College of Sciences Research Symposium

Showcasing the Science Shaping Tomorrow

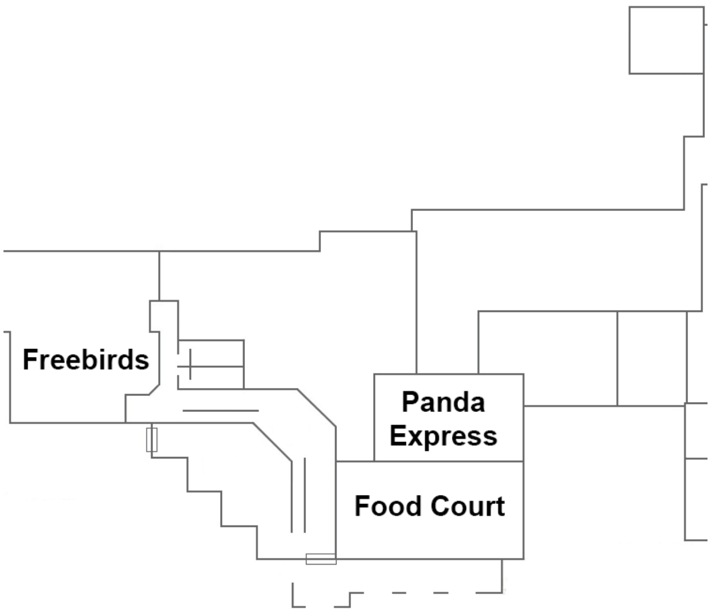
April 10, 2026

Main Campus
8 am-5 pm

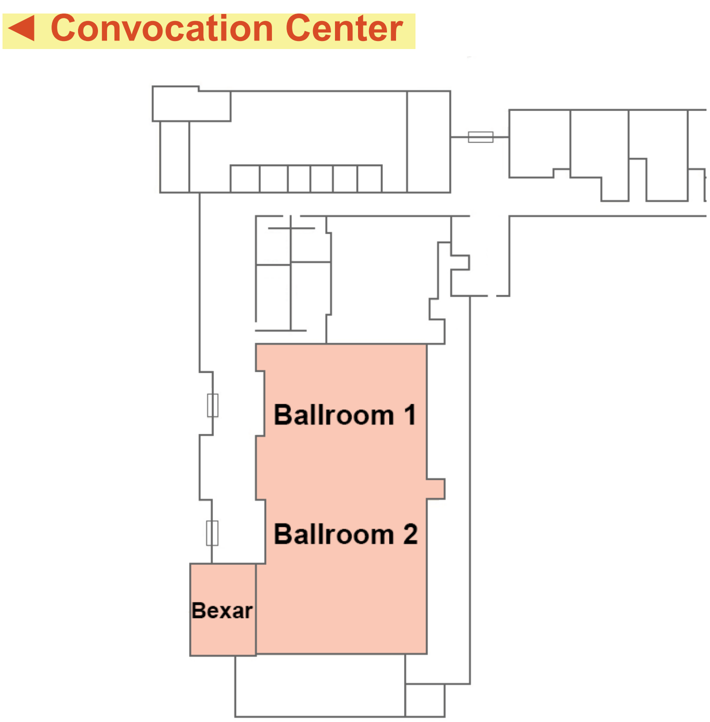
UT San Antonio™
The University of Texas at San Antonio

Student Union Maps

FIRST FLOOR

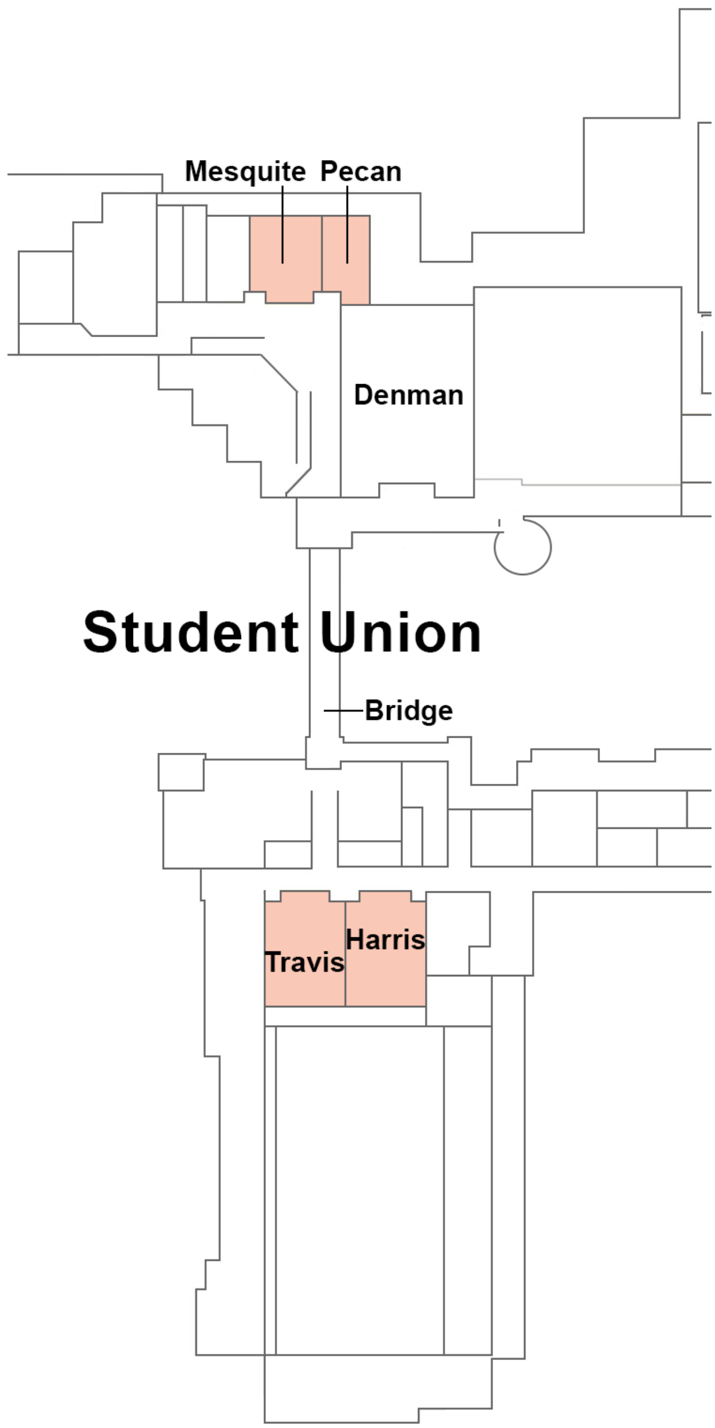


Student Union



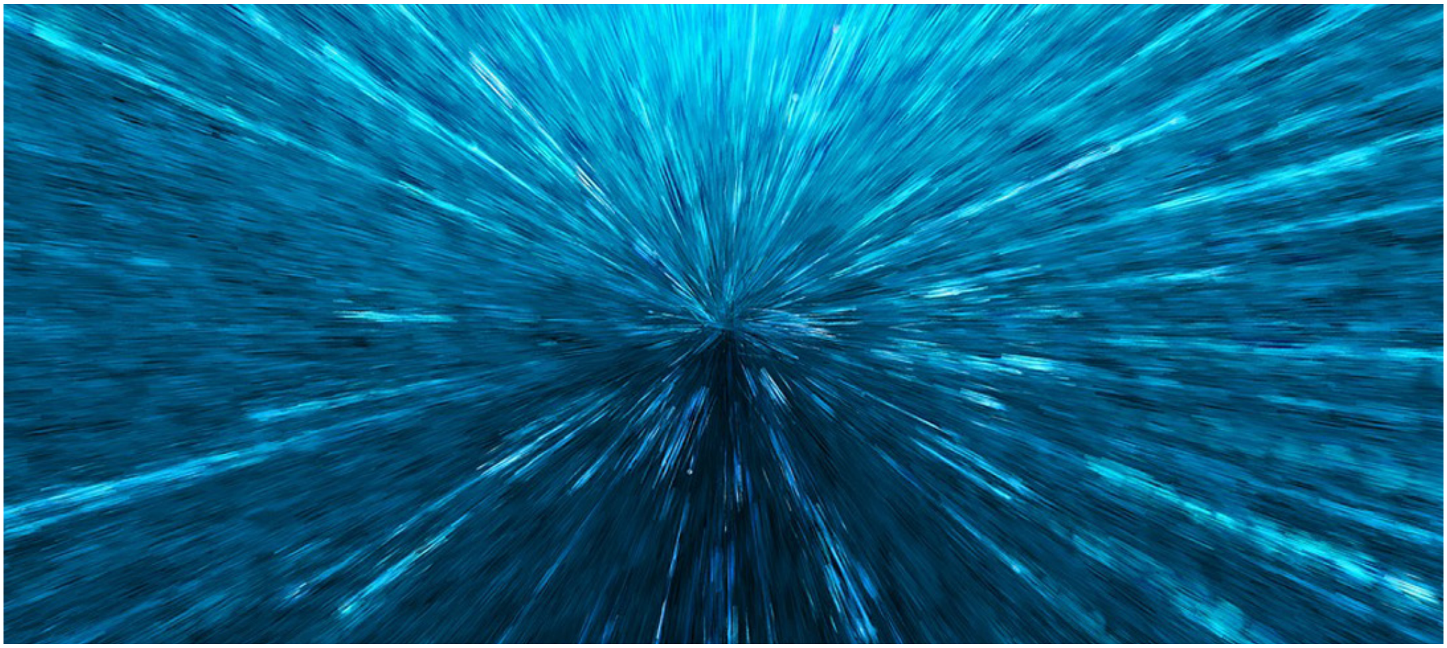
HEB Student Union

SECOND FLOOR



Student Union

HEB Student Union



Showcasing the Science Shaping Tomorrow

Room	Activity
HEB Student Union Ballrooms	• Registration • Opening Remarks • Plenary Speaker • 3-Minute Thesis • Closing & Awards
HEB Student Union Rooms	
– Bexar	Oral Presentations
– Harris	Oral Presentations
– Travis	Oral Presentations
Student Union Rooms	
– Mesquite	Oral Presentations
– Pecan	Oral Presentations
Convocation Center	• Poster Session • Vendor Expo

Welcome to the 2026 College of Sciences Research Symposium

The College of Sciences Research Symposium: Showcasing the Science Shaping Tomorrow is a celebration of the people, ideas, and discoveries that define our community. It reflects the depth and breadth of scholarship across the college and highlights the remarkable contributions of our students, faculty, and staff to advancing knowledge and addressing complex challenges.

This celebration comes at a particularly meaningful time. The landscape for fundamental research continues to evolve, often placing increasing emphasis on immediate outcomes and short-term impact. Yet, the strength of the College of Sciences lies in our enduring commitment to curiosity-driven inquiry- the kind of work that expands the boundaries of understanding, builds foundational knowledge, and ultimately enables transformative innovation. Our faculty lead impactful research programs; our students engage directly in discovery; and together, we contribute to a vibrant and growing research enterprise reflected across this year's symposium tracks and presentations.

We are also in a period of important institutional evolution. The recent merger has expanded our community, bringing new expertise, perspectives, and opportunities for interdisciplinary collaboration. At the same time, we celebrate the transition of Computer Science to the College of AI, Cyber, and Computing, an exciting and strategic step that strengthens both colleges and positions each for continued growth, focus, and impact.

These moments of change invite reflection, but they also clarify who we are.

The College of Sciences is grounded in a culture of scientific thought, where questioning is fundamental, evidence is paramount, and curiosity drives progress. This culture is reflected not only in the research we conduct, but in how we educate and mentor the next generation of scientists, thinkers, and problem-solvers. Our students are not only learners, but active participants in discovery, carrying forward the habits of inquiry, resilience, and creativity that define scientific practice.

Today's symposium showcases these strengths. From oral presentations organized across multiple thematic tracks to an expansive poster session, it highlights the scope, rigor, and excitement of research across our college. It is also a reminder of the collaborative and supportive environment that makes this work possible.

Above all, this event is a celebration of our science, our community, and our shared commitment to discovery. Together, we continue to build a College of Sciences that is dynamic, impactful, and driven by the curiosity that shapes tomorrow.

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Program Schedule

Activity and Location	Time
Registration Desk and Check-in Open HSU Ballroom Galleria	8:00 am – 4:00 pm
Expo Hall and Poster Hall Open Convocation Center	8:00 am – 4:00 pm
Graduate Student Appreciation Breakfast HSU Ballroom 1	8:00 am – 8:45 am
Introductory Remarks: President Taylor Eighmy, Dr. Jennifer Sharpe Potter, and COS Dean Stephanie Santorico HSU Ballroom 2	9:00 am – 9:15 am
Plenary Speaker: Dr. Christopher Glein "Life Beyond Earth: The Opportunity Right Down the Road" HSU Ballroom 2	9:15 am – 10:00 am
Transition and Coffee HSU Ballroom Galleria	10:00 am – 10:20 am
3-Minute Thesis Competition HSU Ballroom 2	10:20 am – 12:30 pm
Oral Presentations	10:20 am – 12:30 pm
Biomedical and Health Sciences HSU Harris Room	
• Alexey Soshnev, Assistant Professor, Neuroscience, Developmental and Regenerative Biology "Making sense of missense: Discovering new biology through histone mutation landscape"	10:20 am
• Megan Kempher, Assistant Professor, Molecular Microbiology and Immunology "Impact of a sequence invariable region on conformation, secretion, and neutralization of the *Clostridioides difficile* toxin TcdB"	10:45 am
• Lacy Barton, Assistant Professor, Neuroscience, Developmental and Regenerative Biology "Guiding the next generation: enetic and non-genetic factors that support and compromise germline development"	11:10 am
• Break	11:35 am

