexta is a specialist herbivore of the Solanaceae family. The removed trichomes were added to artificial diet that was fed M. sexta caterpillars. Results showed that trichome diets had a negative effect in trichome mass, mass gain and time to pupate when compared to the trichome-free diet, although caterpillars had no preference in either trichome diet.

Moreover, non-glandular trichome diets caused more damage than glandular ones. Although trichomes are considered a first line of defense, they can also cause prolonged and continuous developmental effects in a trichome-type manner, and should be explored further across multiple families and species.

P9

Effect of Niclosamide on Proteasome Inhibition-Induced Cytotoxicity in SH-SHY5Y and PC12 Cells

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Niclosamide is an FDA approved drug which belongs to the helminthic drug family. It has been used in the clinical setting to treat beef and tape worm infections. Recently, Niclosamide has been shown to induce apoptosis and cause cell death in various cancer cells. Our previous study showed that Niclosamide induced protein ubiquitination and led to cell death in glioblastoma cell lines. In present study, we investigated the neuroprotective mechanisms of Niclosamide in both human and animal neuronal cells (SH-SY5Y and PC12 respectively), as well as exposing them to a proteasome inhibitor, MG132. Our studies demonstrated that the exposure of the neuronal-derived cell lines SH-SY5Y and PC12 to the proteasome inhibitor MG132 markedly increased accumulation of intracellular ubiquitinated proteins. Dysfunction of proteasome leads to apoptosis with activation of caspase-3, cleavage of poly ADP-ribose polymerase (PARP), DNA condensation/fragmentation and endoplasmic reticulum (ER) stress with upregulation of CHOP/GADD153 levels. These events lead to severe cytotoxicity along with upregulation of p53. Interestingly, all these events including the increment in ubiquitinated proteins were able to be prevented by exposing these cells to Niclosamide. Furthermore, Niclosamide like MG132 is able to promote autophagy, and combination of both reagents further activates autophagy in SH-SY5Y cells. These results demonstrate that Niclosamide could be a potential neuroprotective agent by repressing proteasome dysfunction-induced cytotoxicity.

P10

Using cover crops to attract beneficial insects and reduce herbivory in cash crops

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The use of cover crops provides both direct and indirect benefits to agricultural ecosystems. Cash crops sown after cover crops directly benefit from better nutrient availability, increased moisture retention, and improved weed suppression. Although there is some evidence, we still lack a complete understanding on the effects of cover crops as an insect herbivory suppressor, and the mechanisms that mediate these effects, if any. To test this, we planted two commonly used leguminous cover crop species, sunn hemp, *Crotalaria juncea*, and cowpea, *Vigna unguiculata* in an organic farm in South Texas and observed their effectiveness in providing pest management while also attracting beneficial insects. Data was collected on plant height, insect damage, and plant biomass, in addition to insect community composition in the field. Our preliminary results on cover crops suggest that sunn hemp preformed significantly better in all measures, it continuously showed significantly lower pest damage (caterpillars, true bus, and aphids) along with a high prevalence of beneficial insects (Coccinellids, wasps and bees) when compared to cow pea. Sunn hemp also improved (higher species richness) the surrounding insect community in the area and thrived in the summer heat without much resource input. Since host location and host choice by insects are primarily mediated by plant volatiles, we are currently examining whether the two cover cop species differ in their volatile profile- both constitutively emitted, and emitted under herbivory. Future

experiments also include examining the residual effects of cover crops on the cash crop- which is currently underway.

P11

Using an Electric toothbrush to improve the Buzz Pollination

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Buzz pollination is usually found in approximately 6% of flowering plants. Solanaceae, a major plant family that houses economically important plants such as tomato, potato, eggplant, and peppers, are also buzz pollinated. However, for plant breeding and research programs, insect pollinators are often undependable as controlled buzzers - due to their unpredictable movement and irregular flower visits. Traditionally, a tuning fork is used as an alternative to insect pollinators, but it is expensive, less durable and in many cases- hard to find at the right frequency in a timely manner. To overcome these limitations, we tested the use of inexpensive and easily available electric toothbrush to replace a tuning fork, and examined whether varying the duration of buzzing, affects the amount of pollen extracted, when compared to the tuning fork and pollinators. We used a native but highly invasive weed *Solanum eleaegnifolium* flowers for our experiments and observed the *Xylocopa* spp. (Carpenter bee) for a natural pollinator behavior. Our preliminary results show that electronic toothbrush is a good substitute as it extracts the almost similar amount of pollen as of the tuning fork in any given time intervals. More interestingly, we also found that on average, carpenter bees only buzzed individual flowers for less than three seconds, which was enough to collect maximum pollen as found from our fork and toothbrush experiments. We are continuing our experiments to compare both insect and artificial buzzing to understand the optimum buzzing time and pollen removal using multiple species of pollinators and host plants.

P12

Discerning competitive vs. facilitative relationships of weeds on forest restoration efforts at La Sal Del Rey, TX

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The Tamaulipan thornscrub forest once covered much of the Lower Rio Grande Valley (LRGV), a region characterized by a subtropical climate and high biodiversity unique to this area of the United States. The habitat of over 35 threatened species, it currently faces numerous conservation challenges associated with rapid population growth. Despite the planting of over 3.1 million tree seedlings in the region since 1984, the success of reforestation efforts remains largely understudied. Further, the influence of herbaceous weeds in such efforts is often ignored, despite consensus regarding its importance for implementing appropriate and effective conservation strategies. The study will discern the effect of native and nonnative weeds on 24 species of native thornscrub trees and shrub seedlings to establish a baseline for the facilitative and competitive relationships of flora in the LRGV. The study will take place at La Sal del Rey National Wildlife Refuge over the course of 18 months. Ten replicates of each species will be monitored across two different treatments: weed exclusion vs. control. A variety of traits will be measured on a monthly basis and include height, leaf area, branching, and animal damage, and will serve as indicators of overall seedling health and survivorship. In addition, we will quantify grass cover across a larger area with the use of unmanned aerial system (UAS) and drone technology in conjunction with regular seedling demographic surveys. Data collected is expected to showcase the effects of native and nonnative weed presence on seedling survivorship. Overall, we hypothesize that native weed presence will be more facilitative of tree and shrub seedling survivorship in contrast to nonnative weed presence. A key outcome of this work will be to identify tree or shrub species most

likely to be successful in the initial, most critical stages of reforestation when nonnative weeds predominate.

P13

Effects of Acidic Solutions on Growth and Gene Expression of OPA2 Gene in *S. Mutans*

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Streptococcus mutans is an oral bacterium that is one of the principal causes of dental caries (cavities) in humans. The bacterium forms biofilms (e.g., plaques) on tooth surfaces that erode the enamel leading to tooth damage; in addition, the bacterium is acid-tolerant and flourishes in acidic environments. Like many bacterial species, *S. mutans* may be subdivided into strains that display genetic differences. Strains with genetic differences are known as genotypes that can be distinguished by sequencing and analyzing marker genes. Genotypes represent non-lethal mutations in a bacterium's genetic code and may be induced by factors in the bacterium's environment. This research study examines the expression of a genotypic marker in *S. mutans* grown in a lab broth environment with different pH. Samples of bacteria were collected and their DNA was extracted. Ongoing experiments include genotyping performed using the Polymerase Chain Reaction and DNA sequencing. Different bacterial genotypes may be able to colonize teeth more effectively than others; therefore, this research may be used to estimate future dental health concerns in humans.

P14

Determining the specific status of an unusual, phreatic, Texas cavesnail (Mollusca; Gastropoda; Hydrobiidae)

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Limited research has been done on the freshwater snail family Hydrobiidae across the Edwards Aquifer region of Texas, besides the initial description of species 40-140 years ago. The Texas members of this family are mostly phreatic, meaning they are found in freshwater springs and underground aquifers. Some of the Edwards Aquifer freshwater snails appear to be derived from southwestern U.S. and Northern Mexico freshwater fauna but others are potentially marine relicts. Texas has 16 described hydrobiid species, 14 of which are of conservation concern. In recent surveys of the Edwards aquifer fauna in Comal, Travis, and Val Verde counties, we encountered populations of a snail with unusual shell features that do not resemble any of the existing named species. We use examination of the shell and phylogenetic analysis of mitochondrial (CO1) and nuclear genes (LSU) of this unusual snail to determine if it is an undescribed species endemic to Texas and to place it into the broader phylogenetic context of the Hydrobiidae.

P15

Assessing Species-Specific Responses to Forest Restoration Interventions in the Lower Rio Grande Valley

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Agriculture and urbanization activities have wiped out over 95% of the original vegetation of the Lower Rio Grande Valley (LRGV) including 99% of the native brush in riparian areas. Since the 1990s, various initiatives have been taken to restore the original veg-

etation of the LRGV. However, over the next few decades an increase in the incidence of prolonged droughts is expected, creating unprecedented challenges for restoration initiatives. Research that elucidates species-specific responses to restoration interventions (RIs) aimed at minimizing seedling mortality post-planting is scarce, particularly among the native species of the LRGV. Therefore, in August 2018, we initiated a study to evaluate seedling survivorship of 24 native species in response to RIs incorporating some combination of physical seedling shelters, 5 gallons of slow-release moisture, and mycorrhizae in a semi-factorial design. Seedlings were planted in October – November of 2018. Preliminary assessments indicate large treatment differences in survivorship due to mammalian herbivory, with large species differences in survivorship as well. A comprehensive understanding obtained through studying the plant traits associated with higher seedling survivorship would facilitate the modification and implementation of sustainable restoration strategies in the future.

P16

Neural Network Analysis of Echocardiogram Data to Determine Heart Complications

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The transthoracic echocardiograms (TTE) provide insights into the heart conditions using ultrasound. The TTE data collected from multiple patients admitted to a Danish Hospital were investigated. The demographic profiles, clinical records, TTE variables were measured and summed to find mean, and standard deviations. The logistic regression analysis was then done to find associations among demographics, clinical measurements, recorded TTE data, and possible health complications. The connections between family history and current patient illnesses were also analyzed. The results demonstrated a definite relationship between complications, and the recorded data. The data was processed with deep learning techniques, implementing a neural network, to find patterns and allow for predictive modeling.

P17

Temperature Influence on Insecticide Resistance in *Aedes aegypti* and *Aedes albopictus* mosquitoes from South Texas

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Aedes aegypti and *albopictus* are vectors for several emerging arboviruses such as Zika, Chikungunya, dengue and yellow fever. They can be found along the Rio Grande River in South Texas, along the border between Mexico and the United States of America. They also reside near human settlements and cause significant human health concerns. As temperature change, insecticide resistance may potentially change in *Aedes aegypti* and *albopictus* mosquitoes. We examined the influence of rearing temperature on insecticide resistance on *Aedes aegypti* and *Aedes albopictus*. Colony mosquitoes (F3 generation) were hatched and reared to adulthood in varying temperature regimes that may reflect temperature patterns in South Texas. Insecticide resistance to permethrin and deltamethrin was assessed using the CDC Bottle Bioassay method and resulted were compare to resistance patterns observed in field collected specimens. Adult females were tested between 5 and 10 days after reaching adulthood. These data may elucidate insecticide resistance patterns that are observed, as well as potentially predict resistance patterns that may emerge as climates changes and temperatures increase worldwide.

P18

Synthesis and Biological Evaluations of Hydroquinone and p-Indolequinone Derivatives as Anticancer Agents

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Cancer is one of the costliest diseases to treat and one of the deadliest known to mankind. According to the American Cancer Society, the world suffered from 9,500,000 cancer-related deaths and 17,000,000 cases diagnosed in 2018. Artificial synthesis of natural products has become vital given the need to produce more viable drugs to combat cancer and other newly emerging resistant bacteria. Quinones naturally occur in all living systems and have high rates of bioactivity. Additionally, napthohydroquinones have been proven toxic to leukemia/lymphoma cells. These results inspired the present project on—quinoxialine-5,8-dione with a variety of aldehydes to yield quinoxaline-5,8-diol. The main objectives are to: synthesize the target molecule through sunlight, test the bioactivity of the new compound, produce a relatively inexpensive anti-cancer drug candidate, and formulate an efficient method with a high product yield. First, a multi-reaction step was completed to synthesize quinoxialine-5,8-dione. All reactions were monitored by thin layer chromatography and confirmed by nuclear magnetic resonance spectroscopy. After extraction, the compounds were purified by column chromatography. Finally, quinoxialine-5,8-dione was identified with a 49.4% yield. The sunlight reaction was completed with quinoxialine-5,8-dione and acetylaldehyde and gave a 72.6% yield; the bioactivity has not yet been tested due to time restraints. The second reaction performed to afford quinoxaline-5,8-diol was attempted with quinoxaline-5,8-dione and benzaldeyde, however, the reaction was unsuccessful after ten days. Once the target molecule has been synthesized successfully, the bioactivity will be tested. More future work includes attempting the reaction with different aldehydes and checking the substrate limitation. In this project, not only do we gain insight on the bioactivity of a new compound, but we also help to increase the efficiency of our utilization of natural resources, encourage other scientists to find an environmentally friendly approach, and positively contribute to current knowledge of sunlight driven reactions.