Activity and Location	Time
• Wenicios Ferreira Chaves, Postdoctoral Associate, Neuroscience, Developmental and Regenerative Biology "Serotonin modulates neuropeptide Y neurons in the inferior colliculus by activation of 5-HT2A and 5-HT2C receptors"	11:40 am
• Jesús Romo, Assistant Professor, Molecular Microbiology and Immunology "*Clostridioides difficile* interacts with fungal colonizers of the gastrointestinal tract"	12:05 pm
Molecular, Chemical, and Materials Discovery HSU Travis	
• Philipp Schmidpeter, Assistant Professor, Chemistry "Concentration-dependent dual functionality of specific lipids on ion channel activity"	10:25 am
• Zoe Hoffpauir, Postdoctoral Associate, Chemistry "Journey to the center of the capsid"	10:50 am
• Syed Usama, Assistant Professor, Chemistry "Strategies to access fluorophores for biomedical research"	11:15 am
• Patrick Warren, Assistant Professor of Research, Physics and Astronomy "From oxidation kinetics to nanoscale microstructure: Integrated characterization at EEML and KAMC"	11:40 am
• Kade Johnson, Doctoral Student, Physics and Astronomy "Surface plasmon propagation in silver nanowires under high pressure"	12:05 pm
Fundamental and Applied Physical & Mathematical Sciences SU Pecan Room	
• Jose Morales Escalante, Assistant Professor, Mathematics "Quantum Stochastic Gradient descent in continuous-time limit via the Wigner formulation of open quantum systems"	10:20 am

Program Schedule

Activity and Location	Time
• David Gonzalez Alcantara, Postdoctoral Associate, Physics and Astronomy “Calculation of the properties of ZrN cubic nanocrystals containing Mo and Pd as fission products”	10:40 am
• Xóchitl López-Lozano, Associate Professor, Physics and Astronomy “Symmetry at the nanoscale and its consequences on the properties of nanostructures”	11:00 am
• Break	11:20 am
• Mira Khair, Postdoctoral Associate, Physics and Astronomy “Fabrication and characterization of advanced fuels and surrogates using arc-melt for next-generation reactor application”	11:30 am
• Thayne Currie, Associate Professor, Physics and Astronomy “Directly imaging extrasolar planets around accelerating stars”	11:50 am
• Juan Gutiérrez, Professor, Mathematics “A mathematical theory of discursive networks: Mutual accountability as the architecture of reliable AI”	12:10 pm
Earth, Environment, and Planetary Systems HSU Bexar Room	
• Welcome / Opening remarks	10:20 am
• Chris Packham, Professor, Physics and Astronomy “The Habitable Worlds Observatory”	10:25 am
• Mona El Morsy, Postdoctoral Associate, Physics and Astronomy “Starlight suppression with photonic integrated circuits: Laboratory characterization and future applications for Subaru/GLINT and HWO”	10:40 am
• Kaushik Mitra, Assistant Professor, Earth and Planetary Sciences “Redox sensitive elements on Mars: Implications for surface geochemistry and astrobiology”	10:55 am
• Krishna Kumari, Postdoctoral Fellow, Earth and Planetary Sciences “Understanding the role of Martian oxyhalogens in organic matter degradation: Preservation of potential biosignatures”	11:10 am

Program Schedule

Activity and Location	Time
• Yongli Gao, Professor, Earth and Planetary Sciences “Hydrocarbon formation and transformation from the archean to modern environments: Insights from isotope geochemistry and quantum chemistry”	11:25 am
• Elizabeth Bailey, Assistant Professor, Earth and Planetary Sciences “New perspectives on the geochemical fate of organic carbon in Earth’s history”	11:40 am
• Alan Whittington, Professor, Earth and Planetary Sciences “Using calorimetry to quantify disorder in materials from the Earth to the Moon to the stars”	11:55 am
STEM Education and Workforce Development SU Mesquite Room	
• Priya Prasad, Associate Professor, Mathematics “Structuring PLCs for college-level instructional change”	10:20 am
• Benjamin Sencindiver, Assistant Professor, Mathematics “How calculus students make sense of graphs—and how their understanding evolves”	10:40 am
• Jessica Gehrtz, Assistant Professor, Mathematics “Leveraging student thinking: Taking active learning to the next level”	11:00 am
• Marissa Martinez, Master’s Student, Mathematics “How do Latina STEM majors feel in their calculus courses and what helps them feel supported?”	11:20 am
• Blain Mamiya, Associate Professor of Instruction, Chemistry “We should embrace mistakes in the classroom”	11:40 am
• Hadi Arman, Associate Professor of Practice, Chemistry “Fact or fiction—systematic investigation on the use of AI (or external aids) for online homework”	12:00 pm
Poster Presentations and Judging Lunch provided for volunteers and participants Convocation Center	12:30 pm – 2:30 pm

Program Schedule

Activity and Location	Time
Oral Presentations	2:30 pm – 4:00 pm
Biomedical and Health Sciences HSU Ballroom 2	
• Melanie Carless, Professor, Neuroscience, Developmental and Regenerative Biology "Evaluating baboons as a preclinical model of genetic generalized epilepsies"	2:30 pm
• Won-Haeng Lee, Postdoctoral Associate, Neuroscience, Developmental and Regenerative Biology "The regulation and the role of PKCθ in the pathogenesis of Alzheimer's disease"	2:55 pm
• Luan Vu, Assistant Professor, Molecular Microbiology and Immunology "Asthma susceptibility driven by epigenetic and metabolic reprogramming of RSV-trained ILC2s"	3:20 pm
• Networking roundtable	3:35 pm
Molecular, Chemical, and Materials Discovery HSU Travis	
• Andrey Chabanov, Professor, Physics and Astronomy "Novel gyromagnetic metamaterials for nonreciprocal electromagnetics"	2:30 pm
• Kevin Knebel, Doctoral Student, Physics and Astronomy "Photon management in Si solar cells via $CuInS_2$ quantum dot coatings"	2:50 pm
• Maksym Pavlenko, Doctoral Student, Chemistry "Divergent strategies in enantioselective and regioselective reactions"	3:10 pm
• Sachchida Nan, Postdoctoral Associate, Chemistry "Cyclic sulfone ring remodeling enables molecular shape diversity-oriented synthesis of privileged biaryl and oligoaryl motifs"	3:30 pm
Fundamental and Applied Physical & Mathematical Sciences SU Pecan Room	

Program Schedule

Activity and Location	Time
• Lulu Zhang, Postdoctoral Associate, Physics and Astronomy "Feedback signatures and implications for the central engine of active galactic nuclei from JWST spectroscopy"	2:30 pm
• Zhuolin Qu, Assistant Professor, Mathematics "Density-mediated emergence impacts the success of Wolbachia-based mosquito population reduction strategies"	2:50 pm
• Break	3:10 pm
• Carlos Bassetto, Assistant Professor, Physics and Astronomy "Using photolipids to promote neuronal excitability and study ion channel mechanosensation"	3:20 pm
• Henry Chimal-Dzul, Assistant Professor, Mathematics "How does LESS, a post-quantum digital signature, work?"	3:40 pm
Earth, Environment, and Planetary Systems HSU Bexar Room	
• Collaboration building and proposal development workshop	2:30 pm
Poster Judging and Score Entry Hub SU Mesquite Room	2:30 pm – 4:00 pm
Transition and Coffee HSU Ballroom Galleria	4:00 pm – 4:20 pm
Awards & Closing Remarks HSU Ballroom 2	4:20 pm – 5:00 pm

Plenary Speaker

Dr. Christopher Glein

Dr. Christopher Glein is a planetary scientist at Southwest Research Institute (SwRI) whose research revolves around the “big three” icy ocean worlds—Enceladus, Europa, and Titan. Glein is an expert on the geochemistry of these moons. He develops thermodynamic models for inferring the geochemical properties of their environments and the processes that shape them. He co-led a landmark 2017 Science paper reporting the discovery of molecular hydrogen in Enceladus’s ocean, establishing a quantitative basis for energetic habitability in an extraterrestrial ocean for the first time. His research program also includes exoplanets, both those that could be habitable as well as those that reveal how geochemistry operates across diverse planetary environments. Glein was a member of the instrument team for the Cassini Ion and Neutral Mass Spectrometer, and he is a Co-Investigator on the Europa Clipper MAss Spectrometer for Planetary EXploration team. In addition, he is the Principal Investigator of a James Webb Space Telescope observing program on Enceladus. Glein served on the most recent Decadal Survey for Planetary Science and Astrobiology for the National Academies of Sciences, Engineering, and Medicine. He recently gave the Carl Sagan Lecture at the 2025 AGU Fall Meeting. Glein earned a Ph.D. in 2012 from Arizona State University, where he studied with Everett Shock.

Abstract

Life Beyond Earth: The Opportunity Right Down the Road

Join us for the adventure of a lifetime as we revisit Cassini’s exploration of Saturn’s moon Enceladus. We will consider whether this small but surprising moon can support life. We will then look to the future of the search for life on our solar system’s ocean worlds and explore the scientific and technological opportunities that await.

Presentation Technical Tracks

Biomedical and Health Sciences

This track highlights research advancing understanding of biological systems across molecular, cellular, organismal, ecological, and population scales, including work related to human health and disease. Topics may include neuroscience, immunology, microbiology, infectious disease, genetics, cardiovascular biology, host–pathogen interactions, organismal and ecological health, and translational or diagnostic innovation. Interdisciplinary work integrating computational, environmental, chemical, or materials-based approaches is encouraged. Due to the breadth of activity in this area, multiple sessions are anticipated.

Molecular, Chemical, and Materials Discovery

This track features discovery and innovation in chemistry and materials science. Topics may include synthetic and inorganic chemistry, catalysis, polymer science, nanomaterials, spectroscopy, chemical biology, energy-relevant materials, and advanced materials characterization. Contributions that connect fundamental molecular discovery to applied challenges are especially welcome.

Fundamental and Applied Physical & Mathematical Sciences

This track showcases research in physics, applied mathematics, and quantitative sciences. Areas may include condensed matter, optics, quantum and nanoscale phenomena, astrophysics, theoretical and computational modeling, simulation, and data-driven methods. Submissions that bridge theory, computation, and experiment are encouraged.

Earth, Environment, and Planetary Systems

This track highlights research on Earth and planetary systems across spatial and temporal scales. Topics may include geology, climate science, hydrology, soil and water systems, ecology, conservation biology, wildlife and fisheries science, environmental monitoring, and planetary science. Field-based, laboratory, and modeling approaches are all welcome. Given strong engagement across environmental and ecological sciences, two full sessions are anticipated.

STEM Education and Workforce Development

This track focuses on innovation in STEM education, research-integrated training, and workforce development. Topics may include experiential learning, curriculum innovation, broadening participation in STEM, industry engagement, and evidence-based approaches to student success. Submissions should demonstrate measurable outcomes or research-informed practice.

POSTER ABSTRACTS

Biomedical and Health Sciences

Poster Abstracts

Biomedical and Health Sciences

Poster #100

Activation of Ferroptosis Programmed Cell Death in AD-Derived Neurons

German Plascencia Villa, George Perry

Neurodegeneration is characterized by the progressive loss of neurons. However, the mechanisms by which neurons die in Alzheimer's disease (AD) remain elusive. Disrupted iron homeostasis is associated with accelerated cognitive decline, amyloid beta deposition, and AD progression, but its pathogenic relevance is poorly understood. The recent discovery of ferroptosis (an iron-dependent regulated cell death mechanism) provides an alternative potential explanation for the relevance or iron dysregulation in AD.Methodology. AD-derived neurons are used to determine neurotoxicity, morphological alterations and understanding of ferroptotic responses and progression. Neurons were dosed with ferroptosis-inducing agents to determine susceptibility to oxidative stress and cellular responses.Results. We performed oxidative stress assays to quantify glutathione (GSH/GSSG), reactive oxygen species (ROS), NAD/NADPH, lipid peroxidation, mitochondrial dysfunction and intracellular iron deposition in AD-derived neurons. Furthermore, the neuronal responses to oxidative stress-ferroptosis is visualized with live-cell holotomography (quantitative phase microscopy) to determine the neuronal ferroptotic phenotype.Understand the role of iron accumulation, oxidative stress, and cell-specific susceptibility to ferroptosis programmed cell death in human brain cells and model the complex molecular responses related to neuronal loss in AD. These experiments provide the kinetics of biochemical, metabolic and morphological features of AD neurons under ferroptotic oxidative stress.

Poster #101

Iodine Monochloride as a Probe of the Proteome of the Volatile Odorant Uptake Pathway in Insect Olfaction

Robert Renthal, Michael Zahabi

Insects detect volatile compounds with olfactory neurons that are immersed in the sensillar lymph, an aqueous compartment inside cuticle-coated sensilla. Volatile odorants have low solubility in water, so there must be a transport pathway to facilitate neuronal detection. However, this pathway is not yet understood. We are exploring the use of reactive volatile substances to track the proteome encountered by odorants entering the olfactory sensilla of insect antennas. Iodine monochloride has a high vapor pressure and, upon contact with water, it quickly forms HOI, which can efficiently iodinate protein tyrosines. We exposed adult *Drosophila melanogaster* flies to ICl vapor for 5 minutes. Proteins extracted from dissected antennas were digested with trypsin and analyzed on a Thermo Orbitrap Exploris 480. Using Mascot software, we identified 36 iodotyrosines, of which 35 were in cytoplasmic proteins and only 1 in a sensillar lymph protein. This result suggests a path from the air to the receptor neuron that bypasses the sensillar lymph, possibly through previously described sensillar pore tubules.

Poster Abstracts

Biomedical and Health Sciences

Poster #102

Serotonin Modulates Neuropeptide Y Neurons in the Inferior Colliculus by Activation of 5-HT2A and 5-HT2C Receptors

Wenicios Ferreira Chaves, Maria Carrasco, Zoya Nazir, Subham Nag, Marina Silveira

The inferior colliculus (IC) is a major midbrain hub that receives nearly all auditory information and also receives strong serotonergic input from the dorsal raphe. Serotonin modulates auditory processing in the IC, enhancing or suppressing neuronal responses and influencing complex tasks such as frequency discrimination. However, the cellular mechanisms underlying this modulation remain unclear due to the diversity of IC neurons. Because neuropeptide Y (NPY) marks a subset of GABAergic neurons in the IC, we hypothesized that serotonin increases the excitability of NPY neurons through 5-HT2A and 5-HT2C receptors. Using fluorescent in situ hybridization, we found that ~64% of NPY neurons in the medial and rostral IC express 5ht2c, whereas the caudal area expresses 53%. Expression of 5ht2a ranged from ~39% to ~48%, and about 30% of NPY neurons co-expressed both receptors. Whole-cell patch-clamp recordings in NPYhrGFP mice showed that serotonin strongly depolarized NPY neurons and triggered action potentials, even with synaptic blockers present. Blocking 5-HT2A partially reduced this response, whereas subsequent 5-HT2C completely blocked it. These findings indicate that serotonin enhances NPY neuron excitability, likely increasing inhibitory influence within the IC. Future work will explore implications for tinnitus and age-related hearing loss.

Poster #103

Human T Cell Responses to a Multivalent Recombinant Vaccine for Valley Fever

Parker Reitler, Althea Campuzano, Hao Zhang , Chrissy M. Leopold-Wager, Matthew Mendoza Barker, Sofia Lofazano, Allen Herrea, Ricardo Ramizez, Yufang Jin, Heidi E. Erickson, Joshua Malo, Ken Knox, Neil M. Ampel, Gary Ostroff, Chiung-Yu Hung

Coccidioidomycosis (CM) is a debilitating fungal disease caused by *Coccidioides immitis* (*Ci*) and *C. posadasii* (**Cp**). To combat this infection, our lab has developed a subunit vaccine composed of a multivalent antigen (rCpa1) loaded onto glucan-chitin particles (GCPs) (GCP-rCpa1) which confers protection against pulmonary CM in both C57BL/6 and humanized HLA-DR4 mice through a mixed Th1/Th17 response. We next investigated whether GCP-rCpa1 induces comparable responses in humans. First, global gene expression profiling (RNAseq) was performed with human PBMC-derived macrophages incubated with vaccine and compared to PBS controls. Our analysis revealed GCP-rCpa1 treatment resulted in ~ 800 differentially expressed genes (DEGs), with the vaccine eliciting innate responses via TLR/MyD88- and Dectin-1/Card9-mediated pathways based on Ingenuity Pathway Analysis (IPA). Data from assays using several reporter cell lines validated this prediction and confirmed their engagement in vaccine recognition. Finally, we analyzed human adaptive memory responses to rCpa1 and its components using IFN-γ T-cell recall assays using macrophages from confirmed CM patients and healthy individuals. Analysis revealed 97% (33 of 34 patent donors) responded to rCpa1, indicating it can elicit T-cell recall responses. Altogether, this data supports GCP-rCpa1 can elicit a human Th1-driving immune response and is worthy of further development in humans.

Poster Abstracts

Biomedical and Health Sciences

Poster #104

Investigating Epitranscriptomic Alterations in Rat Ventral Tegmental Area Astrocytes Following Exposure to Cocaine

Leonor Cedillo, Miller, Ashley N., Garcia, Brandon I., Fetch, Dustin R., Ramos, Angelica R., Jumamyradova, Amina., Wanat, Matthew J., Soshnev, Alexey A.

Ventral tegmental area (VTA) dopamine neurons regulate drug-dependent behaviors. While astrocytes are increasingly recognized as critical modulators of neuronal activity, little is known regarding if VTA astrocytes contribute to drug-dependent behavior. Our recent data demonstrate that prior drug exposure alters how VTA astrocytes regulate dopamine-dependent behavior. Specifically, chemogenetic activation of VTA astrocytes facilitates the development of a cocaine conditioned place preference (CPP) in drug-naïve animals but suppresses cocaine CPP in rats with prior cocaine experience. Long-term stability of this effect led us to hypothesize that cocaine exposure specifically alters the epigenetic landscape in VTA astrocytes. To test this hypothesis, we analyzed chromatin accessibility changes in the VTA after repeated exposure to cocaine, using an assay of transposase-accessible chromatin followed by short-read sequencing (ATAC-Seq) [n=6]; additional transcriptomic information was categorized by cell type using single-nuclear RNA-Seq [n=5]. Cross-referencing these datasets, we aim to determine key chromosomal regulatory elements altered in VTA astrocytes following cocaine exposure. Our insights into the epitranscriptomic effects of drug exposure on VTA astrocytes are critical to revealing cellular adaptations in brain circuits that control the development of drug-cue associations.

Poster #105

Characterization of Ligand-Binding Domains of Ionotropic Glutamate Receptors in Deer Ticks

Huey Au, Dr. Robert Renthal

Ionotropic glutamate receptors (iGluRs) play a key role in sensory signaling in ticks, including olfaction and gustation involved in host-seeking behavior. Understanding conformational changes in the ligand-binding domain (LBD) of these receptors may enable the development of new approaches for chemoreceptor targeting and environmentally friendly tick control. In this study, the LBD from rat iGluR2 was expressed in E. coli, purified using Ni-NTA affinity chromatography and dialysis, and analyzed to investigate conformation-dependent chemical modification. Protein expression and purification were verified by SDS-PAGE, while UV-Vis spectroscopy and Bradford assays were used to determine protein concentrations. Benzyl bromide was employed to selectively react with methionine residues because the reaction can be readily controlled and terminated. Mass spectrometry combined with bioinformatic analysis was used to identify peptide modifications. Results indicate that benzyl bromide labeling can produce oxidation products at specific methionine residues, with differences observed between conditions with and without glutamate, suggesting sensitivity to LBD conformational state. These findings demonstrate that selective methionine modification may serve as a reporter of structural changes in iGluRs and provide a foundation for future high-throughput screening methods to identify compounds that modulate tick chemoreceptor activity.

Poster Abstracts

Biomedical and Health Sciences

Poster #106

Pattern of Dopamine Signaling Associated with Generalized Deficits in Motivation

Cecilia Alducin-Martinez, Matthew J. Wanat, PhD

Generalized deficits in motivation are common symptoms associated with mental health disorders such as depression. As such, there is great interest in identifying the neuronal signals responsible for generalized deficits in motivation. Dopamine signaling in the nucleus accumbens core (NAc) facilitates high-effort actions and contributes to value-based decisions. We hypothesized that distinct patterns of dopamine signaling may underlie generalized deficits in motivation. To address this, we first developed a concurrent progressive ratio task where we could assess the motivation to work for two different reward options in a single context. This task provided a means to identify subjects that exhibit a generalized deficit in motivation when we alter the size of one of the reward options during test sessions. Rats were categorized based on their response strategy to the reward size manipulation in test session as 'Maximizers' and 'Non-Maximizers'. Maximizers earned the same or more rewards than would be expected relative to the preceding baseline session. In contrast, Non-Maximizers earned fewer rewards than would be expected relative to the preceding baseline session. Our data illustrates that Maximizers increase their lever press responding to both reward options. In contrast, Non-Maximizers exhibited a generalized deficit in motivation as they decreased their lever press responding for both reward options. We are performing fiber photometry recordings using GRABDA to record NAc dopamine levels in rats trained on the concurrent progressive ratio task. Our preliminary data indicates that Non-Maximizer rats exhibit a robust negative prediction error in response to smaller sized rewards, which was not evident in Maximizer rats. These data indicate that distinct dopaminergic phenotypes related to reward- seeking strategies may underlie the expression of generalized deficits in motivation.

Poster Abstracts

Biomedical and Health Sciences

Poster #107

Increased Parental Age Compromises Primordial Germ Cell Migration to the Gonad

Samuel Jones

Increased parental age compromises gamete quality and increases risk of developmental disorders in offspring. The degree to which increased parental age compromises germline development in offspring is less clear. Using *Drosophila melanogaster*, we found that minor increases in parental age compromise the migration of primordial germ cells (PGCs) to the embryonic gonad. To measure the extent of this phenomenon, we intercrossed three wild type strains and quantified mis-migrated PGCs in embryos from parents at five ages. Across all backgrounds tested, we found a significant increase in PGC migration errors such that half of embryos from nine-day old parents exhibited mild to severe PGC migration errors. At ~15% through their normal lifespan, nine days old is much younger than previously reported parental ages when DNA damage and chromosomal segregation errors increase in *Drosophila* gametes or increased developmental errors are detected in offspring. Nonetheless, we quantified both DNA damage in gametes with gH2Av foci and developmental errors in offspring across parental ages and found no increases in either. Next, we assessed whether there were parental age-dependent changes in signaling required for PGC migration. This analysis revealed a significant decrease in calcium transients required for PGC migration in migratory PGCs from older parents. We are currently determining the relative impact maternal or paternal age on PGC migration success, preliminarily finding equal contributions. In tandem, we are testing whether the intergenerational impact of parental age on PGC migration is conserved in mice. In humans, errors in PGC migration risk the development of extragonadal germ cell tumors and epidemiological studies have found a link between advanced parental age and germ cell tumor incidences. Together, these findings suggest that minor increases in parental age have the potential to impact two subsequent generations and reinforce the need for reproductive developmental biologists to precisely control for parental age.

Poster Abstracts

Biomedical and Health Sciences

Poster #108

The Role of VTA Astrocytes During Reward Learning

Brandon Garcia-Castañeda, Angelica R. Ramos, Ashley N. Miller, Leonor G. Cedillo, Zoe S. Kirchner, Morgan P. Johnston, Claire E. Stelly, Matthew J. Wanat

The capacity to learn from and seek out rewarding stimuli plays a central role in survival across species. Ventral tegmental area (VTA) dopamine neurons play a critical role during associative learning. Increasing evidence highlights that astrocytes can modulate neuronal activity and behavioral outcomes. However, it is unclear how VTA astrocytes regulate dopamine release and associative learning. To address this, we used chemogenetics to stimulate Gq signaling in VTA astrocytes (Gq-DREADD) of rats trained on associative learning tasks with either drug rewards or food rewards. We first examined how VTA astrocytes affected cocaine conditioned place preference (CPP). Gq-DREADD activation of VTA astrocytes facilitated the development of cocaine CPP using a sub-threshold training regimen. However, Gq-DREADD activation suppressed the development of cocaine CPP in rats with a history of drug exposure. These data highlight that exposure to cocaine functionally alters how midbrain astrocytes regulate dopamine-dependent behaviors. We exploited this drug-mediated adaptation in VTA astrocytes and found that Gq-DREADD activation reduced cocaine self-administration. We additionally examined how VTA astrocytes affected learning in rats trained on a Pavlovian conditioning task with food rewards. Preliminary data indicate that Gq-DREADD activation in VTA astrocytes inhibited the expression of conditioned responding and suppressed cue- and reward-evoked dopamine release in the nucleus accumbens core. Collectively, these findings indicate that VTA astrocytes regulate dopamine-dependent behavior in a task-specific manner.

Poster #109

Identification and Characterization of Repositionable Compounds with Activity Against *Clostridioides difficile* Biofilms

Cassandra Spondike

Clostridioides difficile is an anaerobic, toxin-producing gastrointestinal bacterial pathogen responsible for ~500,000 infections yearly. Between 15-30% of people given antibiotics for *C. difficile* infection (CDI) will fail initial treatment, increasing the possibility of recurrence among these patients to 40-60%. While the exact mechanism leading to CDI relapse is not well understood, recent evidence suggests biofilms might be implicated. We hypothesize that targeting *C. difficile* biofilms can reduce the risk of CDI relapse. We aim to identify repositionable biofilm-active compounds.We screened the Pandemic Response and Global Health Priority Boxes from Medicines for Malaria Venture (MMV) (640 compounds) anaerobically against mature *C. difficile* biofilms. In total, 84 candidates with greater than 50% biofilm reduction were identified.Based on structural diversity and potential novel mechanism of action, 15 candidates were prioritized for further study. Dose response assays against planktonic *C. difficile* confirmed the activity of six compounds with MIC50 values ranging from 0.3188 µM to ~50 µM. Dose response assays against biofilms are in progress.We have identified six repositionable candidates with activity against planktonic *C. difficile* and mature biofilms. These compounds will be down-selected further and tested in a murine model of CDI relapse to assess the efficacy of biofilm-targeted treatments.

Poster Abstracts

Biomedical and Health Sciences

Poster #110

Mechanistic Insights into a Small Molecule Inhibitor of *Candida albicans* Filamentation

Kendall Esparrago, Paola Zucchi, Hoja Patterson, Nathan P. Wiederhold, José Lopez-Ribot, Jesús A. Romo

Background: *Candida albicans* is a critical priority pathogen. Its ability to transition from yeast to hyphae is essential for pathogenesis and represents a therapeutic target.Goals/Hypothesis: We previously identified compound 9029936, a small molecule inhibitor of filamentation and biofilm formation in vitro and in vivo. We aim to determine the molecular target(s) of this small molecule and hypothesize that it targets GWT1, a conserved enzyme in the GPI biosynthesis pathway. Methods: We determined the effects of 9029936 on various *Candida* species by measuring growth and staining cell wall components with Calcofluor white and Wheat Germ Agglutinin. We passaged *C. albicans* for 40 days in the presence of the compound, then analyzed their capabilities for growth and biofilm formation with 9029936.Results: The compound induced dose dependent growth defects in *Candida* species, indicating inhibition of filamentation at low concentrations and general growth at higher concentrations. Cell wall staining revealed increased exposed chitin, suggesting altered cell wall architecture. No effects were observed in non-*Candida* yeasts, suggesting species-specific targeting. Lastly, *C. albicans* evolved strains emerged after serial passage capable of filamenting under all tested conditions. Conclusions: This work will uncover novel regulators of filamentation and lay groundwork for new antifungal therapies targeting virulence.

Poster #111

Improved Method for H1 Linker Histone Expression and Purification

Ksenia Dydo, Dmytro Kovalskyy, Alexey A. Soshnev

Mutations impacting H1 dynamics are prevalent in several malignancies and developmental disorders, loss of H1 greatly enhances induction of pluripotent state. Quantitative analyses of H1 association with chromatin in vivo are complicated by accumulation of multiple closely related H1 isoforms, lack of specific antibodies, and complexity of substrates within the nucleus. We aim to establish an in vitro system to quantify H1 interactions with the nucleosome core particle, an approach that would require robust purification of linker histones. Our method allows for high yield recovery without using FPLC or HPLC due to the charge of H1, and its interactions with affinity chromatography matrix. This protocol is applicable for all H1 isoforms and yields tagless, pure H1 from 1L of *E. coli* culture, making in vitro protein studies of H1 accessible to a broad range of laboratories. Our current steps include surface plasmon resonance screens of compounds predicted to interact with H1 in molecular dynamics simulations, and alpha screen of fluorescently labeled H1 and nucleosome core particles, to identify small molecules or histone modifications capable of displacing H1 from the nucleosome. Fundamentally, we aim to regulate chromatin compaction in vivo, in a reversible manner, thus facilitating induction of pluripotency or differentiation.