P19

Synthesis of triiodothyronine hormone derivative to treat prostate cancer

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Triiodothyronine is known as a major hormone for regulation of metabolism. It has also shown to be effective at inhibiting androgen receptor activity. Prostate cancer progression is correlated to androgen receptor activity; thus inhibition of the androgen receptor can potentially reduce growth of cancerous prostate cells. In the course of this study, an unknown active compound was formed in a vial of triiodothyronine in dimethyl sulfoxide and displayed a high efficacy for the androgen receptor. This unknown active compound could not be identified due to an unmeasurable amount. The hypothesized compound is a derivative of triiodothyronine that will be synthesized and tested for androgen receptor binding. There are also several compounds that we have hypothesized that may contain a similar or higher efficacy than the unknown compound, in which we also plan to synthesize. Ultimately our plan is to form in time a usable amount of several triiodothyronine derivatives to compare their respective receptor affinities.

P20

Total Synthesis of Mansouramycins A and B

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In 2009 bioactive compounds from marine *Streptomyces* species was isolated which resulted in deriving four isoquinoline-quinone alkaloids known as Mansouramycins A-D. There have been reports that there are 36 non-small cancer cells against cytotoxicity in Mansouramycins A-C in lung cancer, breast cancer, melanoma, and prostate cancer cells. Reports that have conducted total syntheses were all specific to a single compound only mansouramycin A and D. The total synthesis of mansouramycins are relatively easy to achieve on the other hand, from reported methods preparing the derivatives with different substituents are limited when the substituents are on the fused-pyridine ring need to be changed. The research circulates about the modification for general methods of isoquinoline-quinones are to be able to obtain the total synthesis of the mansouramycins natural compounds and their derivative by the usage of different amino acids to synthesis the aminoacetals.

P21

Synthesis of agonist AR437735 and inverse agonist AR437948 for the treatment of type two diabetes

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With the growing number of people with type two diabetes mellitus (T2DM), there has been an interest in new methods of treatment for T2DM. Recently, GPR119, a G protein-coupled receptor, has been targeted as a method for monitoring the blood glucose levels in a person with T2DM. Ligand binding of the GPR119 has shown a glucose dependent insulin secretion in *in vitro* and *in vivo* studies. Activation of the GPR119 has shown to lower blood glucose in rats and mice when administered orally. Since the discovery of the GPR119 in 1999, there have been several efforts to synthesize molecules that will lead to the activation of the receptor. In 2008, Arena Pharmaceuticals produced a GPR119 agonist AR231453 from a screening hit of an inverse agonist. Ever since the discovery of the potent GPR119 agonist AR231453, there have been dozens of efforts to synthesize analogs of the agonist. This project is an attempt to shed light on the structural activity relationship between AR231453 and other analogs with the GPR119 by using conformational analysis and lead modification approach. Hereinafter is an attempt to synthesize analogs of the AR231453. Agonist AR437735 and inverse agonist AR437948 are to be synthesized by producing a three-ring structure held together by ether linkage. The three-ring structure consists of a pyridine ring, halogenated pyrimidine, and a piperidine. Introducing hydrogen bond acceptor substituents to the pyridine and piperidine rings has shown notable ligand-receptor interactions and, ultimately, high efficacy in the glucose dependent insulin release.

P22

Photocatalytic Degradation of Simazine using ZnO/GO Composites

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The photocatalytic degradation of simazine by zinc oxide/graphene oxide under visible light irradiation was investigated. Various reaction parameters including initial reaction pH, catalyst loading, and ZnO loading on GO were tested to determine the optimal reaction conditions for maximum simazine degradation. Furthermore, reaction thermodynamics, kinetics, and catalyst cycling were investigated. The photocatalytic efficiency for 30, 20, and 10 mmol ZnO/GO composites and ZnO was tested at a pH range from 2

to 8. All catalysts displayed the highest photocatalytic activity at a pH of 2. In addition, the solubility of simazine decreased significantly with an increase in pH. The effects of catalyst loading were investigated at a loading mass range from 10 to 80 mg of catalyst. Simazine degradation for the 30 and 20 mmol ZnO/GO composites increased from 10 to 40 mg, and exhibited minimal change thereafter from 40 to 80 mg. Simazine degradation for the 10 mmol Zno/GO composite decreased from 10 to 20 mg and increased from 20 to 80 mg. Examination of the reaction kinetics indicated that the degradation process of simazine followed second order kinetics, resulting from a dependence on the concentration of simazine in solution. Thermodynamics studies showed a correlation between the concentrations of ZnO on the GO surface and the activation energies of the degradation process. The photocatalytic activity of all catalysts was tested over three reactions cycles and resulted in constant photocatalytic activity for the 30, 20, and 10 mmol ZnO/GO composites and an increase in photocatalytic activity for ZnO.

P23

Synthesis, characterization, and application of vanadyl tetraphenyl porphyrin catalyst for hydrocarbon chain synthesis

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Porphyrins are commonly found in biological systems molecules like heme and chlorophyll are examples of common porphyrins. In addition, porphyrins are commonly found in crude oils from the decomposition of the parent biological materials. Porphyrins exhibit catalytic properties, which are the motivation for investigating vanadium porphyrin catalytic coupling reactions. Vanadyl tetraphenol porphyrin catalysts were synthesized through a method reflux in vacuo under inert conditions using either nitrogen or argon gas, using vanadium (III) chloride as the vanadium source and standard literature procedures. Characterization of the porphyrin was achieved using Fourier transform infrared spectroscopy and powder x-ray diffraction. Vanadyl tetraphenol porphyrin was then tested as a catalyst for the coupling of tetrahydrofuran. These low temperature catalytic reactions were performed using reflux under inert reaction conditions. Reaction progress was performed by sampling reactions every 3 hours and analyzing them through gas chromatography-mass spectroscopy, which demonstrated the ability of the catalyst to produce long chain hydrocarbons and organic acids.

P24

Structural studies of Clostridium difficile translation initiation factor IF-3

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Clostridium difficile is an anaerobic pathogenic bacterium that causes antibiotic-associated diarrhea and pseudomembranous colitis. *C. difficile* infection (CDI) represents one of the most common healthcare-associated infections, results in significant morbidity and mortality worldwide. The treatment of CDI has become more challenging due to the rapid development of antibiotic resistance of *C. difficile* strains and high recurrence rate of CDI, which has led to the unmet need of discovery of effective narrow-spectrum antibiotics. Bacterial protein synthesis is an essential metabolic process and has been proved as a validated antibiotic target. Translation initiation factor 3 in *C. difficile* (Cd-IF3) is one of three IFs, functions to facilitate the binding of the 30S ribosomal subunit to the mRNA during protein synthesis. This study is to make protein samples and determine three-dimensional structure of Cd-IF3 by solution state NMR techniques. The Cd-IF3 gene was subcloned into pET24b vector to construct a C-terminal His-tagged DNA plasmid. The plasmids were transformed into BL21(DE3) cells for protein expression. The high-quality pure protein samples were obtained using Ni-affinity and gel filtration chromatography, will be further used for NMR structure determination. This structural

study will provide a source for the understanding of IFs initiated protein synthesis machinery in *C. difficile* and structural insight onto structure-guided rational design of small molecular inhibitors.

P25

Identification of zinc as a modulator of postsynaptic protein SAP-102

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The essential trace ion zinc is copious in the brain for enzymatic catalysis, structural stability, regulatory functions. Most importantly, zinc is thought to play a vital role in nerve transmission, specifically act as a neurotransmitter at excitatory synapses. Despite its foremost importance in neurotransmission, the exact function of vesicular zinc at synaptic sites is still unclear. Neuronal synapse-associated protein-102 (SAP-102) is a member of the membrane-associated guanylate kinases (MAGUKs) family, and a scaffolding protein mediating synaptic trafficking of glutamate receptors during synaptogenesis. SAP-102 is a major MAGUK expressed in early brain development, with a correlation of mutations leading to intellectual disabilities. Unlike other MAGUKs (i.e. PSD-95) mainly occurring at postsynaptic sites in hippocampal neurons and undergoing N-terminal palmitoylation, SAP-102 is highly mobile and not palmitoylated at postsynaptic density. Interestingly, SAP-102 N-terminus contains a concentrated cluster of cysteine and histidine residues, suggesting other important functions and a possible role in heavy metal binding. To investigate the underlying molecular mechanism, we conducted structural and biochemical studies on SAP-102 and its interaction with zinc. The gene encoding SAP-102 N-terminus (1-148, SAP-102NT) was inserted into a pET-24b(+) plasmid to make a C-terminal His-tagged construct by molecular sub-cloning technique. The plasmids were transformed into BL21(DE3) competent cells for protein expression. The SAP-102NT protein was over-expressed and purified by affinity chromatography. A florescence titration experiment was performed to measure the zinc binding with SAP-102NT. Our results show that zinc binds tightly to the N-terminus of SAP-102 with a binding affinity (K_d) in the micromolar range, suggesting that zinc is likely to serve a functional modulator of SAP-102 at synaptic sites.

P26

Flexible Carbon Nanotube Micro Yarn-Based Perovskite Solar Cells

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Perovskite solar cells (PSCs) have attracted immense attention in the recent past due to their increasing power conversion efficiency, low-cost and simple device fabrication, and all solid-state structure. A promising feature of PSCs can be incorporating them into fiber format which renders them flexibility. In this work, the fabrication of a three-dimensional (3D) perovskite solar cell has been demonstrated using functionalized carbon nanotube (CNT) yarn as both the working electrode and counter electrode material. TiO2 and OLEDs have been used as the electron transporting and hole transporting material respectively. Deposited highly uniform TiO_2 on carbon nanotube yarn acted as primary materials for electron transport. The active material perovskite layer deposited on top of the TiO_2 oxide layer followed the electron transport layer. An enhanced conductive carbon nanotube yarn was wrapped around the hole transporting layer to act as the counter electrode. The photovoltaic characterization of the prepared cells was carried out at different cell lengths. Under artificial solar illumination, it showed an enhanced power conversion efficiency (PCE) with a high open current voltage (V_{OC}) of 0.825 V. The flexibility and good power conversion efficiency of these type of cell make them very suitable in portable and wearable textile electronics.

P27

Cloning and Characterization of the Tyrosyl-S and Tyrosyl Z-tRNA Synthetases from *Pseudomonas aeruginosa*

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Pseudomonas aeruginosa, a Gram-negative opportunistic pathogen, is a leading cause of nosocomial infections. The ability of this bacteria to form resilient biofilms on implanted medical devices results in high mortality rates. Aminoacyl-tRNA synthetases (aaRSs) catalyze the covalent attachment of amino acids to their cognate tRNAs. These enzymes are essential for protein synthesis in bacteria and serve as validated targets for the development of new anti-infectives. Unlike in other bacteria, the *P. aeruginosa* genome contains two genes (*tyr*S and *tyr*Z) which encode two distinct TyrRS enzymes, which are very different at the amino acid level containing only 41.1/26.8 percent similar/conserved residues. The gene encoding *P. aeruginosa* TyrRS-Z was cloned and overexpressed in *E. coli* cells, and purified to homogeneity. Amplification of *tyr*S by PCR was unsuccessful, therefore the gene sequence was optimized for codon expression and synthetically synthesized. Cloning of the optimized gene resulted in expression of large amounts of TyrRS-S. Both forms of TyrRS were active in aminoacylation. The kinetic parameters for the interaction of these enzymes with their three substrates (tRNA, ATP, tyrosine) were determined using timed aminoacylation and ATP:PPi exchange assays. Both forms of TyrRS were developed into screening platforms using scintillation proximity assay (SPA) technology. Using this assay, a synthetic compound library containing over 2000 distinct compounds was screened to detect compounds with the ability to inhibit the function of TyrRS. A number of inhibitory compounds were confirmed and are currently being characterized for the ability to inhibit both the enzymatic activity (IC50) of both forms of TyrRS and growth (MIC) of a panel of problematic pathogens in culture. They are also being analyzed to determine the potential mechanism of inhibition relative to substrate binding, global mode of action of inhibition of growing cultures of bacteria, as well as toxicity to human cell cultures. TyrRS-S and TyrRS-Z from *P. aeruginosa* were cloned, expressed, characterized and used for development of screening platforms to identify compounds that have the potential for development as antibacterial agents against drug resistant pathogenic organisms.