Poster Abstracts

Biomedical and Health Sciences

Poster #112

Establishment of a Rodent-Tick-Rodent (RTR) Model of Tick-Borne Coinfections to Evaluate Pathogen-Targeted Biologics in Reservoir Hosts

Jolie Starling, Venkatesh Kumaresan, J. Seshu

Borrelia burgdorferi (*Bb*), *Babesia microti* (*Bm*), and *Anaplasma phagocytophilum* (*Ap*) are three of seven pathogens transmitted as single or coinfections by the bite of an infected Ixodes scapularis tick. Due to the lack of effective diagnostics and vaccines to combat the growing incidence of tick-borne diseases, as well as the burden of human disease expanding, there is a dire need for alternative strategies to block transmission of one or more pathogens from reservoir hosts to accidental hosts. We have established a rodent-tick-rodent model of coinfection with *Bb*, *Bm*, and *Ap* to determine the levels of pathogen acquisition and transmission from and to immunodeficient SCID and immunocompetent C3H/HeN mouse models and the natural reservoir host, Peromyscus leucopus. Replete tick larvae acquired *Bb*, *Bm*, and *Ap* from infected rodents and all three pathogens were transmitted to naïve rodents via infected nymph challenge. The kinetics of infection of the three pathogens are different and tick acquisition of the three pathogens shows long-term persistence in animals. Additionally, *Bb* burden in certain tissues, including the brain, is significantly higher in coinfected versus single infected animals. This transmission model can be exploited to study the host immune response to single and multiple tick-borne infections.

Poster #113

Mechanisms of Trigeminal Ganglia Sensitization and Chronic Facial Pain in Traumatic Brain Injury

Kimberly Baker, Melody Sandoval, Sean McFadden, Priscilla Gomez, Wesley Cohn, Emily Holder, Mike Fallabella, Kameel Zuniga, PhD, Lindsey Macpherson, PhD, Jack Hutcheson, PhD

Background: Traumatic brain injury (TBI) is a leading cause of chronic pain, with over half of patients experiencing persistent headaches and facial pain that severely impair quality of life. These symptoms are often linked to the trigeminal ganglion (TG), which innervates key facial regions, yet the mechanisms driving post-traumatic headache remain poorly understood. Here, we hypothesize that mitochondrial dysfunction and the resultant release of superoxide and related reactive oxygen species in trigeminal ganglion neurons play a central role in escalating pain sensitivity following traumatic brain injury. To this end, we tested whether a superoxide scavenger "TEMPOL" could reduce injury associated biomarkers when administered intravenously or intranasally and whether oxidative species were notably present in brain and TG. Traumatic brain injury (TBI) frequently leads to chronic headaches and facial pain. This may be caused by dysfunctional mitochondria in the trigeminal ganglion, a nerve cluster in the face. These damaged mitochondria release harmful reactive oxygen species, which increase pain sensitivity. Our study investigated whether an antioxidant (TEMPOL) could reduce injury indicators and confirmed the presence of these damaging molecules in the brain and the trigeminal ganglion after TBI.Objective: 1. Determine whether TEMPOL administered intravenously or intranasally improves outcomes associated with TBI and 2. Determine whether there is evidence of mitochondrial dysfunction in the trigeminal ganglia by measuring 4-HNE.

Poster Abstracts

Biomedical and Health Sciences

Poster #114

Vascular Cues Unlock Accelerated Growth and Sustain a Neurogenic Niche in Human Brain Organoids

Zacharie Maloney, Amber Elizalde, Christopher Rathbone, Jenny Hsieh

During human brain development, blood vessels infiltrate the cortex at the same time that neural tissue rapidly expands and matures, suggesting that vascular signals play an important role in brain formation. Human brain organoids (HBOs), widely used laboratory models of early brain development composed of engineered neural tissue derived from pluripotent stem cells, lack a vascular system, which limits their growth and developmental complexity.Here we show that microvessel fragments (MVFs) derived from adipose tissue can provide vascular cues that significantly enhance HBO development. Strikingly, direct incorporation of MVFs is not required to observe this effect. Simply exposing organoids to the molecules secreted by growing MVFs produces a similar, and more reproducible, enhancement of development. Organoids treated with this MVF-derived secretome develop an expanded SOX2+ neural progenitor layer as early as 30 days in vitro. These progenitor cells persist in a distinct neuroepithelial layer through at least 120 days of development, suggesting that vascular-derived signals may help establish and maintain a long-lived neurogenic niche within the organoids.Together, these results demonstrate that vascular-derived signaling alone can substantially improve the growth and developmental organization of HBOs, providing a simple and scalable strategy to enhance organoid models of human brain development.

Poster #115

Regulatory Mechanisms Controlling Sporulation in *Clostridioides difficile*

James Sewake, Dr. Megan L. Kempher

The bacterium *Clostridioides difficile* is an obligate anaerobe and the leading cause of hospital-acquired infections in the United States. It survives outside of the host as metabolically dormant spores that facilitate environmental persistence and transmission. Sporulation is an energetically demanding process and is primarily controlled by the master regulator Spo0A. However, the mechanisms governing the cellular decision to sporulate in *C. difficile* are not well understood. The Kempher laboratory previously identified a two-component system encoded by sciR and sciK that negatively modulates sporulation in *C. difficile*. Preliminary studies suggested that SciR regulates an important developmental checkpoint through the control of spoIIR, which encodes a signaling protein required to ensure the proper timing of the morphological steps of sporulation. In this study, we further investigated the relative contributions of Spo0A versus SpoIIR to this regulatory pathway. We found that mutating sciR to generate a nonphosphorylatable version of SciR derepressed spoIIR expression while maintaining spo0A expression. These results support a model in which SciR participates in a Spo0A-independent mechanism that regulates sporulation at the level of spoIIR expression. Together, these findings provide new insights into the complex regulation of sporulation in *C. difficile*.

Biomedical and Health Sciences

Poster #116

Modeling 18q Deletion Syndrome: Investigating the Impact of Dysmyelination on Synaptic Maturation and Network Propagation in Human Brain Assembloids

Jesus Vasquez, Sara Mirsadeghi, Jenny Hsieh

Chromosome 18q deletion (18q-) is a rare neurodevelopmental condition (1:55,000 live births) characterized by highly variable phenotypes due to unique hemizygous deletions. Clinical data from array Comparative Genomic Hybridization (aCGH) and psychometric testing indicate that dysmyelination is a hallmark feature, frequently contributing to epilepsy and social-cognitive deficits. While the minimal critical region of 18q contains several candidates, the loss of MBP (Myelin Basic Protein) and ZNF516 are hypothesized to be primary drivers of this dysmyelinating phenotype.To investigate the underlying mechanisms, we propose a human-derived assembloid model. We will generate myelinating organoids (oligodendrocyte-enriched) from iPSCs of individuals carrying 18-mutations and fuse them with cortical organoids to study the interplay between myelin and neuronal networks. We will utilize Immunohistochemistry (IHC) to characterize the distribution and expression of key synaptic markers, specifically VGAT/Gephyrin (inhibitory) and VGlut/PSD95 (excitatory), to determine whether 18q-induced dysmyelination disrupts synaptic stoichiometry and localization. Finally, we will utilize Microelectrode Array (MEA) recordings to quantify the functional consequences of 18q- loss. By comparing healthy myelinating assembloids to those with the 18q- mutation, we aim to test whether signal propagation within the cortical circuitry is significantly altered. This model seeks to elucidate how specific 18q- gene dosages disrupt human white matter development and contribute to the clinical presentation of epilepsy and network hyperexcitability.

Poster Abstracts

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Poster #117

Discovering the Role of Myeloid-Derived Suppressor Cell-Like Neutrophils Using a Vaccine Model of Pulmonary Valley Fever

Nawal Abdul-Baki, Reimi Navarro, Austin Negron, Matthew Mendoza-Barker, Althea Campuzano, Fariba Donovan, Kenneth Knox, Josh Malo, Neil Ampel, George R. Thompson, III, Chiung Yu Hung

Valley fever (VF) is a respiratory disease caused by *Coccidioides* and is estimated to cost over 3 billion in medical costs annually. In VF, the infiltration of Ly6G+ cells into the lungs has been reported in mice and humans, but the role of these cells has not been fully uncovered. Ly6G+ and Ly6C+ cells share a phenotype with myeloid-derived suppressor cells (MDSCs), which suppress protective immunity. We previously showed, Ly6G+ cells enriched from the lungs of non-protected mice, suppressed CD4+ T cell proliferation to a greater extent than those from vaccinated and naive mice. Moreover, adoptive transfer of Ly6G/C+ cells isolated from the lungs of Coccidioides-infected mice or derived from bone-marrow exposed to paraformaldehyde-killed spherules, into vaccinated recipients exacerbated disease. Thus, a portion of the infiltrated Ly6G+ cells comprise of MDSC-like neutrophils, which contribute to the pathogenesis. Parallelly, we have analyzed PBMCs from VF patients. We hypothesize CD15+ cells isolated from the PBMCs of VF patients will suppress CD4+ T cell function. PBMCs from recovered (n=18), pulmonary (n=5), and disseminated (n=13) VF patients were evaluated for CD15+ (HLA-DR-CD11b+CD15+). Flow cytometric analysis revealed that the composition of CD15+ myeloid cells in PBMCs from three patient cohorts was comparable, consistent with other reports of microbial infection conditions. A functional assay was performed in recovered (n=10), pulmonary (n=3), and disseminated (n=8) patients. Enriched CD15+ cells were combined with autologous CD4+ T cells at a 1:1 ratio with a-CD3/CD28 for 72 hours. Indeed, the CD15+ cells from disseminated and recovered patients significantly suppressed the percentage of CD4+ T cell proliferation. These data demonstrate that CD15+ myeloid cells from disseminated and recovered patients suppress CD4+ T cells, a function shared with suppressor cells. This discovery is parallel to our previous report that Coccidioides-infected mice recruit MDSC-like neutrophils into the lungs and exacerbate disease in mice. Our data provide an insight on the role of CD15+ myeloid cells in VF.

Biomedical and Health Sciences

Poster #118

Protective Efficacy and T cell Immunity Elicited by a Novel Recombinant Subunit Vaccine Against Valley Fever Infection

Reimi Navarro, Nawal Abdul-Baki, Austin Negron, Matthew Mendoza Barker, Althea Campuzano, Florentina Rus, Gary Ostroff, Chiung-Yu Hung

Valley Fever (VF) is a potentially fatal fungal disease caused by *Coccidioides*. Despite its designation by the WHO as a public health threat, no clinical vaccine exists. We previously created a recombinant *Coccidioides* antigen, rCpa1, with DRB1*04:01 (DR4) epitopes, but it is poorly expressed in E. coli. To enhance solubility and broaden HLA coverage, we removed 25 amino acids and incorporated three newly identified DRB1*03:01 (DR3) epitopes, generating the rCpa5 antigen. The latter was expressed using an *E.coli*-expression system with a production yield over 100-fold increase compared to rCpa1. The rCpa5 antigen was formulated using glucan-chitin particles (GCPs) as an Th1/Th17-promoting adjuvant/delivery system. We hypothesize that GCP-rCpa5 can protect against VF infection by activating Th1/Th17 responses. T cell epitopes were mapped by IFN-γ T cell recall assays by vaccinating C57BL/6 (BL/6), DR4, and DR3 transgenic (Tg) mice subcutaneously three times with GCP-rCpa5 (100μg & 10μg, respectively). We have identified 14, 11, and 9 novel T cell epitopes within rCpa5 by IFN-γ ELISPOT for BL/6, DR4, and DR3 mice, respectively. Vaccinated BL/6 and DR4 Tg mice, along with controls, were challenged intranasally to assess protective efficacy by survival (45 DPC) or fungal burden at 7 and 14 DPC. T cell responses in the lungs were also profiled using intracellular cytokine assays. GCP-rCpa5 vaccination conferred 90% survival in BL/6 and DR4 Tg mice, compared with 10% and 40% in controls, respectively. At 14 days post-challenge, vaccinated DR4 Tg mice showed a significant reduction in fungal burden in the lungs and spleen, associated with elevated Th1/Th17 responses compared to control mice. Furthermore, the durability of protection elicited by the GCP-rCpa5 vaccine was determined by challenging BL/6 mice one-year post vaccination. Vaccinated mice exhibited a 4 Log10-fold reduction in lung fungal burden and a 5 Log10-fold reduction in the spleen, along with elevated Th1/Th17 responses compared to controls. Additional groups vaccinated intramuscularly, intradermally, or oropharyngeally were compared to identify the optimal administration route. Comparable fungal clearance was observed across all four vaccination routes, indicating that systemic immunity confers protection. In this study, we found that the rCpa5 antigen contains multiple epitopes for the human MHC-II antigen presentation machinery, and the GCP-rCpa5 vaccine is effective and induces long-lasting protection against pulmonary *Coccidioides* infection for both laboratory and humanized mice. The vaccine-induced protection is associated with an elevated mixed Th1 and Th17 response These data support that GCP-rCpa5 vaccine is protective and worthy of further development for clinical application.

Biomedical and Health Sciences

Poster #119

Cytoskeleton Dynamics

Annitta George, Md Mohsin, Lorenzo Brancaleon, Marcelo Marucho

Microtubules (MTs) organize into various structures by modulating their physico-chemical and electro-mechanical properties. Their size and flexibility are crucial for maintaining the cell's mechanical strength and its ability to respond to external forces. Additionally, translational and rotational diffusion enhance MTs' capacity to locate and bind to targets. Therefore, understanding these properties accurately is essential for grasping their critical roles in cellular functions. In this study, we develop a comprehensive framework to characterize the effects of hydrodynamic interactions, polydispersity, bending, and stretching on the hydrodynamic and mechanical properties of MT solutions. The approach integrates dynamic light scattering (DLS), a reliable sample preparation protocol, and an optimized scattering theory for polydisperse semiflexible polymers. It overcomes common limitations related to methodological inconsistencies and modeling inaccuracies in polymer research. Our method yields accurate, reproducible results without exposing samples to extreme conditions. It directly derives asymmetric length distributions, decay-rate profiles, dynamic structure factors, diffusion coefficients, sizes, and bending parameters from autocorrelation functions measured under conditions that simulate the physiological environment. Our findings provide insights into how quickly MT conformations change and how energy dissipates within the cytoplasm, depending on their inherent rigidity. They are linked to the filament's internal dynamics and the influence of hydrodynamic interactions with the surrounding fluid. The results also help in understanding how rigidity, polymerization, and cellular environments affect MT structural adaptability and organization across different cellular compartments. Moreover, this framework clarifies how translational and rotational motions, combined with rigidity, shape their structural behavior and functional versatility. Overall, our work provides a quantitative analysis of semiflexible biopolymers and offers a new approach to studying filamentous systems under various intracellular conditions, supporting future studies of cellular organization and function.

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Poster #120
withdrawn

Poster #121
Methodology for Functionalized Enneamethine Cyanines Enables Synthesis of Diverse Fluorophores Above 850 nm
Jared Head, Hailee McCulloch, Isabella Vasquez, Alyssa Kornegay, Isak Matis, Syed Muhammad Usama, Indrajit Srivastava
Fluorescence imaging within the near-infrared (NIR) region has become an indispensable tool in clinical oncology, allowing for a non-invasive approach to real-time visualization of complex biological processes. Among the various NIR-emissive scaffolds, polymethine cyanine dyes stand out for their high molar absorptivity, tunable electronic structures, and compatibility with biological media. Accordingly, several design strategies to develop biocompatible NIR cyanine scaffolds have been explored such as polymethine chain extension, allowing for a direct synthetic approach to afford favorable red-shifts through highly-conjugated systems. However, achieving NIR emission above 800 nm while maintaining favorable physiochemical properties remains a challenge given the scarcity of synthetic pathways. To overcome this limitation, we report an innovative approach to polymethine functionalized enneamethine cyanines (Cy9) with strong NIR absorption and emission up to 900 nm. The developed strategy proceeds through a 7-carbon intermediate, OxA-chrom4, formed through enolate-driven ring opening of 3- and 4-substituted pyridinium benzoxazole salts. This two-step method provides access to a structurally diverse library of 22 enneamethine derivatives, representing the most extensive report of Cy9 fluorophores to date. Collectively, this work represents a clear advancement towards a synthetic platform for next-generation NIR cyanines for deep-tissue fluorescence imaging.

Poster Abstracts

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Poster #122

Evaluating Baboons as Preclinical Models of GGE: A Pilot Study of snRNA-Seq to Decode Gene and miRNA Expression

Emily Shrimpton, Mark Z. Kos, Dianne Cruz, Charles Akos Szabo, Melanie A. Carless

Genetic generalized epilepsies (GGEs) account for 20-30% of all epilepsy cases. For phenotypes that closely resemble human epilepsy, several mouse models have been developed that employ either electrical or chemical-induced epilepsy-like attributes, however the translatability of such models is hindered by differences in both neurodevelopment and brain anatomical structure, along with a lack of natural disease onset and progression. Thus, generation of a robust preclinical model that can recapitulate human physiological and neuroanatomical structure and function is of high importance. Baboons represent a natural model for GGE and therefore in this study we aim to assess gene and miRNA transcriptional profiles to determine the relevance of baboons as preclinical models of epilepsy. Since the medial orbitofrontal cortex (mOFC) is a known node in corticothalamic networks, exhibiting early neurodevelopmental abnormalities, blood flow changes, and is implicated in seizures, we isolated this region from a pilot cohort of four baboons (n=2 epilepsy, n=2 controls) and performed single-nuclei RNA sequencing. Several genes involved in angiogenesis and vascular/ neurodevelopmental pathways were upregulated in epileptic baboons, whereas, primary miRNAs modulating similar pathways, were concomitantly downregulated. We also observed cell-specific dysregulated networks of miRNAs in glutamatergic and GABAergic neurons, highlighting the importance of vascular and neurodevelopmental processes.

Poster #123

Characterizing Interkingdom Biofilm interactions Between *Candida albicans* and *Serratia marcescens*

Sofia Lozano, Vina Manouchehri, Jesús A. Romo

Introduction: *Candida albicans* is an opportunistic pathogenic fungus and colonizer of the alimentary tract, where it interacts with members of the microbiome, influencing colonization and pathogenesis. We have shown that the opportunistic bacterial pathogen, *Serratia marcescens*, interacts with *Candida albicans* in vitro, potentially influencing host-pathogen interactions. Hypotheses/Goal: We hypothesize that *S. marcescens* influences *C. albicans* morphogenetic transitions in biofilms. The present study aims to characterize the mechanism(s) involved in these interactions. Methodology: To determine the impact of bacterial cell density on biofilm formation, *C. albicans* (2 × 106 cells/mL) was co-cultured with *S. marcescens* at distinct concentrations (10-2 - 10-6) for 24 hours. To determine the effect of *S. marcescens* on distinct *C. albicans* biofilm maturation stages, *S. marcescens* was introduced to 0, 6, 12, 18, and 24-hour-old biofilms. Plates were incubated at 37 °C in 5% CO_2 for 24 hours after introducing bacteria. Biofilm biomass was quantified using the Crystal violet assay. Results: During co-culturing, fewer *C. ablicans* filaments were detected, suggesting that *S. marcescens* modulates fungal morphology. No significant differences in *C. albicans* viability were detected, suggesting the mechanism is not cytotoxic. Conclusions: Determining the mechanism behind these interactions will inform the management of polymicrobial infections.

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Poster #124

From Neurotoxicity to Leukocyte Attraction: The Impact of Astrocyte TNFR2 on Multiple Sclerosis Pathogenesis

Kyle Pressley, Zeynep Dulkadir, Mary Jo Valencia, Itay Raphael, Thomas G. Forsthuber

Multiple sclerosis (MS) is a chronic autoimmune demyelinating disease characterized by leukocyte infiltration into the central nervous system (CNS). Astrocytes play critical roles in regulating neuroinflammation during MS, yet the contribution of TNFR2 signaling to astrocyte function remains poorly defined. To investigate this we used global (DR2bΔR2) and astrocyte-specific TNFR2-deficient (cKO) mice with experimental autoimmune encephalomyelitis (EAE), the mouse model of MS. Our studies indicate that astrocyte TNFR2 is a key regulator of pathogenic astrocyte responses during EAE. Single-cell RNA sequencing of DR2bΔR2 astrocytes revealed increased neurotoxic astrocyte functions, including enrichment of antigen presentation and inflammatory pathways. Flow cytometry of CNS tissue from cKO mice revealed significantly increased infiltration of CD4 T cells, myeloid cells, and neutrophils, accompanied by increased astrocyte and microglia activation. Spinal cord cytokine profiling of cKO mice revealed elevated TNF, IL-17, IL-12(p40), and CCL2, and TNFR2-deficient mixed glial cells cultures produced more C3 and CCL2 in response to inflammatory stimuli. At chronic EAE, leukocytes remained elevated in CKO spinal cord, astrocytes maintained increased S100A10 expression, and myelin levels remained low, indicating impaired resolution of neuroinflammation. Taken together, these findings indentify TNFR2 as a critical regulator that suppresses neurotoxic astrocyte polarization, reduced CNS leukocyte infiltration, and attenuates both acute and chronic pathology.

Poster #125

A New Technique to Promote Membrane Tension Using Photoswitchable Lipids

Patrick Kollias, Dr. Carlos Bassetto

Mechanical forces within the cell membrane influence biological processes, including mechanotransduction in sensory systems such as touch and pressure detection which is mediated by the gating of PIEZO1and 2 channel. State-of-the-art techniques for mechanosensation probes still need improvements and suffer from indirect or limited resolution of the tension applied, and lower resolution related to the speed of the stimulation. Here we develop an approach, photomechanical stimulation, which combines photoswitchable lipids (OptoDArG) with whole-cell patch clamp. This new technique allows us to optically modulate the tension of the membrane under voltage-clamp. We label HEK293 piezo 1 knockout cells with OptoDArG and use ultraviolet and blue light pulses to promote photoisomerization of the photolipid, producing rapid changes in membrane surface area and thickness that generate optocapacitive currents. We use voltage steps and the complex analysis of the impedance to measure membrane capacitance. Because membrane capacitance increases with membrane surface area and decreases with bilayer thickness, these measurements can potentially provide a readout of changes in membrane tension without the need of external probes. Preliminary recordings show reproducible optocapacitive currents and measurable capacitance changes in OptoDArG labeled cells.

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Poster #126

Methods in Modulating Temperature Jump Systems for Voltage-Clamp Technique

Jesus Uresti Mireles, Carlos Bassetto

The Temperature Jump (Tjump) technique allows the study of the energy landscape of voltage and temperature-dependent ion channels. Generating sustained temperature pulses (Tstep) based on Tjump technique is possible by modulating the laser pulses, but it is time-consuming and requires empirical validation and tuning. This project aims to create an automated system using computational methods and feedback systems to generate Tsteps. We adapted the heating diffusion model described in a study on photothermal heating of gold nanoparticles (DOI: https://doi.org/10.1016/j.neuron.2015.02.033) to the melanin present in the oocyte membrane. Then, we used this model to fit experimental temperature time courses. Next, we used the fitted parameters to simulate the laser-induced temperature on the oocyte cell membrane and ultimately to generate laser pulses to achieve sustained temperature (Tstep). Additionally, we designed a feedback system using an analog circuit to maintain the pulse modulation to generate Tsteps. We believe that these systems will help improve Tstep techniques applied to voltage-clamp technique for oocytes.

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Poster #127

Natural Variation in Sex Chromosome Drive Enables the Identification of Putative Drive Factors on the *Drosophila albomicans* Neo-X Chromosome

Joel Osegueda Delgado, Cassandra Spondike, Jeffrey Vedanayagam

Gametogenesis is a conserved biological process that produces gametes for reproduction. During gametogenesis, chromosomes split and segregate equally, ensuring that gametes retain only one copy of each chromosome. However, selfish genetic elements such as meiotic drive genes are known to frequently 'cheat' equal segregation principles to propagate their own transmission to the gametes. When meiotic drivers occur on sex chromosomes in males, they cause unequal transmission of X and Y chromosomes, resulting in a skewed sex ratio among offspring—a phenomenon known as sex chromosome drive. Sex chromosome drive often reduces host's reproductive fitness, and an imbalanced sex ratio can be detrimental to the species. As a result, strategies to counteract drive evolves to restore equal segregation of X and Y chromosomes, but the identities of meiotic drive genes in most cases, and the mechanisms of host suppression, remain unknown. Only a few meiotic drivers have been identified at the gene level so far, and none have had their molecular mechanisms fully elucidated. Here, we study sex chromosome drive in hybrids between *D. albomicans* and *D. nasuta*—two relatively young *Drosophila* species in the immigrans group. Our work builds on a prior genetic study that identified four quantitative trait loci (QTL) associated with sex chromosome drive in *D. albomicans*. Since these QTLs are predicted to contain genes responsible for sex chromosome drive, we performed third-generation sequencing, and testis transcriptomics from the *D. albomicans* driving strain and characterized 1008 annotations, of which, 526 genes are expressed in the testis within the major effect QTL (QTL1). As sex chromosome drive occurs primarily in hybrids, we hypothesize that the loss of suppression in hybrids may result in the misexpression of meiotic drive genes. To identify putative meiotic drive gene(s) within QTL1, we performed comparative transcriptomics from testes in *D. albomicans* and *D. nasuta* and identified 6 genes that are upregulated in F1 *D. albomicans* (♀) X *D. nasuta* (♂) hybrids, of which, MYH01-18694 is a multi-copy gene on the D. albomicans neo-X chromosome that we are currently investigating its potential role in sex chromosome drive. Additionally, we also seek to validate our putative meiotic driver using three *D. albomicans* strains that lack sex chromosome drive. Overall, our study aims to uncover novel sex chromosome drive genes, which will pave the way for mechanistic investigations into sex chromosome drive and its effects on genome and sex chromosome evolution.

Poster Abstracts

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Poster #128

Development of Potent and Selective YAP-1 Inhibitors Towards Cancer: Lead Optimization and In Vitro Proof-of-Concept Studies

Leslie Barrera, Radhika Amaradhi, Marie El Arba, Uttara Saran, Praveen Barrodia, Suresh Satpati, Bishal Singh, Kunal Rai, Stanton McHardy

YAP1 is a potent oncogene that drives tumorigenesis and metastasis in various cancers. YAP1 is dispensable for the homeostasis of most adult tissues as evidenced by the relatively mild phenotypes of the YAP1 knockout mouse model suggesting that it could be a novel therapeutic target. From high-throughput screening, we identified several compounds with a core structure that degrade YAP1 protein. Structure Activity Relationship (SAR) studies followed by extensive validation identified a lead molecule, RL-77, which degrades YAP1 at nanomolar concentrations. RL-77 inhibited the proliferation of YAP1-dependent cell lines in vitro and reduced tumor growth in a xenotransplantation mouse model. Two potent PROTACs, RLP-88 and RLP-89 that degrade YAP1 at low nanomolar concentration were identified. RL-77 has excellent stability in the plasma in vitro, however preliminary pharmacokinetic analysis suggested that RL-77 is rapidly cleared in mice. Considering this, we further synthesized small molecules and PROTACS around RL-77 and RLP-88 aiming to develop molecules with improved potency, pharmacokinetic properties and selective YAP1 protein degradation. Our aim is to develop clinical compounds for the inhibition of YAP1dependent cancers. The lead optimization strategies, potency and selectivity (structure activity relationship, SAR), in vitro data of the novel compounds will be presented in the meeting.

Poster #129

Regulation of Neurogenesis and Neuronal Migration by Rrm2 and Timp3 Following Seizures

Adebayo Adeyeye, Parul Varma, Nico Enerlan, Marissa Coppin, Jenny Hsieh

Temporal lobe epilepsy is associated with aberrant neurogenesis and ectopic migration of adult-born granule cells (abGCs), yet the molecular mechanisms driving these changes remain poorly defined. Using a pilocarpine-induced mouse model of temporal lobe epilepsy and chemogenetic silencing of abGCs via Designer Receptors Exclusively Activated by Designer Drugs (DREADDs), we previously demonstrated that abGC inhibition reduces both ectopic migration and seizure susceptibility. To identify underlying molecular regulators, we performed RNA sequencing of FACS-isolated abGCs and identified Rrm2 and Timp3 as top candidate genes modulated by seizure activity and neuronal silencing. To assess their functional roles, we pharmacologically inhibited Rrm2 with Triapine (3-AP) and Timp3 with the LXR agonist T0901317 (T09). Inhibition of Rrm2 significantly reduced seizure frequency, decreased hilar abGC migration, and altered the proportion of immature neurons arising from dividing progenitors. While T09 treatment did not significantly alter Timp3 transcript levels, it increased the number of DCX+ neurons in the hilus without affecting seizure burden, suggesting an effect on neuronal migration independent of robust Timp3 knockdown. These findings highlight distinct roles of Rrm2 and Timp3 in hippocampal plasticity following seizures. Together, these data identify new molecular targets for modulating aberrant neurogenesis in epilepsy.