P28

Removal of As (III) and As (V) from potable water using ZnO nanoparticles

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Heavy metal and toxic element contamination of the environment has been increasing with increasing industrialization. Arsenic has become an element of particular concern as arsenic has a high toxicity, which is oxidation state dependent. As(III) is observed to be much more toxic than As(V), as well the removal of As(III) is more difficult than As(V) in traditional water treatment technology. In the present study, As (III) and As(V) removal was investigated using a synthesized zinc oxide nanomaterial. The zinc oxide was synthesized using a titration/precipitation technique. The synthesized ZnO was characterized using powder x-ray diffraction, to determine the phase, and the average grain sized of the nanomaterial. The optimal conditions for removal of arsenic was determined using a series of batch studies, which included pH, time, isotherms. It was determined that the optimum binding pH was at pH 4.0 All reactions concentrations were determined using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES). In addition, from the batch isotherm studies, performed at three temperatures, the binding capacity of As(III) and As(V) to the ZnO nanoparticles was determined. As well the thermodynamics parameters of the binding were determined. Finally, from

the batch kinetics studies the activation energy of the reaction was determined.

P29

Synthesis, characterization, and application of vanadium phthalocyanine as a mixed heterogeneous catalyst for low temperature coupling reactions

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Inspired by the bio-catalytic ability of porphyrins in nature, the vanadium phthalocyanines were studied as viable catalysts for organic molecule coupling reactions at low temperatures. Vanadium phthalocyanine was synthesized by means of reflux *in vacuo* using phthalonitrile, vanadium (IV) chloride, and 1-chloronaphthalene. An alternative synthesis method by which this compound was synthesized include open air reflux of vanadyl sulfate, ammonium molybdate, ammonium chloride, and urea in nitrobenzene. Both methods yielded mixtures of chloro- and oxo- substituted vanadium phthalocyanines which were characterized using Fourier transform infrared spectroscopy, x-ray diffraction, and x-ray photoelectron spectroscopy. Phthalocyanines were tested for their coupling ability using a modified Suzuki-Miyaura cross coupling reaction. Reactions were performed under an inert atmosphere, sodium carbonate as a base, Millipore water, tetrahydrofuran, and were refluxed at 65°C for 24h with periodic sampling. Analysis using gas chromatography-mass spectroscopy (GC-MS) demonstrated the ability of the catalyst to perform carbon-carbon coupling and oxidative coupling, which was shown by the generation of high molecular weight hydrocarbons.

P30

Conformational Analysis of Cyclopentane carboxylic Acid

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Cyclopentanecarboxylic acid (CPCA) has been found to be the base molecule for a class of zinc-dependent proteolytic enzymes referred to as matrix metalloproteinases (MMPs) involved in the turnover of the extracellular matrix. The upregulation of MMPs has been associated with illnesses such as arthritis and cancer. The downregulation of MMPs can be a potential therapeutic approach. Therefore, understanding CPCA's stability and its potential energy at all possible structures can help to further the research in substituted CPCA. Using the cluster computers from the Texas Advanced Computing Center (TACC), we studied the energy and structure at which this molecule is most stable. By taking into consideration both axial and equatorial positions of the carboxylic acid functional group with respect to the cyclopentane ring we will find the conformational preference of this molecule. We also measured the rotational spectrum of CPCA.

P31

Ultrasound-assisted Green Synthesis of Medicinally Privileged Pyranopyrazoles

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A comparatively recent trend in chemical synthesis is to develop green methodologies to synthesize valuable molecular scaffold and subsequent derivatization of the scaffold targeted to medicinally privileged molecules following the principles of green chemistry. On the other hand, azaheterocycles are prevalent in nature among which pyranopyrazole moiety is an important pharmacophore that is present in several drugs (both synthetic and natural) and in porphyrins, bile pigments, coenzymes, and alkaloids. Pyranopyrazole derivatives have been reported as anti-inflammatory (Celecoxib), herbicidal, and antimicrobial agents. As a part of our ongoing research leading to the development of greener methodologies a new greener procedure has been developed to synthesize diversely substituted pyranopyrazoles via one pot, four component

cascade reaction strategy using N, N-Diisopropylethylamine, (DIPEA) [aka Hünig's base] as green catalyst in ethyl acetate under sonication. A series of six diversely substituted aldehydes are used to standardize this greener route.

P32

Applications of vanadium phthalocyanine in catalytic, acid-based medium to couple saccharide bi-products

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Vanadium phthalocyanine was synthesized using a method from the literature. The vanadium phthalocyanine was characterized using a combination of FITR, XPS, and XRD. Subsequent to synthesis, the compound was studied in the conversion of fructose into different molecules. The ability to convert fructose into other compounds is an important process, for the synthesis of organic compounds such as levulinic acid. Levulinic acid is an important starting material in the synthesis of biofuels, it is a precursor for pharmaceuticals, plasticizers, THF derivatives, valerolactone. The reactions were performed under acidic conditions using strong acids which included nitic acid, sulfuric acid, as well as hydrochloric acid. The products synthesized from the reactions were followed by periodically sampling the reactions and testing the reactions' mixture using GC-MS. The reactions showed a series of compounds that are produced during the reactions; however, the majority of the fructose was converted into levulinic methyl ester and heptadionic acid. These result in a combination of reactions occurring which include chain growth (coupling or the formation of carbon-carbon bonds) and de-cyclization of the sugar. The reactions indicate the metal-porphyrin systems play a catalytic role in the generation of organic molecules from biological materials such as sugars, cellular materials and cell walls.

P33

Removal of As(III) and As(VI) ions from aqueous solution using SnO2 nanoparticles: A thermodynamics study

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Toxic elements and heavy metals observed in the environment have been increasing since industrialization. Elements such as arsenic have been shown to be detrimental to human and environmental health. One of the main routes of exposure to arsenic is through the consumption of contaminated drinking water. In the present study, SnO_2 nanoparticles were synthesized using a sodium hydroxide precipitation method followed by a calcination at 400°C. The nanoparticles were characterized using powder x-ray diffraction and analysis using a Le Bail fitting procedure in the FullProf software. In the present study, batch studies were performed to investigate the ability of SnO_2 nanoparticles to adsorb both As(III) and As(V) from an aqueous solution. The batch studies were designed to investigate the effect of pH, time, and potential interferences on the binding of as(III) and As(VI) to the SnO_2 nanoparticles. Isotherm studies were performed to determine to binding capacity of the SnO_2 nanoparticles for the As(III) or As(V) ions. The SnO_2 particles showed optimal binding of arsenic at a pH of 3. Approximately 85% adsorption of As(III) and 95% for As(V) were observed at pH 3. The interferences showed little to no effects on the binding at low concentrations. However, some of the interferences showed effects at higher concentrations. Furthermore, from the isotherm data the thermodynamics of the binding were determined and will be presented.

P34

Unbinding Pathways of Testosterone from Androgen Receptor in the Presence of Endocrine Disrupting Chemicals

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Exposure to endocrine disrupting chemicals (EDCs) affects the function of the androgen receptor (AR) Causing infertility, reduced bone mass, and other health difficulties in males. Experimental results show that the presence of EDCs such as DDT and its analogues, allosterically cause the release of testosterone (TES) from the AR hormone binding site. It is hypothesized that they mediate this effect via binding to the BF-3 surface binding site. In this project we employ molecular dynamics simulations to study the unbinding pathway of TES from AR and the affect that EDCs may have on this process. To that end, we prepared a control simulation system, AR-TES complex, and started the MD simulations. The control system was prepared by selecting a AR-TES protein-ligand crystal structure, solvating it using TIP3 water Molecules and adding ions to simulate the ionic strength of the cytosol. While we Run MD simulations on the control system, we will prepare the experimental system that includes AR, TES and also DDT bound on the BF-3 site and run MD simulations. Our hypothesis is that the stably bound TES will unbind from AR more easily in the system with DDT than the control system via a pathway that does not involve movement of helix 12. The two simulation systems will be analyzed to determine the possible unbinding pathways of TES from AR and how EDCs allosterically affect AR causing it to release TES. The results obtained from this study will help us better understand how AR functions and potentially formulate compounds that can modulate AR activation.

P35

Identification of Chemical Compounds that Inhibit the Function of Initiation Factors I and III from *Pseudomonas aeruginosa*

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Pseudomonas aeruginosa is a bacterium that is known for its increasing rate of antibiotic resistance. As an essential metabolic process, protein synthesis is a target for the development of new antibiotics. Initiation of protein synthesis is stimulated by three initiation factors (IF), in which two of them (IF1 and IF3) act to facilitate formation of an active 30S initiation complex and are released from the 30S initiation complex as a result of the addition of the 50S ribosomal subunit to form the 70S ribosomal complex. We previously developed a protein synthesis system in the form of the aminoacylation/translation (A/T) assay which was used to screen for inhibitors of protein synthesis. This system allows the polyU mRNA dependent synthesis of poly-Phe peptides and in the presence of low concentrations of IF1 and IF3 the activity is enhanced. Titration of either IF1 or IF3 into the A/T assay results in reduced activity. Treating the IF1 and IF3 as inhibitors of activity of the A/T assay allows the IC_{50} for each to be determined (127 and 10.9 μM, respectively). The effect is additive and addition of both results in increased inhibition of protein synthesis. Holding IF3 at 10 μM, and titrating IF1 into the assay decreases the IC50 of IF1 to 6.6 μM. This assay can be used to detect inhibitory effects of the function of IF1 and IF3. If either IF1 or IF3 is inhibited the activity of the A/T assay is restored. Development of this assay into a screening platform to detect compounds with the ability to inhibit the function of IF1 or IF3 allowed the screening of a synthetic compound library from ChemDiv, Inc. containing over 2000 distinct compounds. A number of inhibitory compounds were confirmed and are currently being characterized for the ability to inhibit both the enzymatic activity (IC50) of the initiation factors and growth

(MIC) of a panel of problematic pathogens in culture. They are also being analyzed to determine the potential toxicity to human cell cultures. IF1 and IF3 at elevated concentrations block the activity of the *P. aeruginosa* protein synthesis assay. In this format they are being screened to identify chemical compounds that inhibit their function to interact with the 30S initiation complex and thus restore the ability of the A/T assay to carry out protein synthesis. This assay allows us to specifically identify inhibitors of the initiation phase of protein synthesis in *P. aeruginosa* and may lead to identification of potential broad spectrum antibacterials.

P36

Removal of Pb(II) ions from aqueous solution using ZnO nanoparticles

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As industrialization has increased the contamination of the environment with heavy metals has been increasing. Lead is a metal that is commonly used in many different industrial applications and manufacturing, such as the manufacturing of the lead acid battery. Lead (II) ions are highly soluble in water and naturally diffuse through cell membranes disrupting proteins, membrane lipids, and DNA. Lead ions are very difficult to remove from an aquatic environment, and have been known to displace calcium in the bone when ingested at high concentrations. In the present study ZnO was investigated for the potential of removing Pb(II) ions from aqueous solution. The ZnO was synthesized using a precipitation method and the particles were characterized using X-ray powder diffraction. Batch studies were performed to investigate the effects of pH, time, and interferences on the binding of the Pb(II) ions to the ZnO nanoparticles. Further isotherm studies were performed to determine the thermodynamics of the binding process, as well as the binding capacity of the ZnO for Pb(II) ions. pH studies showed that binding occurred over the entire studied pH range from 2 to 6 and was observed to be approximately pH independent. The binding was observed to occur within the 5 minutes and remained constant throughout the 2-hour contact time. In addition, the binding was found to follow the Langmuir isotherm model, indicating a monolayer binding process. Results on the thermodynamics, kinetics, and interferences will be presented.

P37

Identification and Characterization Chemical Compounds that Inhibit Lysyl-tRNA Synthetase from *Pseudomonas aeruginosa*

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Pseudomonas aeruginosa is an opportunistic pathogen and a major cause of nosocomial infections. Aminoacyl-tRNA synthetases (aaRSs) are a class of enzymes that catalyze the covalent attachment of amino acids to their cognate tRNAs during protein biosynthesis and are validated targets for development of antibacterial agents. The gene encoding *P. aeruginosa* lysyl-tRNA synthetase (LysRS) was cloned and the resulting overexpressed protein was purified to 98% homogeneity. Aminoacylation assays were used to measure kinetic parameters for interactions of LysRS with tRNA and ATP:PPi assays were used to determine the kinetic parameters for interactions with lysine and ATP. *P. aeruginosa* LysRS was developed into a screening platform using scintillation proximity assay (SPA) technology and used to screen natural product (800) and synthetic (890) compound libraries to identify compounds with the ability to inhibit the function of the enzyme. Three compounds (BM01D09, BT06F11, and BT08F04) were identified and inhibitory activity was confirmed. The IC50 values and minimum inhibitory concentration (MIC) was determined for each compound. Each compound exhibited broad spectrum activity. Time-kill studies indicated a bacteriostatic mode of inhibition

for each compound against cultures of *S. aureus*, however in cultures of *M. catarrhalis*, BT06F11 and BT08F04 was observed to be bactericidal. When tested in cultures of human embryonic kidney 293 (HEK-293) cell lines using MTT cell proliferation assays, BT06F11 was not toxic at any concentration tested. BM01D09 was observed to only inhibit human cell growth at high concentrations. However, BT08F04 was toxic at much lower concentrations. LysRS from *P. aeruginosa* was characterized and developed into a screening platform to identify potential anti-bacterial compounds. Three compounds were identified as having inhibitory activity against the aminoacylation of LysRS. The compounds were then characterized for inhibition of enzymatic activity, bacterial growth and toxic effects in human cell cultures.

P38

Synthesis of Niclosamide derivatives to study Protein Ubiquitintion and Pro-Survival Signaling Pathways in the Human Glioblastoma Cells

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Niclosamide has traditionally been used as an anti-helminthic drug but in recent years it has become a prospect for cancer treatment. Its potential for cancer treatment was found because it affects various signaling pathways in the human glioblastoma U87-MG cell line which lead to tumor suppression. The tumor suppression of the glioblastoma is a result of decreased cell viability which is significant because this type of cancer is aggressive with high fatality and it does not respond well to conventional treatments. The mechanism(s) of action by which the drug illicits these anticancer effects has not been deciphered but the synthesis of niclosamide derivatives make it possible to study the mechanism(s) to develop viable options for treatment of gliobastoma. In our preliminary study substituent modification of niclosamide affected drug activity and inferred that the hydroxyl group is in the pharmacophore therefore important to the mechanism(s) of action. This study built upon our preliminary study by continuing the investigation of the structure-activity relationship (SAR) with further modification of the niclosamide substituents. The designs of the niclosamide derivatives structures were based upon drug activity from our preliminary study that indicate the importance of the hydroxyl so the structures were manipulated to test its significance. The niclosamide derivatives were formed through various processes such as amide formation, hydrogenation, and acetylation. The niclosamide derivatives synthesized examine the role of the hydroxyl group in the mechanism(s) of action and to see whether it is essential to the pharmacophore.

P39

Identification of Inhibitors of Glutaminyl-tRNA synthetase from *Pseudomonas aeruginosa*

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Bacterial infections caused by antibiotic resistant bacteria have become increasingly difficult to treat with most current antibiotics. *Pseudomonas aeruginosa* is a Gram-negative opportunistic pathogen and a leading cause of nosocomial infections. Aminoacyl-tRNA synthetases (aaRSs) catalyze the covalent attachment of amino acids to their cognate tRNAs. The glutaminyl-tRNA synthetase (GlnRS) from *P. aeruginosa* was over-expressed, enzymatically characterized and developed into a screening platform for the discovery of chemical compounds that inhibit protein synthesis. The *P. aeruginosa* GlnRS was developed as a platform to screen chemical compounds for detection of compounds that inhibited function using scintillation proximity assay (SPA) technology. Using this assay, natural product (800 compounds) and synthetic compound (890 compounds) libraries were screened to detect compounds with inhibitory activity.

Results: From this screening campaign three compounds (BM02E04, BM04B05, and

BM04H03) were identified and confirmed as inhibitors of the activity of P. aeruginosa GlnRS, with IC50 values of 1.7, 2.5, and 39.3 μM, respectively. The minimum inhibitory concentration (MICs) was determined against a panel of bacteria. Time-kill studies indicated a bacteriostatic and a bactericidal mode of inhibition for compound against cultures of S. aureus and M. catarrhalis. When tested in cultures of human embryonic kidney 293 (HEK-293) cell lines, there was no toxicity observed by either BM02E04 or BM04B05 at any concentration. P. aeruginosa GlnRS was cloned, expressed characterized and developed into a screening platform to identify compounds that have the potential for development as an antibacterial agent. Three compounds were identified as having inhibitory activity against the aminoacylation activity of GlnRS. Two of the compounds were further characterized for inhibition of enzymatic activity, bacterial growth and toxic effects in human cell cultures.

P40

Polydiacetylene Nanofibers as Fluorescence Sensor for Food Spoilage Detection

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Increasing attention has been attracted to the safety and quality control of food, particularly meat and seafood, due to health and economic concerns. Ammonia and biogenic amines (BAs), such as trimethylamine, putrescine, and cadaverine, are released during the decomposition of meat protein. Therefore, sensitive detection of released BAs is crucial to assess the safety and quality of meat products during their storage, transportation and consumption. Polydiacetylene (PDA) nanofibers are promising candidate due to their excellent properties with high surface area, simple construction, and the versatile colorimetric signaling. In this study, silica-embedded PDA nanofiber mats were developed by a Forcespinning technique. The nanofibers are characterized with SEM, FTIR and photoluminescence spectroscopy (PLS). We have demonstrated their optical sensing of amine using propylamine as an example. Due to the electrostatic interaction between the PDA nanofibers and BAs, a color transition from blue to red and an enhancement of fluorescence are observed. For the nanofibers made from ECDA and PCDA monomers, the ECDA-PDA nanofibers have better performance to determine amine vapor in a few minutes with a detection limit of 6.95 ppm. Furthermore, the ECDA-PDA nanofibers are explored for sensing BAs from spoiled meat, including chicken, beef, fish and pork and their colorimetric response are examined. In summary, we have developed PDA nanofibers and test their performance for detecting food spoilage. We have demonstrated that they are suitable for real-time and in situ monitoring of the deterioration of meat freshness.

P41

Thermally Induced Disorder–Order Phase Transition of $Gd_2Hf_2O_7:Eu^{3+}$ Nanoparticles and Its Implication on Photo- and Radioluminescence

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The luminescence properties of Ln^{3+}-doped phosphors are highly affected by the crys-

tal structure. In this work, we have investigated the effect of thermally induced phase transition of $Gd_2Hf_2O_7$ nanoparticles (NPs) on photo- and radioluminescence properties using Eu^{3+} as a spectroscopic probe. Undoped and Eu^{3+} doped $Gd_2Hf_2O_7$ NPs were synthesized via a combined coprecipitation molten salt synthesis (MSS) route. Samples were originally prepared at 650°C (GHO-650 and GHOE-650) and then two derivatives of the GHOE-650 NPs were further annealed at 1100°C (GHOE-1100) and 1300°C (GHOE-1300). XRD patterns confirmed the purity of the prepared NPs, while Raman spectra showed that the GHOE-650 and GHOE-1100 NPs exist in disordered fluorite phase and the GHOE-1300 NPs exist in ordered pyrochlore phase. The size and morphology of the samples were investigated using scanning electron microscopy (SEM) which showed spherical particles with a progressing increase of the average particle as a function of annealing temperature. The particle sizes as found from SEM were 14 nm for the GHOE-650 NPs, 48 nm for the GHOE-1100 NPs, and 57 nm for the GHOE-1300 NPs. Photoluminescence results showed a red emission for all the samples with GHO-1300 having the highest quantum yield, luminescence intensity and lifetime values, while the asymmetry ratio of the GHOE-650 was the highest. As the structure changes from fluorite to pyrochlore phase, radioluminescence emission spectra showed tunable color from red to orange. Hence, our work provides a fundamental understanding of the relationship between crystal structure and photophysical properties of lanthanide-doped nanomaterials, and a strategy based on the MSS method for making tunable nanoparticles for advanced optoelectronics.

P42

Asymmetric AC Signal Ion Trap Channels for Concentration Bias

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We have created a channel-reservoir system with smart channels for one-way ion flow. The channel walls have a set of multiple parallel electrodes which are used to trap the negative and positive ions from a salt solution alternatively using a specific square asymmetric signal. The process begins with high voltage signal trapping a type of salt ions (positive/negative) in bulk from one chamber and carry the trap to the other chamber. This happens alternatively for both positive and negative ions which eventually results into a concentration bias between two chambers. Due to low diffusion rate of the ions in the water, the signal used is of low frequency >10 Hz. Our unique system aims to address the problem of small-scale desalination systems which are inefficient due to use of a membrane.

P43

Improvement of Methanol Oxidation Kinetics by Enhancing the Water Dissociation Rate

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Direct methanol fuel cells (DMFCs) are very promising as the future portable energy sources. The DMFC s are still under developed. High production cost and longevity are two main factors behind the commercial non-success of DMFCs. These factors depend on the quick dissociation of water which is produced as a result of redox reaction at platinum (Pt) site. If Pt absorbs the water, it loses electro-catalytic activity. Usually, the Pt/Ru alloy is used to dissociate water. The limitations are the durability and cost of the Pt/Ru electrode. In this work, $Ni(OH)_2$ grown on graphene oxide (GO) nanosheets was used to perform the function of Pt/Ru electrode. The $Ni(OH)_2$ was grown on the GO nanosheets using the solution of GO, anhydrous dimethylformamide (DMF) and nickel

acetate [Ni(Ac)] with controlled hydrothermal reaction at 180°C for 10 hours. It was observed that the water dissociation rate changes with the variation of concentration of $Ni(Ac)_2$. The optimal concentration of $Ni(AC)_2$ was found for better methanol oxidation kinetics. It is more durable and cost-effective. This presents a cheaper and more durable alternate to current elect.

School of Mathematical and Statistical Sciences (SMSS)

P44

The Sato Theory for The KP Hierarchy

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By using pseudo-differential operators, we formulate the KP theory discovered by Sato. Then, we will present Lax and Sato's equations along with the general solution to the KP hierarchy.

P45

Using Markov Chains to Model Progression of Diseases

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Researchers use stochastic models like the Discrete-Time Markov Chains (DTMC) to model progression of morbidities with public health impact, like HIV and Hepatitis C. In our research, we use single and double-DTMC to model progression of co-morbidity, such as the Non-Alcoholic Fatty Liver Disease (NAFLD), as well as diabetes and obesity. Nonalcoholic fatty liver (NAFL) is a condition that can progress to nonalcoholic steatohepatitis (NASH) as consequence of obesity, interaction of genes with microbiota and perhaps excessive fructose intake. Some factors, like carotenoids (vegetable consumption), weight loss, exercise or some medications can have beneficial effects on reduction of the risk of the disease progression. The disease progression model will take into account the possible dependence between subjects with genetic biomarkers in addition to other variables like BMI, life-style, gender, etc. Dependence between the subjects due to familiality will be one addition also to the research of diease progression using stochastic models. Clinical data from Mexican and Mexican-American cohors will be used to estimate the intensity matrices that involve the rates of transition between the different stages of the diseases. We will test the robustness of the models using cross-validation with the same data. The model will be useful for making stratified predictions regarding patient's gender, presence of diabetes or treatment modalities.

P46

Dynamics of Glucose on the Regulatory System

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We are developing a mathematical model that shows that interaction of glucose and insulin in the Regulatory System. We are currently analyzing the interaction between glucose and insulin for a normal patient with food intake while considering linear and nonlinear cases. We have also developed some graphs which clearly show this interaction. On the future, the plan is to extend this study on analyzing different types of diabetic patients.

P47

Optimal quantization for probability distributions

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Quantization for probability distributions refers to the idea of estimating a given probability by a discrete probability supported by a set with no more than n points. It has many applications in our daily life. While driving it is important that the cell phone is working, i.e., the cell phone always gets signal so that for any emergency we can quickly communicate and get help. The signal of the cell phone depends on how far we are from the tower. In optimal quantization our goal is to find the exact locations of the towers so that while driving we can get the best signal as much as possible. Nobody still knows how to find the exact locations of the towers unless the road has a nice geometrical shape such as exactly a straight line, a circle, a triangle, or a square, etc.