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Poster #130

Complete Genome of Multidrug-Resistant Shiga Toxin-Producing *Escherichia coli* O111:H8 Strain UTAK-22: Plasmid Inventory, Antimicrobial Resistance, Virulence, and Conjugation Phenotypes

Irvin Rivera, Anwar Kalalah, Sara S.K. Koenig, Mariana Sainz Garcia, Felix Borrego, Jacob Alford, Joseph M. Bosilevac, Mark Eppinger

Shiga toxin-producing *Escherichia coli* (STEC) are important foodborne pathogens whose virulence depends on phage-encoded Shiga toxins. Because antibiotic treatment is generally contraindicated, antimicrobial resistance in STEC remains underexplored. Here, we characterized the complete genome and conjugation-associated phenotypes of multidrug-resistant (MDR) STEC O111:H8 strain UTAK-22. Antimicrobial resistance, virulence genes, and mobile elements were identified. Resistance determinants spanning six antibiotic classes were located on three conjugative MDR plasmids. Plasmid incompatibility groups were consistent with low copy number and broad host range within E. coli, and one plasmid carried a hybrid incompatibility profile suggestive of expanded dissemination potential across *Enterobacteriaceae*. Five resistance genes were embedded within two class 1 integrons. Two MDR plasmids encoded the enterohemolysin (ehxCABD) operon, which was highly conserved in major STEC serogroups. Phenotypic testing confirmed resistance to the predicted antibiotic classes, often exceeding CLSI breakpoints. Streptomycin resistance was associated with overlapping mechanisms encoded by aadA2, aph(6)-Id, and aph(3″)-Ib. Conjugation assays in a WG5 background showed that plasmid combinations increased streptomycin tolerance relative to single-plasmid strains. These findings highlight the genomic plasticity and mobility of plasmid-linked MDR and virulence loci in STEC and the role of conjugative plasmids in the potential dissemination of these pathogenicity traits into larger host populations.

Biomedical and Health Sciences

Poster #131

Juvenile Hormone Signaling Regulates N-Cadherin Expression in the Male Germline Stem Cell Niche

Krystal Goyins, Azeezat Adewale, Lia Sorrell, Samantha Cocita, Yashfa Naseem, Lacy J Barton

Isoprenoid signaling molecules regulate development and fertility across the animal kingdom. Despite their essential and diverse functions, where, when and how they support fertility is not well understood. To overcome challenges in detection and manipulation of lipophilic isoprenoids, our lab studies juvenile hormones (JHs) in the genetically tractable *Drosophila melanogaster* fly model. Our lab developed a fluorescent JH reporter to investigate where JH signaling is active in developing and adult gonads. I found that JH signaling is active in the male germline stem cell (GSC) niche in developing and adult stages, whereas JH signaling in the ovary is highly dynamic across development. Since far less is known about the role of JH signaling in male fertility, we first focused on the role of JH signaling in the testis and how it supports male fertility. We first measured fertility in males lacking either a key JH synthesis enzyme or one of two classes of JH degradation enzymes and found that both JH synthesis and degradation are required for male fertility. Next, we investigated how JH signaling supports GSC niche function in JH transcription factor mutants. We found that N-Cadherin, a marker of the GSC niche, was absent in testes lacking the JH transcription factors, suggesting either N-Cadherin is a target of JH signaling or niche cell identity was compromised. To determine if niche identity was affected, we knocked down the JH transcription factors and assessed the expression of multiple niche markers. We found that only N-Cadherin expression was reduced, suggesting N-Cadherin is a target of JH signaling. Further supporting this conclusion, we found that genetically increasing JH titers increased N-Cadherin mRNA expression levels relative to wildtype controls. Together, these data not only revealed a new function for JH signaling in male fertility but also revealed a new JH signaling target. Next, we will determine if JH signaling in the niche is required for male fertility and if JH functions through N-Cadherin expression in the niche. More broadly, these results will provide insights into the functions of isoprenoid signaling in development and fertility.

Poster Abstracts

Biomedical and Health Sciences

Poster #132

Interkingdom Interactions as a Platform for Antifungal Drug Discovery

Vina Manouchehri, Jesús A. Romo

Introduction: While we are just beginning to understand how bacterial microorganisms communicate with each other, interactions between bacteria and fungi are underexplored. Previous studies, including from our own group, have shown that *C. albicans* interacts directly with bacteria and these interactions can be synergistic (e.g. *Streptococcus mutans*) or antagonistic (e.g. *Pseudomonas aeruginosa*). Hypotheses/Goal: We hypothesize that defining interkingdom interactions, can reveal novel therapeutic targets. The goal of the present study is to co-culture a library of bacterial species with *C. albicans* to identify interkingdom interactions. Methodology: *C. albicans* SC5314 was co-cultured with 18 distinct bacterial strains using a biofilm formation assay in 1:1 media (TSB:RPMI). *C. albicans* (2 x 106 cells/mL) was cultured with a 1:10 or 1:100 dilution of each bacterium and seeded into 96 well plates. Plates were incubated for 24 hours at 37 °C in 5% CO_2. Biofilm biomass was quantified using the Crystal violet assay. Results: We have identified interactions that enhance or prevent overall biofilm biomass with some recapitulating previously reported findings (e.g. *Enterococcus faecalis* and *Streptococcus pyogenes*) while others are novel phenotypes (e.g. *Alcaligens faecalis*). All interactions reduced or fully inhibited *C. albicans* filamentation, underscoring their complexity. Conclusions: Our findings i) underscore the value of our screening platform as several interactions recapitulate previous published findings, ii) have identified multiple interkingdom interactions that inhibit *C. albicans* filamentation, a key virulence factor. In future studies, we will test distinct culturing conditions (e.g. media) and characterize interactions in the context of mature *C. albicans* biofilms.

Poster #133

Endocannabinoid Modulation of Chronic Peripheral Pain and Its Therapeutic Potential

Ziying Fang

Chronic peripheral pain, driven by persistent nociceptor activity and inflammatory sensitization, remains a significant clinical challenge due to the limitations of current pharmacotherapy. The endocannabinoid system (ECS) has emerged as a promising therapeutic target due to its role in modulating neuronal excitability and immune responses. This review examines the mechanisms of ECS-mediated antinociception, focusing on the roles of CB1 and CB2 receptors and the metabolic enzymes FAAH and MAGL. Preclinical evidence suggests that peripherally restricted CB1 agonists and positive allosteric modulators (PAMs) offer analgesic efficacy while avoiding central nervous system-mediated psychoactive effects. Clinical data demonstrate potential in neuropathic pain populations, though variability in delivery and dose-limiting side effects persist. This review concludes that future therapeutic success depends on achieving target selectivity and the development of biomarkers to confirm ECS engagement.

Poster Abstracts

Biomedical and Health Sciences

Poster #134

Evaluating the Photodynamic Antimicrobial Efficacy of a PPIX-BME Adduct Against *E. coli*

Chantal Estrada, Dr. Lorenzo Brancaleon

This study evaluates a novel photosensitizer created by covalently modifying Protoporphyrin IX (PPIX) with bis-maleimidoethane (BMOE). Spectroscopic analysis confirms successful synthesis via Diels-Alder reaction, showing enhanced fluorescence and modified electronic properties. We present a protocol to test this adduct against *E. coli* using 660–690 nm light to evaluate its potential for oxygen-independent antimicrobial activity.

Poster #135

Exploring the Phenotypic Diversity of Environmental *Nakaseomyces glabratus*

Oscar Reyes Parker, Taylor Hearne, Kendall Esparrago, Paola Zucchi, PhD

Nakaseomyces glabratus is an opportunistic pathogenic fungus and human gastrointestinal (GI) tract colonizer. It is also found in the environment, where it is exposed to diverse stressors (e.g., desiccation, heat, competitors). Despite its clinical importance, a significant knowledge gap exists about how environmental adaptations influence its virulence. We hypothesize that non-mammalian environmental adaptation influences clinically relevant traits. Four environmental isolates of *N. glabratus* were compared to two lab adapted strains in growth assays, biofilm formation, antifungal susceptibility, and stress responses. To determine growth phenotype, isolates were cultured at 30ºC and 37°C in YPD or RPMI media. Biofilm assays were performed in RPMI at 37°C and quantified using Crystal violet. Antifungal susceptibility was determined via minimum inhibitory concentration. Response to stressors was determined by growing strains in distinct chemical stressors (e.g., SDS, and Caffeine). We found that two environmental isolates displayed growth defects at 30°C in YPD, while all isolates grew comparably at 37°C. No significant differences in drug susceptibility or biofilm formation were observed. Stress response varied across isolates. Overall, our findings suggest that clinically relevant traits of *N. glabratus* are present before encountering a mammal. However, characterization of a larger isolate collection is required.

Poster Abstracts

Biomedical and Health Sciences

Poster #136

Optimization of Extra-Long Gold Nanorods Synthesis for the Optical Absorbance in the 808 nm Range via Varying Seed Volumes

Simone Prieto, Katheryn M. Mayer PhD, Anjelyka Fasci BS, Laura Escobar, R. Lyle Hood, PhD

Pancreatic cancer, although one of the most difficult cancers to diagnose, remains one of the most ubiquitous cancers worldwide. In the majority of cases, diagnosis only occurs after the illness has progressed beyond its earliest and most treatable stages. To address this obstacle, the Fiberoptic Microneedle Device (FMD) has been developed to specifically target pancreatic cancer cells through a combined delivery of gold nanoparticles and photothermal therapy within the 808 nm wavelength range. However, synthesizing batches of extra-long gold nanorods that meet the required optical properties required for medical applications consistently proves difficult. The objective of this research was to optimize the synthesis of extra-long gold nanorods with peak absorption in the 808 nm region. To accomplish this, we incorporated a surfactant-directed, seed-mediated bottom-up chemical synthesis method derived from Manrique-Bedoya et al. and tested variations in the seed solution volume compared to the original protocol. UV-Vis spectroscopy was used to observe the plasmonic properties of the synthesized extra-long gold nanorods. Our results suggested that increasing the seed solution volume led to an enhanced nanorod absorption near ~800 nm, a wavelength range acceptable for integration with the FMD. These results indicate that the modified synthesis approach can procure gold nanorods with the desired optical properties suitable for the FMD application; however, additional experiments are necessary to confirm consistency and reproducibility of production of the gold nanorods within the desired absorption range.

Poster #137

Characterizing a Novel Fungal Calcineurin Signaling Pathway in *Candida albicans*

Mariam Akhtar, Dr. Stephen Saville, Luke Heck, Kimberly Garcia

The limited number of antifungal treatments currently available, and rising prevalence of drug resistance, necessitates the urgent development of novel therapeutic options. It has been shown that inhibiting calcineurin impacts the virulence of many fungal pathogens. Unfortunately, calcineurin is highly conserved, limiting its utility as a direct target. Indeed, calcineurin inhibitor drugs already exist but are used to prevent transplant rejection due to their impact on the immunesignaling pathway leading to the transcription factor NF-AT. However, other calcineurin controlled pathways exist and we believe that characterizing these will identify cellular components which could be targeted without the unwanted immunosuppression.We therefore screened a library of Candida albicans transcription factor mutants for strains displaying resistance to calcineurin inhibitors: this identified Gln3. Since previous studies in Mucor circinelloides demonstrated a role for general amino acid permeases in sensitivity, we examined GAP gene expression in the gln3 mutant: this revealed that, unlike the situation in the wild-type parent, the GAP1 gene is only modestly upregulated in the gln3 mutant during calcineurin inhibition. We hypothesize that Gln3-dependent GAP1 regulation contributes to drug sensitivity. This will be tested by overexpressing GAP1 in the gln3 mutant and determining whether this restores sensitivity to calcineurin inhibitors.

Poster Abstracts

Biomedical and Health Sciences

Poster #138

Impact of RPP Protein Within Phage Inducible Chromosomal Island II on Helper Phage Infection in *Francisella novicida*

Mosi Jones, Lindsey Winograd, Janie A. Alonso, Zackary Armstrong, Cedric Carr, Xhavit Zogaj, Karl E. Klose

Francisella tularensis (*Ft*) is a Gram-negative coccobacillus that causes Tularemia. It is a category A select agent, and as such it has a low infectious dose and high lethality rate. Currently, there is no approved vaccine in the U.S, increasing the necessity for alternative treatments. Phage-inducible chromosomal islands (PICIs) are mobile genetic elements that hijack helper phage machinery for their own dissemination. *Francisella novicida* (*Fn*), a model organism for *Ft*, has two PICIs. *Fn* is unable to be infected by the KIRK helper phage. Within PICI II it is hypothesized that the redirected phage packaging protein gene (RPP) may be the main reason KIRK phage is unable to infect *Fn*. By creating a *Fn* strain containing a RPP knockout and a separate strain lacking PICI II with a RPP complementation plasmid, the effects of these mutations on the ability to be infected by helper phage can be monitored. These studies may lead to novel PICI-based therapeutics against tularemia.

Poster Abstracts

Biomedical and Health Sciences

Poster #139

LIPA Inhibition Enhances the Therapeutic Efficacy of DNA-Damaging Agents in Ovarian Cancer Through Induction of ER Stress and Enhancing DNA Damage

Durga Meenakshi Panneerdoss, Tae-Kyung Lee, Khaled Mohamed Nassar, Scott Elmore, Henry Neal, William Cole Arnold, Edward R. Kost, Suryavathi Viswanadhapalli, Jung-Mo Ahn, Ganesh V. Raj, Ratna K. Vadlamudis

Ovarian cancer (OCa) is the most lethal gynecologic malignancy in the United States, largely due to limited early detection and the development of chemoresistance following initial treatment. This highlights the need for improved therapeutic strategies. Recently, our team identified ERX-208, a novel molecule with strong activity against OCa cells. ERX-208 targets lysosomal acid lipase A (LIPA), inducing endoplasmic reticulum (ER) stress, disrupting protein synthesis, and promoting apoptosis. The objective of this study is to evaluate the potential of ERX-208 to enhance the efficacy of FDA-approved chemotherapeutics. We performed in vitro screening of 147 FDA-approved chemotherapy drugs in combination with ERX-208 to assess effects on OCa cell viability. Dose-response data were analyzed using SynergyFinder Plus. To validate synergistic effects, we conducted cell proliferation, colony formation, cell cycle, apoptosis, invasion, DNA damage, and comet assays. Preclinical studies using patient-derived organoids (PDO) and xenograft (PDX) models evaluated combination efficacy in clinically relevant systems. Drug-combination screening identified multiple synergistic pairs in OCa models. SynergyFinder analysis revealed strong sensitivity and synergy scores for several DNA-damaging agents. ERX-208 monotherapy inhibited OCa cell growth in vitro and in vivo, consistent with its induction of LIPA-dependent ER stress. Combination treatments with paclitaxel or cisplatin further amplified these effects, significantly reducing viability across OCa cell lines. Mechanistic studies showed enhanced gamma-H2AX accumulation, increased DNA damage, robust induction of ER stress markers, and reduced invasion following combination treatment. In PDO and PDX models, ERX-208 combined with DNA-damaging agents produced marked tumor suppression beyond monotherapies, confirming translational relevance. ERX-208 also reduced viability of therapy-resistant OCa models in vitro and inhibited xenograft growth in vivo. These findings support ERX-208 as a potent ER stress-inducing agent that enhances the therapeutic efficacy of standard chemotherapies in OCa models. The patents surrounding ERX-208 are licensed to EtiraRx.