P48

Division Algebras and Minkowski Space-time

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A normed division algebra K is a module over a field endowed with a bilinear map, a neutral element and a norm. By Hurwitz' theorem there are precisely four normed division algebras up to isomorphism: the real numbers R, complex numbers C, quaternions H, and octonions O. Division algebras are widely used in mathematical physics; for example the space of 2x2 hermitian matrices with entries in K is isomorphic to the Minkowski space-time of dimension n+ 2 (where n is the dimension on K). Hence the purpose of my presentation is to convey the seemingly convoluted definitions and propositions mentioned above into a more intuitive and accessible manner. Moreover I will discuss future research regarding super-symmetric Yang-Mills theories and division algebras. Hereby the goal of the presentation is to spark student interest in advanced mathematics by elucidating and disseminating elegantly derived mathematical formalism whilst gaining more experience as a STEM communicator.

P49

On the Dirac System in Curved Space-time

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We endeavor upon determining the idiosyncrasies displayed by the electron when in compliance with its relativistic theory, formally known as the Dirac Equation. We commence with a brief explanation of the equation of motion of the quantum realm, the Schrödinger Equation, and briefly convey the deficiencies of such an illustration. Thenceforth, we derive the Klein-Gordon Equation from the classical energy expression, explicitly the Energy-momentum relation, as well as the Correspondence Principle. Nonetheless, akin to the Schrödinger Equation we discuss the fraility of this equation when attempting to rigorously determine a relativistic equation of motion for the electron, i.e. it fails in naturally producing spin within its framework and must be included *a posteriori*. Consequently, in lieu of the previous shortcomings we discuss the Dirac Equation, the true relativistic equation of motion for the electron, and deliberate upon its relation to the Klein-Gordon Equation, as well as its intrinsic properties and fullfillment of the conditions that the Klein-Gordon and Schrödinger lacked. Finally, we attempt to deduce pecularities displayed by the electron when under the influence of curved

space-time.

Physics & Astronomy

P50

Formation of TiC/Ti composites by highly exothermic process

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Titanium alloys as well as titanium carbide (TiC) have attracted a good attention for many high temperature structural applications due to extremely high melting temperature, excellent hardness, high thermal conductivity, exceptional mechanical strength, and great chemical resistance. The titanium carbides (TiC/Ti) alloys were produced by combustion synthesis technique by using titanium and graphene at (80:20) wt. % as an initial source, respectively. Titanium (149 μm) and Graphene (12 nm) particles were ball-milled by using MSK-SFM-3 high speed vibrating ball miller to prepare homogeneous mixture powder. After ball milling, the mixture was heated up to 900 0C in DSC to initiate the reaction between titanium and graphene and an exothermic reaction has been observed at 642°C. The formation mechanism of TiC/Ti particles in a Ti-C system were studied by using differential scanning calorimetry (DSC), XRD, and SEM to identify the reaction products in different temperature ranges. The TiC characteristics X-ray peaks were well observed on 2θ =34, 36, 41. The TiC reaction is used to reinforce MWCNT laminar composites.

P51

Analysis of Test-Mass Suspension Subsystems of Gravitational-Wave Detectors for Future Optimization

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The Laser Interferometer Gravitational-Wave Observatory (LIGO) detectors in Livingston, Louisiana and Hanford, Washington made the world's first direct observation of gravitational waves on September 14, 2015. LIGO is a very complicated instrument and consist of various subsystems such as: Optics, Suspensions, Data acquisition and Storage. To detect small perturbations in space which are gravitational waves, LIGO uses laser light and optical interferometer. With this LIGO is capable of measuring a change in distance on the order of 10^{-19} meters, so it is extremely sensitive to all vibrations, forces and some physical properties of nature such as vehicles on nearby roads, seismic waves from earthquakes, slight temperature differences between the detector arms and even the tidal tugging of the Sun and the Moon. Main goal of suspension system is to isolate these vibrations, so that interferometer can detect Gravitational waves. Few designs of suspension are very effective to suppress vibration effect, such as double pendulum, inverted pendulum and so on. We analyzed and built realistic model of suspension system with active mirror position stabilization control in our lab. Using this model, we are analyzing suspension system under different conditions and optimizing it to reduce vibration noise for certain frequencies.

P52

Search Methods for Optical Transients in Galaxies

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A Kilonova is an astronomical event which occurs when two neutron stars or a neutron star and a black hole merge (Metzger 2017). They are the optical counterpart of a gravitational wave (GW), just recently observed for the first time. By following up GW events,

we have the possibility of observing an electromagnetic counterpart associated with the GW signal. However, these events are very short-lived, being transient on the order of about a week in the visible spectrum. Also, the probable region on the sky from which the GW source is expected to have propagated is too large to be thoroughly searched By telescope imaging with small fields-of-View. Observing galaxies is the best way of improving the chances of finding such events. The first step of the project would be to decide what kind of galaxies we are going to observe from our region of the sky with the equipment that we have. In this project, we will show how we choose our galactic targets, how we conduct image subtraction, and how we apply photometric measurement

P53

Realizing Narrow Band Thermal Emitters in the Mid-Infrared by Utilizing Polaritonic Metasurfaces

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The purpose of this study is to show evidence that surface phonon polaritonic(SPhP) Metasurfaces can produce a well-defined thermal emission signal in the optical phonon band of Silicon Carbide to realize narrow band emitters in the mid-IR wavelengths. Preliminary data and results have demonstrated strong localized SPhP resonances of these devices, so there is a high possibility that a well-defined emission signal will be obtained if we apply Kirchhoff's Law of Heat Radiation. To observe the thermal radiation from the polaritonic metasurface patterns, an optical setup was built in which the beam path of the visible light and thermal radiation would be equivalent. This was done primarily for the precise alignment of the metasurface and to maximize the collection of thermal radiation. The device was heated conventionally and data analysis was attained using a FTIR Spectrometer. Initial results showed an emission spectrum with broad resonances from 820 cm^{-1} to 960 cm^{-1}, it was then determined the resonances were from multiple patterns on the metasurface. Currently, we have improved the setup to collect emissions from single patterns

P54

Low-cost Quantum Population Transfer in no-Time Using Gain and Loss

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We introduce a class of non - Hermitian Hamiltonians that offers a dynamical approach to a shortcut to adiabaticity (DASA). In particular, in our proposed 2×2 Hamiltonians, one eigenvalue is absolutely real and the other one is complex. This specific form of eigenvalues helps us to exponentially decay the population in an undesired eigenfunction or amplify the population in the desired state while keeping the probability amplitude in the other eigenfunction conserved. This provides us with a powerful method to have a diabatic process with the same outcome as its corresponding adiabatic process. In contrast to standard shortcuts to adiabaticity, our Hamiltonians have a much simpler form with a lower thermodynamic cost. Furthermore, we show that DASA can be extended to higher dimensions using the parameters associated with our 2×2 Hamiltonians. Our proposed Hamiltonians not only have application in DASA but also can be used for tunable mode selection and filtering in acoustics, electronics, and optics.

P55

Raman Spectroscopy of Polymer-Based Nanocomposites

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Raman spectroscopy is a powerful tool in the investigations of atomic and molecular motions with applications that includes (remote) thermal and stress sensors, capable to generate thermal and stress maps at micron scale. The driving force for these future applications is the temperature dependence of Raman line position, typically governed by the thermal expansion and frequently characterized by a linear dependence of the displacement of the Raman line with the temperature. The linear shift of the Raman lines as a function of applied stress, in the elastic regime (describes by Hooke's law) makes possible the other application. Polymer-based nanocomposites consist of a polymeric matrix that embedded some amount of filler, confined at nanometer scale at least along one direction. As the volume of the nanocomposite is smaller than the sum of the polymer and nanofiller volumes, it is concluded that the filler exploits the elastic features of the polymer stretching the polymeric matrix. Hence the polymeric matrix is subjected to a mechanical stretching; this stress is further transfer back to the filler. The very first consequence of this is that the Raman lines of both polymeric matrix and the filler will be displaced compared to their initial positions. These small displacements allow the estimation of the elastic state of the nanocomposite and if the composite is in the elastic state, the stress/strain and even the associated maps at micron scale may be obtained remotely. Typically, the Raman spectrum of polymer-based nanocomposite is expected to be differential, as different atomic and molecular groups are affected differently by the inner stress of the nanocomposite. The first Raman investigations of polymer-based nanocomposites that proves the feasibility of this approach and opens the door to applications such as remote stress strain (and eventually thermal) mapping of electronic components and sensitive materials at micron scale.

P56

Analysis of Optical Configurations of Gravitational Waves Detectors for Future Optimization

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Gravitational waves are ripples in space-time caused by massive stellar objects in space, such as, binary stars and black holes. In 2015, the new chapter in the development of physics begun. Laser Interferometer Gravitational-Wave Observatory (LIGO) was able to detect gravitational waves, which will let us to observe the universe in a different way. In an effort of hundreds of people, it took 20 years to discover it. As gravitational waves originate from the objects that are billions of light years away, the scales of the gravitational waves are extremely low. In order to be able to study small displacement generated by gravitational waves, Caltech and MIT had to build laser interferometers, which are able to detect displacements as low as 10^{-19} m. To reach this kind of sensitivity, optical configuration of the interferometers undergoes multiple changes. In this project, we will give an overview of an existing optical configurations of LIGO, starting from Michelson with Fabry-Perot arms optical configuration, which was improved with power recycling and signal recycling to the resonant sideband extraction - the current optical configuration LIGO is using. Additionally, we will include future optical configurations, such as configurations based on Sagnac interferometer. Moreover, we are going to describe the ongoing work in the optical laboratory at the UTRGV.

P57

A Search for a High-Order Excitation of Surface Phonon Polaritons on Silicon Carbide Metasurfaces

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Metasurfaces have been promising a control of light in free space and integrated

photonic circuits using subwavelength-scale nanostructures. For surface localized or propagating light, a control of the light waves has been challenged due to a lack of highly efficient nanostructures. Conventional metallic nanostructures are widely used in visible and near infrared and show a high coupling efficiency to the light assisted by free charge carriers. However, the free charges cause a significant optical power loss. Alternative choice of a nanostructure material is dielectrics. Polar dielectrics has been a good candidate for satisfying both a high coupling efficiency and low optical power loss because of their metallic character originated from a strong optical phonon resonances. We recently designed and fabricated a new metasurfaces platform which is metal-dielectric multilayer aperture on ionic crystal showing a strong resonance tuning at infrared spectrum region. The device consists of thin gold-silicon multiplayer gratings on silicon carbide. The strong resonance results from static charge dipolar resonance of the localized surface phonon polaritons, which is a collective oscillation of electromagnetic waves and surface charges. In this work, using angle illumination and angle detection of light we searched for the higher order surface phonon polariton modes beyond the dipole modes. We used full-wave simulation with the finite-difference time-domain method to understand the behavior of higher order resonance in our device. The device was fabricated by using electron beam lithography system, reactive ion etching system, and metal and dielectric deposition system. We designed a special setup for angle illumination and angle detection measurement integrated with Fourier transform infrared spectrometer. We measured infrared spectrum of the device to investigate higher order localized surface phonon polariton modes. This work will benefit to infrared sensing and modulations, scattering enhanced spectroscopy for chemicals and biological samples.

P58

Synthesis of Chitosan Nanoshells for Drug Delivery

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Drug delivery is the process of carrying therapeutic agents to a specific location in the human body. This has become widely used for the treatment of different illnesses, for example cancer therapy. Moreover, the use of hollow nanoparticles for drug delivery systems has become one of the best-known methods to deliver drugs to a desired area of the human body. Chitosan is a biopolymer that is biodegradable and biocompatible, which makes it a good candidate for the creation of hollow nanoparticles for the use in drug delivery systems. In this study, we use a simple method to prepare chitosan nanoshells. Chitosan with three different molecular weights (low, medium, and high), are used to synthetize nanoshells with various sizes and properties. Scanning electron microscopy, atomic force microscopy, and FTIR techniques are used to characterize the morphology and physical properties of the nanoshells and the nanoscale. Our preliminary data show that the chitosan nanoshells may have great potential for application as a nanocarrier in drug delivery system.

P59

Synthesis and Characterization for Chitosan Magnetic Nanoparticles for Medical Uses

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Chitosan coated iron oxide nanoparticles were synthesized using ex-situ or in-situ methods. The in-situ method results in the production of chitosan-coated MNPs in one step with the presence of chitosan. In the ex-situ synthesis method, MNP were first synthetized then coated and stabilized with the derivatives of chitosan polymer. The later synthetizing method consists in controlling the co-precipitation process. The char-

acterization of the synthetized MNPs and the modified MNPs was done using FTIR, AFM, SEM, and PPMS techniques in order to determine, respectively, the composition, particle sizes, the degree of coating and the magnetization properties. These nanoparticles have almost spherical shape and their diameter varies from 6 nm to 20 nm. For the purpose of comparison, purchased iron oxide MNPs (50-100 nm) were also coated with chitosan and characterized following the same methods and techniques. Our preliminary data, indicate that our synthesizing methods are simple, consistent, and provide a wide range of biomedical applications.

P60

Effects of Nanosized Glass Beads on the Formation of Amyloid Fibers

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Recent studies have shown that several neurodegenerative disorders such as Alzheimer's, type II diabetes and encephalopathies can be caused by the accumulation of protein fibril aggregates. The objective of this study is to investigate if nanosized glass particles can be used to inhibit the amyloid fibrils formation. First, we determined the optimal conditions for the fibrilization and the temporal effect on the morphology and physical properties of the fibers. β-lactoglobulin which is typically found in Bovine milk is used as model protein in this study. β-lactoglobulin requires 20 hours of heating at 80°C and pH of 2 to form fibers. Atomic force microscopy (AFM) in both high-resolution imaging and force spectroscopy modes is used to investigate the structural and physics properties of the fibers at the nanoscale. Our data show that β-lactoglobulin fibril formation obeys the nucleation dependent polymerization model in which small nuclei are slowly formed and fast fibril formation proceeds subsequently. Our preliminary data also indicate that glass beads in size 10-50 nm can bind the protein at very fast rate. This study also establishes conditions for high-throughput amyloid assays that enable the control over fibril morphologies and physical properties. d from locally-sourced biomass materials that are otherwise considered to be wastes.

P61

Evanescent coupling of whispering gallery modes in photonic micro ring and disk resonators

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Optical structures in the integrated photonic circuits are an emerging field that allows for faster data transmission than their electrical counterparts. Research is still being conducted on the development of optical circuits that can reliably replace electric circuits. The difficulty of implementing micro optical designs is the inability to analytically calculate their properties. Even the main building blocks of nanophotonics such as silicon integrated micro-ring resonators do not have complete analytical description. Therefore, numerical computations are widely used to study such optical structures. The solutions to the propagation of light are done by numerical simulations based on the Finite Difference Time Domain (FDTD) model. We present analysis on the evanescent coupling of light to the micro ring and disk resonators. The curved structure of the ring and disk allows for whispering gallery modes (WGM) that are exited through the tunneling effect. Understanding the limits on the parameters of the evanescent coupling and the allowed modes propagating in the ring and disk resonators plays a crucial role. The findings of modeling of light propagation in the photonic structures are outlined and presented through the examination of the reflection and transmission coefficients. The results of this work will be useful for the parameter estimation and the efficiency of the micro optical structures.

P62

Quantifying intra- and inter- species bacterial cell interactions to understand the mechanisms of biofilms formation using atomic force microscopy

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A biofilm is a community of sessile microbes that produce an extra cellular matrix of polymeric substances after attaching to a surface. Only recently, it has been found that bacterial biofilms can cause chronic infections which are different from the acute infections caused by planktonic bacteria. Biofilms can be very difficult to eradicate as the extracellular matrix provides them mechanical, and chemical endurance while the sharing of genes among the microbes enhances their chances of developing antibiotic resistance. Understanding the mechanism of biofilms formation is an important step towards developing effective treatment against them. Although there have been some studies investigating single species biofilm formation, the empirical data for multi species biofilms is insufficient. In this study three common pathogenic bacteria that have been found to coexist in the same biofilm were chosen (*Pseudomonas aeruginosa, Escherichia coli, and Staphylococcus aureus*). At first a mid-exponential phase liquid bacteria sample was obtained. Afterwards a single cell of the freshly prepared bacteria was attached to the tip of the AFM cantilever using 0.1% Poly-l- lysine solution. The electrostatic attraction between Poly-l-lysine and the bacteria ensures its adherence to the tip. At the same time another liquid bacteria sample was centrifuged and washed in appropriate buffer three times. Subsequently, bacteria were immobilized either on a polymeric filter of appropriate size (*S. aureus*) or on a freshly cleaved mica surface treated with 0.1 % Poly-l-lysine solution (*P. aeruginosa, E. coli*). AFM-force spectroscopy was used to quantify the inter- and intra- species interactions (*maximum adhesion force, work of adhesion, and rupture length*) between two single cells under physiological conditions. The empirical data obtained in this research will be helpful for understanding the process of bacterial biofilm formation.

P63

Machine Learning Applications on Galaxy Selection

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The recent detection of gravitational waves by the Laser Interferometer Gravitational-Wave Observatory (LIGO) revolutionized the field of astrophysics, showing that much of the research in the field was heading in the right direction. However, it became evident that the localization of source galaxies varied for different members of the LIGO Scientific Collaboration, including our very own Center for Gravitational Wave Astronomy (CGWA). Comparing the results of different galaxy selection algorithms to the known localizations of gravitational wave sources may help identify potential enhancements to CGWA's current localization pipelines. If such changes were made and verified as improvements on the current algorithm using known localization data, the CGWA pipelines could be adjusted to more accurately locate the source of gravitational waves on a three-dimensional sky map. The hope is that CGWA will eventually be on the frontlines during future detections of gravitational waves, ready to respond in real time to event alerts from LIGO, but also be in possession of pipelines that could analyze large quantities of archived sky map data, such as the data from the Sloan Digital Sky Survey archives.

P64

MgB_2 embedded multi-walled carbon nanotube wires

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We examined the critical current density (Jc) of multi-walled carbon nanotubes (MWCNT) wires embedded with superconducting powders of magnesium diboride (MgB_2). Higher critical current density in a superconducting material is an essential aspect of transmitting energy, improving it is vital for saving energy and future application. The homogenous mixture of magnesium (Mg) and boron (B) powder, mixed with rotatory ball milling, were integrated with a MWCNT about 30 sheets extracted from a carbon nanotube forest. The twisted yarns were produced by twisting MWCNT sheets with deposited Mg-B layer. The twisted yarn sample was heated up to 900°C to initiate reaction within the carbon nanotube matrix. For the comparison, the Jc values were measured for the pure yarns and yarns with MgB_2 produced by both in-situ and ex-situ processes. Differential scanning calorimetry, scanning electron microscopy and X-ray diffraction measurement were performed to characterize the samples. Superconductive critical temperature 39K was determined by measuring temperature dependent magnetization curves by using a Multi-functional instrument Cryocooler-based Physical Property Measurement System EverCool

P65

A Resonance Tuning of Localized Surface Phonon Polaritons on Hexagonal Boron Nitride

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Metasurfaces are sub-wavelength patterned layers which interact with light and alter optical responses including phase, amplitude, polarization, and impedance. In particular, gradient optical metasurfaces have been used to control a wavefront of light in free space and in optical waveguides by imposing spatially varying optical responses to the light. However, control of light localized and propagating on a two-dimensional surface has been challenging so far because of the high optical power loss from metallic nanostructures. In recent years, we have chosen polar dielectrics as an emerging metasurfaces platform because the polar dielectrics have a low optical power loss and a high coupling efficiency of the light originated from the optical phonon resonances of ionic crystals. We classified polar dielectrics into two groups depending on the evanescent field characters of surface waves of the light on polar dielectrics. Type-I, mostly bulk material, has one visible evanescent wing and type-II, two-dimensional polar dielectrics, has two evanescent wings. First, we studied type-I polar dielectrics such as silicon carbide. We designed and fabricated metal/dielectric multilayer aperture on silicon carbide which displays a strong resonance of localized surface phonon polaritons and we are able to tune the resonance in their optical phonon band. In this work, we propose another new metasurfaces platform made of type-II polar dielectrics such as two-dimensional hexagonal boron nitride. We have searched for a localized surface phonon resonances by designing the device using full wave simulation with the fintie-difference time-domain method. We studied two different geometries; metal/dielectric multilayer boundary (1) underneath the polar dielectrics and (2) on the polar dielectrics. Both structures are easily realized by current nanofabrication technology. We present surface phonon polariton resonance tunings from an atomically thin polar dielectric in mid-infrared spectral range. This work will benefit to chemical fingerprint sensing and scattering enhanced spectroscopy for biological samples.

P66

Design of Microfluidic Injection System using Bernoulli's Principle

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Bernoulli's principle states that an increase in the speed of a fluid occurs simultaneously

with a decrease in its pressure or decrease in the fluid's potential energy. In this study, this principle was used to create a microfluidic injection system. Microfluidic injectors are used to generate flow in parallel microchannels without the help of external pumps. The physical understanding of microfluidic injection systems can provide creative solutions for complex injection problems in microfluidic chips. A microfluidic channel with a converging-diverging section was created using PDMS. An injection hole was made at the middle of the converging-diverging section. A low Reynolds number flow was created at the inlet using a syringe pump and the pressure drop was observed at the middle of the converging-diverging section. This pressure drops sucked the fluid from the injection section. The injection efficiency was observed at a range of Reynolds numbers. The flow field was also observed at varying converging-diverging lengths. It was found that such injection system could be used as a microfluidic pump. The fluid with a distinct concentration was injected into the channel to test the mixing capability of the system. It was observed that it worked as an efficient micromixer. The experimental results can help in the rational design of complex microfluidic systems.

P67

VLITE-Fast

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The VLA Low Band Ionosphere and Transient Experiment (VLITE: http://vlite.nrao.edu) project commensally collects data at 320-384 MHz on 16 antennas during all Very Large Array (VLA) observations, VLITE-Fast is a GPU-based backend, operating alongside the CPU-based correlator, capable of detecting short (<1s) transients in real time and triggering recording of baseband voltage for offline imaging. In the A and B configurations of the VLA, the 1 to 10 arcsecond resolution is sufficient to uniquely identify FRB (Fast Radio Bursts) host galaxies. Recent results from the bright ASKAP sample suggest VLITE-Fast should detect at least 1 FRB every 3 weeks. In addition to the heimdall-based candidate detector, we are developing a software suite, dubbed Asgard, for real-time analysis, visualization, and assessment of FRB candidates. We anticipate further extension to machine learning-based candidate classification. Here we present the development status of VLITE-Fast and results from our initial FRB searches.

P68

iband Observations of Exoplanets: The Beginning of Spectroscopy

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As the field of exoplanet astronomy advances, there is an increasing need for small observatories to have the ability to observe exoplanets multiple optical passbands. With the detection of thousands of new worlds, we understand that most exoplanets are typically terrestrial worlds with low periods orbiting close to their host star. Many of these detections are made using time series photometry of the host star, the result of which produces a light curve of star flux over time. If a light curve can be made of a transiting exoplanet in multiple wavelengths, this could reveal information regarding the structure and formation of the orbiting planet. The Cristina Torres Memorial Observatory (CTMO) is a small observatory capable of conducting time series photometry of many star systems, which places it in the unique position to follow up known transiting exoplanets. This project aims to produce light curves of known transiting systems in multiple wavelengths in order to make deductions about the structure and composition of exoplanets. The overall goal of this project is to understand multiband observations of transiting exoplanets in order to gain a better understanding of their respective physical properties which would otherwise be difficult to deduce with other observational techniques. The

multiband observation is a first step into spectroscopy, which is a much more powerful observational tool used for observing various celestial bodies. Spectroscopy allows for more accurate and precise deductions to be made about their physical properties, including atmospheric and planetary chemical composition.

P69

Thermal Consolidation of Dredge Sand for Artificial Reef Formations

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Coral Reef ecosystems have degraded over years due to a variety of environmental issues such as ocean acidification. The continuous stress has detrimental effects on coral reef ecosystems that can possibly lead to the loss of the ecosystem. Our research aims to construct a prototype of an artificial reef by consolidating dredge sand from the ship channels of South Texas. Consolidation is achieved through an aluminum polytetrafluoroethylene self-propagating high temperature process that yields a solid formation to mimic the physical properties of coral reef structures. Using thermodynamic calculations, the variation of initial components was determined that reached an adiabatic temperature with a maximum peak of 2000 K. The self-sustaining reaction front was obtained to rigidly consolidate the dredge sand only at composition concentrations exceeding a critical value of 24 wt.% Al, and 3 wt.% PTFE. The combustion synthesis produced a consolidated formation with a hardened and porous structure.