Poster Abstracts

Biomedical and Health Sciences

Poster #140

Male Infertility Caused by Enzyme-Catalyzed DNA Deamination and Uracil Excision

Austyn Lucero, Yaxi Wang, Reuben Harris

The DNA deaminase APOBEC3B (A3B) contributes to mutagenesis in over 50% of cancers by converting cytosine to uracil in single-stranded DNA. A murine model expressing tumor-like levels of human A3B (Rosa26CAG-A3B/+) exhibits male-specific infertility, characterized by embryonic arrest at the 4-cell stage, and increased tumorigenesis beginning at 18 months (PMID:37797615). This study investigates the mechanism underlying infertility, focusing on interactions between A3B and uracil DNA-glycosylase (Ung), a base excision repair enzyme that removes uracil lesions. Uracil excision generates abasic sites that are cleaved by Ape1, initiating repair. We hypothesize that excessive uracil lesions overwhelm this pathway, leading to incomplete repair, DNA fragmentation, and genomic instability.To test this, customized alkaline and neutral COMET assays were developed and used to quantify DNA damage in sperm from four mouse cohorts: wildtype, Rosa26CAG-A3B/+, Ung knockout, and Rosa26CAG-A3B/+;Ung-/-. Results show significantly increased DNA damage in Rosa26CAG-A3B/+ sperm compared to wildtype, with damage significantly reduced upon Ung knockout. Comparison of alkaline and neutral COMET assays indicates that the damage is predominantly single-stranded. These findings support a model in which A3B-induced deamination and Ung-mediated excision synergistically generate excessive DNA breaks, driving male-specific infertility.

Poster #141

Natural Transformation in *Vibrio vulnificus*

Vivian Smith, Venus Stanton, Carlos Candanosa, Karl E. Klose

Vibrio vulnificus (*Vv*) is a Gram-negative halophilic bacterium that causes vibriosis, a disease characterized by gastrointestinal illness, with complications that can include severe necrotizing infections and septicemia. Developing genetic tools for *Vv* is essential for the development of therapeutics against vibriosis.Multiplex Genome Editing by Natural Transformation (MuGENT) is a genetic manipulation technique utilized in other *Vibrio* species. Natural transformation can be induced in *Vibrio* species, causing them to take up exogenous DNA and integrate it into their chromosome. Natural transformation can be induced by plasmid-based induction of the competence regulators TfoX and QstR, which induce the pilus formation that is responsible for DNA uptake.In efforts to optimize MuGENT as a genetic tool for *Vv*, we varied the length of flanking homology needed for maximum transformation efficiency of a DNA fragment that contained a deletion of flrC. FlrC is a σ54-dependent activator essential for flagellar synthesis, and thus, motility of co-transformants in soft agar was monitored to evaluate transformation efficiency.

Poster Abstracts

Biomedical and Health Sciences

Poster #142

Increased Parental Age Compromises Early Embryonic Germline Development

Amira El-Sheikh, Samuel Jones, Rosario Lopez-Roca Fernandez, Lacy J Barton, PhD

Among sexually reproducing species, genetic material is passed from one generation to the next by the germline. The germline consists of egg and sperm, as well as their precursors called Primordial Germ Cells (PGCs). PGCs are among the first cell types specified in developing embryos and thus have to migrate through several tissues to reach the developing ovaries and testes. Using Drosophila melanogaster as a model, my lab found that increased parental age compromises PGC migration in offspring. Although advanced parental age is known to impair fertility and offspring health, its specific impact on germline development is less understood. We investigated whether age-related DNA damage is a cause for PGC migration defects. We crossed three wild-type Drosophila lines to minimize inbreeding effects and confirmed age-dependent PGC mis-migration. To test whether DNA damage in gametes explains these defects, we stained 3-day-old and 15-day-old gametes with γ-H2AV to mark double-strand breaks. Across all three backgrounds, aged females showed no significant increase in γ-H2AV foci, suggesting that age-related PGC migration defects are not driven by DNA damage and likely arise from alternative mechanisms.

Poster #143

Effects of Sound on Semantic Processing in ADHD: An EEG Study of the N400

Samantha Holt, Dr. Nicole Wicha, Antonio Allevato

Attention-deficit/hyperactivity disorder (ADHD) is characterized by deficits in sustained attention, which may impact language comprehension during reading. The purpose of this study is to investigate whether individuals with ADHD. show differences in semantic processing compared to neurotypical individuals. Participants completed a sentence comprehension task under two conditions: silent and noisy. In the noisy condition, participants also performed a secondary task requiring them to occasionally identify “pings.” Sentences varied in contextual strength (strong vs. weak) and expectancy (expected vs. unexpected target words), forming a 2 × 2 design. Electroencephalography (EEG) was used to measure the N400 component, an event-related potential (ERP) associated with semantic processing. We hypothesize that N400 amplitudes will be larger in the silent condition, reflecting differences in semantic processing efficiency. Additionally, this study explores how the presence of background noise and an embedded secondary task influences N400 responses—either impairing processing due to increased attentional demands or enhancing engagement through increased stimulation. Findings from this study will provide insight into how attentional challenges and environmental factors interact to influence language comprehension in individuals with ADHD.

Poster Abstracts

Biomedical and Health Sciences

Poster #144

Functional Characterization of PLCε Catalytic Activities

Sarthak Mohanty, Rahul M. Mojidra, Maria E. Falzone

Cells respond to their environment through signal transduction, where extracellular cues activate transmembrane receptors and initiate intracellular signaling cascades. Phospholipase C (PLC) enzymes are key intermediates, hydrolyzing phosphatidylinositol 4,5-bisphosphate (PIP2) to generate inositol trisphosphate (IP3) and diacylglycerol (DAG). IP3 triggers Ca^{2+} release from the endoplasmic reticulum, while DAG activates protein kinase C (PKC), together promoting cell growth and metabolism—pathways often dysregulated in cancer. Positioned downstream of G-protein coupled receptors and receptor tyrosine kinases, PLCε integrates signals through regulation by small regulatory proteins. Unlike other PLC isoforms, PLCε contains additional domains that enable dual functionality as both a phospholipase and a guanine nucleotide exchange factor (GEF). Through its GEF activity, PLCε can also activate small regulatory proteins called GTPases, contributing to oncogenic signaling. However, the structural and regulatory mechanisms coordinating these dual functions remain poorly understood. Prior studies relied on truncated PLCε constructs lacking regulatory domains due to challenges in expressing the full-length ~230 kDa protein, limiting mechanistic insight. Here, we optimized purification of full-length PLCε to enable functional interrogation of the intact protein. Using fluorescence-based assays, we quantify lipase activity via PIP2 hydrolysis and assess GEF activity through nucleotide exchange assays across small GTPases. This integrated framework enables direct investigation of how PLCε coordinates signaling outputs in oncogenesis.

Poster #145

BIGH3/TGFB1 Regulates Collagen Assembly, Enhances Fiber Diameter, and Mediates Skeletal Muscle Cell Adhesion

Abigail Hernandez, Paola Rico, Ivan Orellana, Richard G. LeBaron

Background: Robust tissue-implant integration requires an extracellular matrix (ECM) that provides both mechanical strength and a substrate for cell adhesion. TGF-β upregulates BIGH3, an ECM protein implicated in adhesion, yet its role in collage organization remains loosely defined.Objective: Examine whether BIGH3 associates with collagen type I (Col-I) and how this interaction influences matrix assembly and skeletal muscle cell behavior. Methods: BIGH3 localization in Col-I-rich tissues was analyzed using immunohistochemistry and electron microscopy. Protein interactions were assessed by immunoprecipitation. Collagen fibrillogenesis was evaluated using turbidity assays, and skeletal muscle cell adhesion was examined using substratum assays. Results: BIGH3 localized along Col-I fibers in myotendinous junctions and corneal stroma and directly associated with Col-I. Functionally, BIGH3 altered fibrillogenesis kinetics, increasing nucleation lag time and final turbidity, consistent with enlarged fiber diameter confirmed by electron microscopy. BIGH3 further promoted integrin-mediated skeletal muscle cell adhesion and spreading. Conclusion: BIGH3 acts as an active regulator of collagen architecture, enhancing fiber assembly and cell adhesion. These findings position BiGH3 as a promising target for strengthening tissue interfaces and improving implant integration.

Biomedical and Health Sciences

Poster #146

Investigating the Effects of High-Sucrose Diet on the Composition and Innervation of Taste Buds

TEAM: Neuroscience, Developmental and Regenerative Biology

Jennifer White, Emma Coli, Sarah Junco-Chavez, Rajeshwari Mallick, Noelle Roach, Priscila Trinidad, Brian Brigham, Lindsey Macpherson

Diet can change the sensitivity of the taste system. High sugar diets can reduce the perception of sweetness and lead to overconsumption of high sugar foods. This can be attributed to changes in both peripheral and central gustatory circuits. In the peripheral taste system, studies to date have focused on changes to the expression of peripheral taste receptors and/or the cellular composition of taste buds. Although the innervation of the taste bud is necessary for proper taste processing, no studies have yet examined changes to the innervation patterns in taste buds due to diet. Here, we examine whether high sucrose (30% sucrose in water — the equivalent of a regular soda) changes the amount of innervation in taste buds (labeled using the gustatory neuron fiber marker P2x2) along with the number of Type II (sweet, bitter, and umami) Taste Receptor Cells (TRCs) and their marker, PLCB in taste buds in the posterior tongue. Towards this goal, we have developed a standardized data analysis pipeline for confocal images collected from immunohistochemically labeled taste tissues from cohorts of mice fed with sucrose water or control water for 4 weeks. We present our methods, analysis pipeline and preliminary findings here.

Biomedical and Health Sciences

Poster #147

Characterization of Myelin Lipid Changes Across Disease Stages in Experimental Autoimmune Encephalomyelitis

TEAM: Biology, Health, and the Environment

Michael Rodriguez, Dahlia Navaira, Mackenzy McCormack, Mary Jo Valencia Morales, Krista Berlin, Stephan Bach, Thomas Forsthuber

Multiple sclerosis (MS) is an autoimmune demyelinating disease of the central nervous system. The myelin sheath of the CNS is a highly specialized, lipid-rich membrane that acts as theprimary target of autoimmunity in MS, leading to demyelination, axonal injury, and consequentneuronal dysfunction. While the immunopathogenesis of MS has been extensively studied,particularly autoreactive lymphocytes, cytokine networks, and myelin sheath targeted immuneresponses, the contribution of lipid metabolism to disease progression mechanisms remainsrelatively underexplored. Here, we investigated whether neuroinflammation promoted alterationsin the myelin lipidome during the initial attack of disease and during disease relapses that couldcontribute to MS progression. We used mass spectrometry imaging (MSI), thiobarbituric acidreactant (TBARS) assays, and integrated immunohistochemistry to characterize lipid profiles,peroxidation, and spatial distribution in relapsing-remitting experimental autoimmuneencephalomyelitis (EAE) models across disease stages. We identified significant lipidperoxidation during the acute phase of disease, with levels remaining elevated throughoutremission, spatial heterogeneity of myelin sheath sulfatide distribution in the central nervoussystem, and disease-specific lipid modifications corresponding to inflammatory infiltrates,supporting the pathogenic role of oxidized lipids in MS. These findings provide novel insightsinto the dynamics of the CNS lipidome during neuroinflammation and suggest that myelin lipidalterations could contribute to MS progression through mechanisms independent of neuroinflammation.

Biomedical and Health Sciences

Poster #148

Making Sense of Missense: What Can Dominant Lethal Mutations in Core Histone Genes Tell Us About Fundamental Biology?

TEAM: Neuroscience, Developmental and Regenerative Biology

Natalie Redding, Marzieh Rouzbehani, Ava George, Dustin R. Fetch, Tiffany Bastos, Juliannah Rea-Avendano, Alexey A. Soshnev

The nucleosome core particle is a universal subunit of eukaryotic genomes, comprised of an octamer of four core histones H2A, H2B, H3 and H4, and ~146 base pairs of DNA. Histones are essential proteins, and their post-translational modifications make up the basis of “epigenetic” (i.e. sequence independent) regulation of all genome functions. Histones are exceptionally conserved across all eukaryotes. Further, in all multicellular organisms each core histone isoform is encoded by dozens of near-identical paralogs. Missense mutations in core histone genes occur frequently in many cancers, yet the biological effects of most of those are poorly understood. To refine the true “driver” mutations we reasoned that critical residues in histones must be constrained in healthy population. Interrogating gnomAD 4.1 data encompassing over 800,000 human exomes and whole genomes from diverse heathy subjects – corresponding to ~30 million individual histone alleles – we assembled a saturated map of synonymous and missense variants across all core histone genes. These studies identified three entirely invariant residues (i.e. ones that tolerate no substitutions), as well as cases where a specific expected missense variant was missing from the population, all suggesting yet-unknown dominant mechanisms of extreme biological significance. Our current work aims to uncover specific mechanisms disrupted by such mutations, including genome maintenance and developmental transcriptional programming.