P70

On Isotactic Polypropylene Filled with Vapor Grown Carbon Nanofibers

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Isotactic polypropylene (IPP) type Marlex HLN-120-01 from Philips Sumika Polypropylene Company, has been loaded with vapor grown carbon nanofibers (VGCNF) with diameters ranging between 60 and 100nm and lengths between 30,000 and 100,000nm supplied by Pyrograf Products (PR-24AG). IPP–VGCNF nanocomposites have been prepared by extrusion at 180°C for 9 min at 65 rpm, followed by a 5 min mixing at 90 rpm and 180°C. The loading with nanofiller was ranging from 0 to 20 wt.%. VGCNFs. The as obtained samples have been hot pressed into sheets with a thickness of about 0.6 mm at about 180°C and by a force of 1000N for 100s. IPP–VGCNF nanocomposites have been investigated by several spectroscopic methods such as Wide Angle X Ray Scattering, Raman spectroscopy, and FTIR spectroscopy. The experimental data suggested that the polymer is wrapping around carbon nanofibers and that the polymer-nanofiller stress transfer is weak as the positions of the X-Ray lines was not change as the loading with VGCNFs was increased. Atomic and molecular vibrations were monitored by both FTIR and Raman spectroscopy. The displacements of these lines upon adding VGCNFs are discussed in detail. The investigation is completed by a detailed analysis of the thermal properties of these nanocomposites with emphases on glass and melting transition temperature and further extended to provide a direct analysis of the dc electrical characteristics of IPP-VGCNF nanocomposites in a wide temperature range, from 10K to 500K. A model that combines tunneling of the electrons along carbon nanotubes and their hopping from one conducting nanotube to the nearest one is suggested. The modification of the electrical conductivity of the sample upon loading with VGCNF is reported and discussed within the percolation theory. Experimental data support the proposed model.

P71

Synthesis of Chitosan Nanoshells for Drug Delivery

Miriam Ramos Arevalo, Shams Mehdi, Ahmed Touhami
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Drug delivery is the process of carrying therapeutic agents to a specific location in the human body. This has become widely used for the treatment of different illnesses, for example cancer therapy. Moreover, the use of hollow nanoparticles for drug delivery systems has become one of the best-known methods to deliver drugs to a desired area of the human body. Chitosan is a biopolymer that is biodegradable and biocompatible, which makes it a good candidate for the creation of hollow nanoparticles for the use in drug delivery systems. In this study, we use a simple method to prepare chitosan nanoshells. Chitosan with three different molecular weights (low, medium, and high), are used to synthetize nanoshells with various sizes and properties. Scanning electron microscopy, atomic force microscopy, and FTIR techniques are used to characterize the morphology and physical properties of the nanoshells and the nanoscale. Our preliminary data show that the chitosan nanoshells may have great potential for application as a nanocarrier in drug delivery system.

School of Earth, Environmental and Marine Sciences (SEEMS)

P72

Developing multispectral imaging techniques to determine canopy coverage and carbon storage of seagrasses in the Gulf of Mexico

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Although seagrass beds provide global ecosystem services, total seagrass coverage is in rapid decline, with the capacity of seagrasses to sequester carbon of special concern. Current seagrass monitoring methods are time and labor intensive and may not offer a complete picture of coverage. Remote sensing offers the ability to oversee vegetation patterns on a landscape-scale but the presence of water in coastal environments presents challenges, as the commonly used near-infrared wavelength dissipates in water. This project aimed to provide reliable methodology to assess seagrass coverage using multispectral imagery taken from an unmanned aerial vehicle. The second goal of the study was to provide evidence for the link between seagrass coverage and stored belowground carbon for *T. testudinum* in the Gulf of Mexico. The imagery allowed for coverage estimates that were compatible with in-water surveys. Canopy coverage proved to be a reliable predictor of below-ground carbon storage. This research demonstrates that carbon stocks can be assessed with remote sensing when carbon storage rates for local species are established.

P73

Soil hydrologic and chemical change affected by compost and tillage in turfgrass seeding site

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Urban development in the US-Mexico border region has led to an increase in impervious surfaces and soil compaction. Soils and substratum in this region contain an appreciable amount of expansive clay, which is prone to surface crusting and sealing. The effect is increased stormwater runoff with the threat of urban flooding. The objective of this study is to evaluate soil remediation methods to improve infiltration on urban compacted land, consisting of tillage and/or compost amendment. A field-testing site (~ 0.13

acre) was established at the University of Texas Rio Grande Valley (UTRGV) Edinburg campus following completion of on-site construction activities. A Ground Penetrating Radar unit was used on the site to scan for any subsurface obstructions. The site received four different treatments in four replicated trials on a randomized complete block design: 1) tillage only, 2) compost only, 3) tillage+compost, and 4) control (no tillage + no compost). Each plot was sized in 3.5-m width and 4-m length. Tillage was done by a rear tine tiller (up to 15 cm in depth). Compost was obtained from a municipal composting facility and it was applied in 5-cm depth. For compost + tillage treatment, compost was incorporated during the tillage. After the tillage and/or compost treatments, a total of 16 plots were hydroseeded with common Bermuda grass in June, 2018. Monitoring of relevant soil physical properties is in progress, including infiltration rate from various methods, bulk density, soil moisture, wet aggregate stability, and penetration resistance. Phosphate, Nitrate, Nitrite and Ammonia gets tested for in the runoff byproduct of the Infiltration tests before and after fertilization occurred. The outcome of this study will have broad impacts in both US and Mexico in restoring urban lands and promoting infiltration, especially where water shortage is expected.

P74

Potential Effects from Soil Shrink-Swell on the Weathering and Decay of Bird Wing Bones

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Soil shrink-swell (ShSw) capacity results from weather patterns causing water flow through the soil and subsequent contraction and expansion. Soil unit types are affected by this soil and water relationship along with other properties like moisture, permeability, and porosity. The ShSw ability of a soil is measured through indices and coefficients used to determine the predicted destructiveness of the process; which is an important engineering variable. The ShSw properties of soils may have taphonomic implications for archeozoological samples. Our study investigates the potential effects of low, medium, and high ShSw processes on bird bone recovery from Pleistocene assemblages. To further understand the impact of ShSw soils, the bones underwent a compression test using the Bose ElectroForce 3200 Test Instrument . We present the preliminary results of experimental outdoor trials using bird wing bones (humeri, radius, and ulnae) exposed to soil of different ShSw measures over a five-month period. The observations of below ground weathering and decay, at different time intervals and soil change events, are provided to help researchers reconstruct site depositional histories and interpret bird bone use by prehistoric and historic peoples.

P75

Bacterial pathogen, *Vibrio cholerae* in the American oyster from South Texas Water

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The American oyster is a commercially important shellfish, usually consumed raw globally. This shellfish species is common and abundant in south Texas waters, and its simple anatomy makes it ideal for multidisciplinary pathogenic research. People consuming raw oysters are unaware of the presence of pathogenic bacteria. Bacteria such as Salmonella and Escherichia coli have previously been found in American oyster, especially in those collected from polluted waters. Another, possibly fatal-disease causing bacteria, Vibrio cholerae (V. cholerae), is suspected to have contaminated the American

oyster. This poses a serious public health risk for those who eat raw oysters collected from polluted water. Anthropogenic contamination contributes to polluted waters in the Brownsville area which in turn provides ideal breeding conditions for bacterial growth on seafood often consumed raw. The objective of this study is to investigate and compare the presence of V. cholerae in American oyster collected from polluted and non-polluted waters. Oysters were collected from South Padre Island (non-polluted site), and San Martin Lake which receives municipal and industrial drainage runoffs (polluted site). Digestive gland and gill tissue were collected from oysters and fixed in 4% paraformaldehyde for a week at 4°C. Immunohistochemical and general histological techniques were used to visualize the presence of V. cholerae in oyster tissues. V. Cholerae was found in the oyster's tissues collected from both the polluted and non-polluted waters. Our results showed the presence of a dangerous pathogen, V. cholerae, present in the body cavity of the American oyster. For this reason, consumption of raw seafood products should be done with caution, as it poses a real public health risk.

P76

Viability of Wetland Crops for Use in Treatment Wetlands: Nitrogen Removal from Water and Production of Food

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Treatment wetlands are naturally occurring or constructed forms of wetlands that are engineered to treat various types of wastewaters such as industrial waste, municipal sewage, or agricultural runoff. These constructed systems are low-cost, low-energy-input, and have shown to be as effective at filtering water as manmade water treatment plants. This is achieved by utilizing the ecological potential of wetlands; their soils both filter water and immobilize pollutants/excess nutrients after which bacteria in soil break them down into other forms that are taken up by the plants therein or become part of the soil. The plants found in wetlands are critically important for the uptake of nitrogen and phosphorous, the nutrients which once in abundance in aquatic systems often cause eutrophication and hypoxic/anoxic conditions leading to dead zones. Most work on treatment wetlands has focused on very few rapidly growing graminoid species. However, given our need to increase agricultural productivity especially in areas with high rates of hunger and food insecurity, in this study we set to test if wetland food crops can meet the demands of excess nutrient while also providing an additional source of food. Globally, several major crops are grown in flooded soils and are therefore good candidates for use in treatment wetlands. To better understand both (a) the viability of wetland macrophytes as sources of food production and (b) the capacity of these macrophytes for removal of nitrogen from fertilizer-rich water, this study will quantify plant growth, food production, and nitrogen removal capacity of three common wetland crops as well as three locally dominant graminoid species in a variety of relevant ecological contexts. Focal plant species include: wetland crops – *Nelumbo nucifera* (sacred lotus), *Oryza sativa* var. Rex (a locally-adapted rice cultivar), and *Colocasia esculenta* (taro, AKA elephant ear); local graminoids –*Sorghum bicolor* (grain sorghum, also a crop), *Typha domingensis* (southern cattail), and *Cynodon dactylon* (Bermuda grass). In three related experiments, each of the six plant species, and a control with only soil, will be grown in three moisture regimes (flooded, soil surface, below soil surface), in a flooded competition scenario with *Lemna minor* (duckweed), and in one of three water cycling treatments (once per week, twice per week, no cycling). We will have 3 replicates per treatment combination, for a total sample size of n = 126 mesocosms (n = 63 for the moisture experiment; n = 42 for the competition experiment, with 21 shared with the moisture experiment; and n = 63 for the cycling experiment, with 21 shared with

the moisture experiment). From this experiment we hope to illuminate a viable pathway for limiting eutrophication in waterways and increasing the productivity of constructed wetlands.

P77

Evaluation of temperature and aeration on the longevity of Steinernema riobrave in invective juvenile nematodes in a water solution

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Steinernema riobrave (Cabanillas, Poinar, and Raulston) is being evaluated as a biological control agent of the cattle fever tick, *Rhipicephalus microplus* (Canestrini). The cattle fever tick transmits a disease known as bovine babesiosis. Cattle fever ticks were eradicated from the U.S., but have recently re-invaded South Texas (Fig 1, A). Nilgai antelope, *Bosephalus tragocamelus* (Pallus) (Fig 1C), are implicated in its long range dispersal especially in Cameron, Willacy, and Kleberg counties in South Texas. Remotely activated sprayers set up at nilgai fence crossings are being evaluated for control of *R. microplus* on nilgai (Fig 1B). A solution of water and *S. riobrave* (Nemasys-R, BASF Corporation, Raleigh, NC) is sprayed on the nilgai as it transits the crossing. This study finds that aeration significantly improves the longevity of *S. riobrave* in a water solution when compared to other application prototypes.

P78

Soil carbon fluxes in a mangrove-marsh-mudflat continuum of the lower Laguna Madre

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Estuaries and other coastal wetlands provide relevant and valuable ecosystem services. Mangrove forests tend to dominate riparian estuarine plant communities in many tropical and subtropical coastal zones, protecting against oceanic storms, providing habitat for commercially important species, sequestering nutrient and carbon. In the Texas coast, black mangrove (*Avicennia germinans*) coexists with stands of herbaceous halophytes and cyanobacterial mats, usually in a well-defined zonation from the water edge. One recognized consequence of climate change is sea level rise. Its effects on the coastal zone are diverse and many times only partially understood. More frequent or persistent flooding of estuarine shorelines is expected to promote shifts in biotic communities, but it is not known if carbon stored in soil and sediment (a component of what is called “Blue Carbon’), will preserved or on the contrary, be released back into the atmosphere. One way to better predict this is measuring soil carbon fluxes in the mangrove-marsh-mudflat continuum under drained and flooded conditions. In this study, we will take direct measurements of carbon dioxide and methane gases emitted by the soil over this continuum. A portable greenhouse gas analyzer will be used to take short term measurements of these gases in five transect perpendicular to the water edge where the continuum is well represented. We hypothesize that more frequent and persistent flooding conditions reduce organic matter mineralization rates and thus abate soil carbon fluxes, in particular carbon dioxide. Measurements of carbon dioxide and methane fluxes will be analyzed for differences among zones and flooding conditions. Results will be presented and discussed.

P79

A Landscape-Scaled Social-Ecological Approach to Wildlife Corridor Design in South Texas

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A few of the most daunting challenges in landscape ecology are determining how to address the effects of habitat fragmentation and how to restore connectivity to an ecologically degraded landscape. These obstacles to conservation are a derived consequence of the continuous expansion of humanity at the expense of the natural world. In the past, management groups tried to address this problem by forming isolated preserves around exemplar biologically diverse areas for the conservation of wildlife and preservation of open space for posterity. Unfortunately, numerous scientific studies have determined that these preserves are of insufficient size to preserve biodiversity and the lack of connectivity between preserves presents a formidable obstacle for viable population of species to persist especially for larger, migratory, and/or widely dispersed species. Therefore a proposed method to alleviate these problems is through the use of wildlife corridors. The definition for a wildlife corridor is still a subject of debate in the literature, with the definition that best describes the type of corridor being examined in this study being "a linear landscape element that provides for survivorship and movement, but not necessarily natality, between other habitats" (Rosenberg et al. 1995). The primary objective is to develop a quantitative, systematic, and repeatable protocol for designing wildlife corridors that are readily translatable elsewhere. To develop this protocol, the study used a prospective region for a wildlife corridor in South Texas to test the utility of different wildlife corridor strategies and schemes at maximizing the conservation value of a corridor for the least implementation cost. One of the strategies examined is the use of a traditional focal taxon approach compared to a community ecology approach. In addition to testing strategies, we examined the integration of cost saving steps like the use of rapid assessment methods whenever possible. Thus far we have developed a GIS-based least cost analyses model (the base model) that summarizes the conservation of two endangered species; Leopardus pardalis albescens (northern ocelot), Falco femoralis septentrionalis (northern aplomado falcon). In addition, we have assessed the Lepidoptera diversity in a rapid assessment fashion by utilizing the high species diversity observed during the fall migration. We then assessed whether a greater conservation value is accomplished by a corridor was achieved with the inclusion of Lepidoptera compared to the base model. Secondarily we assessed how landscape features like habitat fragment size, type, and quality (land-use history) influence taxonomic groups like Lepidoptera use of a landscape.

P80

Is cold stratification needed for the germination of the native and symbolic Montezuma Cypress (*Taxodium mucronatum*)?

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The disjunct distribution range of Montezuma Cypress (*Taxodium mucronatum*) encompasses several subtropical and temperate regions of Mexico and Guatemala, and reaches its historical northern limit in the lower Rio Grande Valley. This magnificent riparian species is the national tree of Mexico (named Sabino or Ahuehuete), and was also named the official city tree of Brownsville in 2014. The Montezuma Cypress used to dominate riparian vegetation of the lower Rio Grande and its associated resacas.

Currently, only one resaca section in Brownsville still has around 60 old-growth trees, with few isolated individuals found in other resacas and private lots. Efforts to restore the local population of this symbolic tree have failed due to several factors including difficulties to propagate it. This tree propagates naturally by seed but may be possible to induce vegetative propagation (by cuttings). However, the U.S. Fish and Wildlife Service require that all plant materials used in restoration be propagated by seed which allows for genetic diversity. The more widespread and abundant Bald Cypress (T*axodium distichum*) occurs from central Texas to Louisiana's bayous; it is closely related to the Montezuma Cypress and are often mistaken. Similarities between the two species include a very low germination rate of their seeds. A previous study found that prolonged soaking of the seeds improves their germinability reaching more than 30%. This study will determine if the seeds have physiological dormancy and require periods of cooler temperatures to promote germination. For this, Montezuma Cypress seeds were obtained from cones collected this past January at the site were the last natural stand of trees remain. The treatments being tested include several cold stratification regimes varying in time and moisture availability at cold (6°C) and room (27°C) temperatures. We hypothesize that a cold pretreatment of the seeds improves germination metrics (germinability, speed, synchrony). The goal is to find the seed treatment yielding the highest germination rates and speed allowing for the use of this relevant species in riparian reforestations of regional freshwater wetlands.

P81

HISTORICAL ECOLOGY INDICATORS AS ECOSYSTEM SERVICE MEASURES AND ASSESSMENTS

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Historic and current human land-use activities and changes affect ecological functions and ecosystem services quality. The clearing of native Tamaulipan scrub, mesquite, and riparian forests for agricultural use and expansion followed by rapid urbanization and population growth resulted in profound ecological impacts to the Lower Rio Grande Valley (LRGV), Texas. Our study used historical ecology indicators to compare past and present land use (agriculture, residential, and commercial or industrial) impacts to measuring ecosystem services. We compared a site sample for each of these land use designations to baseline sites representing native ecological conditions in the LRGV. Indicators of habitat type, vegetation, surface conditions and visual and noise characteristics were measured at sample sites to generate ecosystem service measures of carbon uptake, aesthetics, air quality, climate regulation, and erosion control. We used the field application of Ecosystem Services Identification & Inventory Tool (ESII Tool) (EcoMetrix Solutions Group, Portland Oregon) to, 1) collect ecological data and measure percent ecological performance and ecological function and service acres, and2) document historic and contemporary land use changes by producing heat map graphical representations. Our use of historical ecology indicators to compliment current site ecological conditions generated important ecosystem service measures useful to assessments and conservation land-use planning and management.

P82

Following the Chronosequence of carbon sequestration in sites converted from agriculture to reforested land

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In an effort to restore degraded agricultural lands, reforest unused areas surrounding La Sal del Rey, and record the increase of carbon (C) sequestration throughout different plots surrounding La Sal del Rey within Linn, TX. Plots and sections consisting of several acres have been reforested as of the 90s, and every year afterwards volunteers have planted trees consistently up to present day. There are still several acres of land reserved for continuation of restoration activities until 2022. We are working in partnership with US Fish and Wildlife Service and Land Life Company to create an accurate map of carbon sequestration productivity over the course of 1990 to 2018. The objective of this research is to quantify soil C sequestration across a chronosequence of restored sites in the region of La Sal Del Rey. This will be done in two phases: 1) development of a database containing soil and site properties for selection of normalized sites and 2) soil sampling and analyses of C budgets in the sites selected in phase 1. Using USDA's soil conservation program, Web Soil Survey which is provided by NRCS, we will also be able to gain approximate information regarding each soil type within La Sal del Rey as well as a wide range of soil properties information. This information will be taken into consideration to normalize the sites that will be selected for soil sampling that will form the restoration chronosequence within La Sal del Rey.

P83

Microbial life in Sustainable Agriculture

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The human population growth has resulted in agricultural intensification. Farming with intense chemical use for weed and pest management has resulted in a significant degradation of soil health. In return, soil quality affects soil factors that can affect weed and pest presence, abundance and type. Managing weeds becomes more challenging with declining soil health. Weeds as regarded as the symptoms of soil health and can provide insight into soil problems. In this study, I will analyze soil samples under the major summer weeds in the Lower Rio Grande Valley farmlands to better understand how the community of microorganism within the soil interact with the weedy plants. In this research, I will analyze the beneficial nematodes, plant parasitic nematodes, bacteria and fungal populations. The soil samples will be collected from three farms in the Lower Rio Grande Valley: Terra Preta in Edinburg, Hilltop Gardens in Lyford, and PPC in Mission. Each of these farms have collaborated with the faculty members at UTRGV in research projects aimed to improve the soil conditions. For the analysis of plant parasitic and free-living nematodes I will work together with a graduate student who will train me in morphological identification of these organisms. For the bacteria and fungal community, I will determine the colony forming units of each following the serial dilution and plating technique. I will also determine the ratio of Gram-positive and Gram-negative bacteria in these sites. Furthermore, I will analyze the soil organic matter, texture, moisture, and pH. I will present the results of this study in the 2019 ASA-CSSA-SSSA International Annual

Meeting, Nov. 10-13, San Antonio, Texas.

P84

Aqueous Lead removal using pyrolyzed algal and woody biomass

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Biochar is a high carbon charcoal formed with lignocellulosic biomass under low oxygen conditions (pyrolysis). The production of biochar can be used as a carbon sequestration method, since pyrolyzing biomass "fixes" carbon that would otherwise be released into the atmosphere through decaying organic materials. Biochar is used as a soil additive for fertility and improved soil structure but may also be used as a filter media due to its highly porous structure and reactive surface. The objective of this study is to evaluate biomass sources from the Lower Rio Grande Valley for biochar production and their efficiency as a filter media for contaminated water, specifically aqueous lead removal. Biomass sources evaluated are will include Brown Seaweed (*Sargassum*) and Oak tree acorns (*Quercus virginiana*), which represent marine waste and yard waste. Biochar will be produced through conventional pyrolysis using a commercially available biochar producing container ("Biocharlie") in a grill. Biomass sources and biochar produced will be characterized for its physical properties (pH, electroconductivity, C, P, and N composition), surface morphological properties (surface functional groups, scanning electron microscope, surface area), and proximate analysis (ash content, fixed carbon, moisture). To analyze biochar's effectiveness as a filter media, batch adsorption tests will be performed to assess aqueous lead (Pb) removal by the biochars. Results from this study will further information on biochar as a filter media and the efficiency of locally sourced biomass materials as biochar and a filter media.

P85

Raw Oyster Contaminated with Bacterial Pathogens Can Be Life Threating

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The American oyster (*Crassostrea virginica*) is also known as Atlantic or Eastern oyster, a popular sea food for its delicacy and high nutritional value with concomitant significant commercial importance. Oyster is a filter feeder and accumulate considerable amount of pathogenic bacteria specially in its gill, digestive gland and connective tissue. Presence of deadly bacterial pathogens has made raw oyster consumption extremely hazardous to its consumer's health as bacterial pathogens rapidly facilitate and transmit chronic infectious diseases to its consumers. Based on increasing concern about bacterial pathogen contamination from raw oyster, our objective of research has been focused on detection and comparison of two important bacterial pathogens, Escherichia coli (*E. coli*) and Salmonella spp. proliferation in the American oyster of South Texas waters (South Padre Island and San Martin Lake), local market and laboratory samples. Coelomic fluid (body fluid) glucose levels were relatively constant, whereas fluid pH levels were significantly higher in oyster collected from San Martin Lake compared to South Padre Island. Histological observation and immunohistochemical analysis showed substantial bacterial pathogen's presence in gill, digestive gland and connective tissue in oyster collected from San Martin Lake compared to South Padre Island. Laboratory sample analysis showed increasing trend of bacterial pathogen growth with increasing temperature (28 and 32°C) compared to control (24°C). Collectively, our histological and immunohistochemical results, together with coelomic fluid pH and glucose levels suggest that the American oyster is prone to water-borne pathogen contamination in south

Texas waters.

P86

How will Global Warming affect the Future of American oysters?

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Global warming is likely to intensify heat stress in marine and coastal organisms, affecting their development, growth, and reproductive functions. In this study, we performed histological observations on gonadal functions, immunohistochemical analyses of heat shock protein (HSP) and nitrotyrosine protein (NTP, an indicator of reactive nitrogen species, RNS) expressions, in situ TUNEL assay for cellular apoptosis, biochemical analyses of coelomic fluid (CF, body fluid that regulates physiological functions) in the American oyster gonad with various water temperatures. Oysters were placed in six different twenty-gallon aquariums and exposed to control (24°C), medium (28°C), and high (32°C) temperatures under controlled laboratory conditions for one week. Higher temperature significantly decreased the number and diameter of eggs in ovary of female oysters and sperm cell growth, development, and production in male oysters. CF protein concentrations also declined compared to control temperature (24°C). In contrast, CF pH and HSP expression in gonad increased after heat-exposure, consistent with increased cellular apoptosis. Collectively, these results suggest that higher temperatures drastically increase ROS and RNS levels leading to increased cellular apoptosis which subsequently decline gonadal functions in oyster.

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