Poster Abstracts

Biomedical and Health Sciences

Poster #149

Three Left Standing: Invariant Histone Residues Across the Healthy Population Missense Mutation Landscape

TEAM: Biology, Health, and the Environment

Dustin Fetch, Tiffany Bastos, Wan Song, Natalie Redding, Marzieh Rouzbehani, Ava George, Ksenia Dydo, Juliannah Rua-Avendano, Alexey Soshnev

The nucleosome is the fundamental repeating unit of chromatin, in which DNA wraps around a histone octamer composed of the four core histones H2A, H2B, H3, and H4. Mutations in histones are linked to developmental disorders and cancer. The functions of many residues remains unclear as each histone is encoded by multiple paralogous genes, complicating the interpretation of pathogenic variants. To identify residues essential for histone function, we analyzed missense variation in the Genome Aggregation Database (gnomAD v4.1), which includes approximately one million exomes from healthy individuals. We reasoned that crucial residues would exhibit extreme constraint in healthy populations. Surprisingly, despite the strong evolutionary conservation of histones, only three residues were completely constrained. Structural analyses indicate that two of these residues, H4 K91 and H4 Y98, interact with Mrc1/Claspin, a histone chaperone during DNA replication. We propose that this interaction is required for efficient nucleosome recycling at the replication fork and that disruption of H4 K91 or Y98 impairs epigenetic inheritance. Our findings provide a foundation for identifying previously unrecognized functional residues in histones and for uncovering mechanisms that link nucleosome dynamics to epigenetic stability, advancing our understanding of an underexplored aspect of the histone code.

Biomedical and Health Sciences

Poster #150

Potential In Vitro Activity of Streptomyces Crude Metabolites Isolated from Soil Samples Against Multidrug-Resistant *Candida auris*

TEAM: Molecular Microbiology and Immunology

Adriana Terrazas, Cecilia Garcia, Hadaisah Nelapati, Ilya Badali, Olabayo Ajetunmobi, Xhavit Zogaj, Hamid Badali

Candida auris is an emerging multidrug-resistant fungal pathogen associated with persistent healthcare-associated outbreaks, high mortality rates, and notable tolerance to current antifungal therapies. The increasing clinical threat posed by *C. auris* highlights the urgent need for new antifungal agents, particularly those derived from unexplored microbial sources. Soil-derived *Streptomyces* species are prolific producers of diverse bioactive secondary metabolites and represent a promising reservoir for novel antifungal compounds.This pilot study evaluates the in vitro antifungal activity of crude metabolites produced by *Streptomyces* isolates recovered from ecologically diverse soil samples in Texas. Soil specimens were serially diluted and plated on selective media to obtain filamentous actinobacteria, which were purified and characterized based on colony morphology and biochemical traits. Crude metabolites were extracted following submerged fermentation and initially screened against *Candida albicans* and *C. auris* using agar diffusion assays. One *Streptomyces* isolate exhibited potent inhibitory activity and was selected as the candidate strain for broth microdilution testing to further quantify antifungal potency.Based on MIC values, the newly discovered crude metabolite demonstrated strong activity against *C. auris*, with an MIC of 4 mg/L, which is five $\log_2$ dilution steps lower than that of fluconazole (>64 mg/L). Ongoing work includes evaluating the activity of this candidate extract against *C. auris* biofilm formation, a clinically relevant phenotype associated with persistent infections and antifungal tolerance. Additional efforts involve chromatographic fractionation and LC-MS analysis to identify active compounds and characterize their chemical diversity.These findings highlight Texas soil microbiomes as a promising source of novel antifungal metabolites and support the development of natural-product-based strategies to combat drug-resistant fungal pathogens such as *C. auris*.

Poster Abstracts

Biomedical and Health Sciences

Poster #151

SuFEx-Enabled Bioconjugation of Near-Infrared Fluorophores for Biomolecule Labeling

TEAM: Chemistry

Stefan Nashawati, Paula McKay, Jude Aden, Syed Muhammad Usama

Heptamethine cyanine (Cy7) fluorophores are powerful near-infrared (NIR) imaging agents valued for their reduced tissue scattering, low autofluorescence, and improved penetration depth in vivo. Covalent bioconjugation of Cy7 to biomolecules such as antibodies and proteins is essential for their utility in biomedical research, yet current strategies suffer from poor labeling selectivity, limited stability under physiological conditions, or require multi-step pre-functionalization of the biomolecule. Here we report the synthesis of SuFEx-enabled Cy7 fluorophores bearing an aryl sulfonyl fluoride moiety, a reactive handle that is hydrophilic, aqueous-stable, and capable of single-step covalent reaction with nucleophilic residues. The aryl sulfonyl fluoride was introduced onto the cyanine scaffold via a mild halide-exchange reaction and condensed with a sulfonated indolenine to yield an unsymmetric heptamethine cyanine. We demonstrate that SuFEx-Cy7 and its monoclonal antibody (mAb) conjugate are stable across varying pHs and biological conditions. We further show that the degree of labeling (DOL) can be tuned by adjusting reaction pH, offering a practical method for controlling conjugation efficiency. Using this strategy, multiple antibodies and proteins were successfully labeled. To our knowledge, this is the first example of SuFEx-enabled fluorophore bioconjugation as a general biomolecule-linking strategy, offering a selective, aqueous-compatible alternative to existing methods.

Poster Abstracts

Biomedical and Health Sciences

Poster #152

Isolation and Characterization of APS1, a Soil Bacterium Exhibiting Antimicrobial Activity

TEAM: Molecular Microbiology and Immunology

Alex Acosta, Gabriel Felan, Cecilia Garcia, Susana Van Rijn, Kynnedi Williams, Cole Rivard, Hamid Badali, Adriana Terrazas, Hadassah Nelapati, Xhavit Zogaj

This project was conducted by the Antimicrobial Compound Discovery Consortium (ACDC) and supported by the Connect & Thrive Mini-Grant. The research framework builds on the implementation of the Tiny Earth program at The University of Texas at San Antonio in microbiology laboratory courses MMI3722 and MMI4923, where undergraduate researchers actively participate in the discovery of antibiotic-producing soil microorganisms. Using this course-based research platform, we isolated and screened 80 soil-derived bacterial specimens for antimicrobial activity against representative ESKAPE pathogens (*Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and *Enterobacter* species), a group of organisms responsible for a large proportion of MDR infections worldwide. Screening was performed using agar-based inhibition assays to identify isolates capable of producing compounds that suppress pathogen growth.Among the isolates examined, one specimen consistently demonstrated strong antibacterial activity against multiple test organisms. This isolate was selected for further microbiological andbiochemical characterization and was designated Antimicrobial Producing Specimen 1 (APS1). Ongoing analyses aim to determine the physiological and phenotypic properties of APS1 and to further evaluate its antimicrobial potential.These findings demonstrate the effectiveness of course-based research initiatives in generatingpreliminary discoveries of antibiotic-producing microorganisms while simultaneously providingundergraduate students with authentic research experience in antimicrobial discovery.

POSTER ABSTRACTS

Molecular, Chemical, and Materials Discovery

Poster Abstracts

Molecular, Chemical, and Materials Discovery

Poster #200

The Regulation and the Role of PKCθ in the Pathogenesis of Alzheimer's Disease

Won-Haeng Lee, Hyoung-gon Lee

Alzheimer's disease (AD) is the most prevalent neurodegenerative disorder that has Aβ plaque deposition and neurofibrillary tangle (NFT) formation as hallmark pathologies. In our previous study, we found that PKCθ, a Ser/Thr kinase, was elevated in pyramidal neurons in AD brains, especially those bearing tau pathology. Therefore, the goal of this study was to find out the causal relationship between PKCθ and the pathologies of AD.Firstly, the activity of PKCθ and its expression were examined in the APP/PS1 and PS19 transgenic mice mimicking Aβ and tau pathologies, respectively. We found that the active form of PKCθ, pPKCθ(T538), is significantly increased in the brains of APP/PS1 transgenic mice, which suggests that Aβ pathology could be a causal factor that upregulates PKCθ in human AD brains.Moreover, the role of aberrantly upregulated PKCθ is investigated in the brains of WT, PS19, and APP/PS19 mice that have genetic modification for PKCθ. Firstly, we found that the overexpression of PKCθ results in a significant increase in tau phosphorylation at S202/T205 residues, which are pathogenic phosphorylation sites in AD, in the brains of WT mice. Also, in the brains of PS19(P301S), the level of expressed PKCθ showed a positive correlation with the level of pTau(S202/T205). Lastly, in APP/PS1 mice, Aβ-induced pTau(S202/T205) level is significantly decreased with the knockout of PKCθ. Taken together, this study demonstrated that Aβ pathologic conditions could upregulate PKCθ, then induce and exacerbate tau hyperphosphorylation, which in turn contributes to the pathogenesis of AD.

Poster #201

Cyclic Sulfone Ring Remodeling Enables Molecular Shape Diversity-Oriented Synthesis of Privileged Biaryl and Oligoaryl Motifs

Sachchida Nand, Viet D. Nguyen, Ramon Trevino, Arka Porey, William T. Thompson, Graham C. Haug, Seth O.Fremin, Shree Krishna Dhakal, William B. Hughes, Dylan P. Moran, Johant Lakey-Beitia, Chandan Kumar Giri, Patrick Manning-Lorino, Samuel G. Greco, Hadi D. Arman, Oleg V. Larionov

The three-dimensional shape of biaryl scaffolds plays a critical role in their performance across medicinal chemistry, catalysis, and materials science. However, current biaryl chemical space is heavily biased toward planar para- and meta-substituted architectures, while more three-dimensional, bis-ortho-substituted scaffolds remain largely inaccessible due to synthetic limitations. We present a regioselective nucleophile/electrophile coupling strategy enabled by cyclic sulfone ring remodeling that provides rapid, modular access to diverse biaryl and oligoaryl frameworks. This platform accommodates a broad range of nucleophiles—including aliphatic and (hetero)aromatic amines, phenols, (thio)ethers, and phosphines—allowing efficient construction of structurally complex, shape-rich scaffolds. To guide regioselectivity in these transformations, we developed a Bernoulli Naïve Bayes machine-learning model capable of predicting substitution outcomes across varied substrates. Together, this integrated synthetic and data-driven approach expands access to underexplored biaryl architectures and supports systematic exploration of three-dimensional chemical space.

Poster Abstracts

Molecular, Chemical, and Materials Discovery

Poster #202

Journey to the Center of the Capsid

Zoe Hoffpauir, Audrey Lamb

Riboflavin (vitamin B2) is essential for all life, but only plants and microorganisms are able to synthesize riboflavin. Animals lack riboflavin biosynthetic machinery, and many pathogenic bacteria rely on endogenously synthesized riboflavin making the specialized enzymes involved in riboflavin biosynthesis an attractive target for novel antibiotics. Riboflavin is synthesized by five unique enzymes which catalyze unusual and complex chemical reactions that are notably slow in vitro. In order to support all life on Earth, in vivo biosynthesis must be much faster. The penultimate enzyme of the pathway, lumazine synthase, forms a capsid which we propose encapsulates the remaining enzymes of the riboflavin biosynthetic pathway. However, there are considerable gaps-in-knowledge for lumazine synthase. The hypothetical chemical mechanism lacks evidence, and lumazine synthase is post-translationally acetylated, but the effect of acetylation on capsid formation and kinetics is not determined. Using a wide array of methodologies, including 13C-NMR, x-ray crystallography, cryogenic electron microscopy and transient-state kinetics, we will elucidate lumazine synthase's role in facilitating the formation of a riboflavin biosynthetic machine.

Poster #203

Evolution of the Chemical and Crystal Structure of Burned Human Teeth

Aislinn Reyes Conder, Chris Rightsell, Gabriela Azcarate, Ivet Gil-Chavarria, Arturo Ponce

The need for this research arose from a growing number of burned bodies found in the desert in Mexico, without a reliable way to identify the conditions in which they were burned. Teeth are primarily comprised of inorganic hydroxyapatite, which outlasts any of the organic material around the enamel. Due to this quality, it can be used to identify the burning conditions based on both the crystal structure and the chemical compounds present. Research has been done on the thermal decomposition of hydroxyapatite, but there has not been a comprehensive study based on both time and temperature. In this study, human teeth were annealed in a laboratory furnace at varying times and temperatures in order to replicate realistic burning conditions, and the structure was examined using X-ray diffraction (XRD), transmission electron microscopy (TEM), and selected area electron diffraction (SAED). Analysis indicates distinct differences in the chemical composition and crystal structure, dependant on both time and temperature. This research is the start to a comprehensive data set that can be used by forensic investigators, in collaboration with microscopists and materials scientists to gain insight into the conditions to which the bodies were subjected.

Molecular, Chemical, and Materials Discovery

Poster #204

Enhanced Photostable Pentamethine Cyanine Dyes for Prolonged Biological Imaging Applications

Fnu Biakengzaua, Syed Muhammad Usama

Pentamethine cyanine dyes (Cy5) are widely used fluorophores in fluorescence imaging, super-resolution microscopy, and live-cell tracking due to their favorable optical properties. Despite their broad utility, Cy5 dyes exhibit two major limitations: rapid photobleaching and fluorescence intermittency (blinking), which compromise signal stability and overall imaging performance. These challenges primarily arise from the formation of long-lived triplet excited states via intersystem crossing (ISC), which promotes non-radiative decay pathways and singlet oxygen generation. In this work, we investigate a new synthetic strategy to improve photostability and emission consistency through electronic modulation of the polymethine scaffold. Specifically, strong electron-withdrawing groups (EWGs) are incorporated to tune the dye's electronic structure, stabilize the singlet excited state, and reduce ISC probability. This modification is expected to suppress photobleaching pathways, providing a rational framework for the design of next-generation cyanine fluorophores with enhanced stability and reliability for advanced biological imaging applications.

Poster #205

Photon Management in Si Solar Cells via $CuInS_2$ Quantum Dot Coatings

Kevin Knebel, Raul Montes-Bojorquez, Maria Villa-Bracamonte, Arturo Ayon

Silicon based solar cells dominate the photovoltaic market but face efficiency limits from incomplete use of the solar spectrum. This study explores $CuInS_2$ quantum-dot (QD) thin films, applied by spin-coating, as spectral conversion layers to boost device performance. We systematically investigated how spin casting speed determines film thickness and photovoltaic response. The $CuInS_2$ QDs displayed strong ultraviolet absorption, while their broad visible photoluminescence aligns with the silicon spectral response coatings delivered efficiency gains up to 3.7%, with the most consistent improvements from thinner, uniform films produced at higher spin speeds. Incorporating QDs into a PMMA matrix enhanced coating uniformity and reproducibility while preserving efficiency benefits, confirming the QDs as the primary source of performance gains. These findings demonstrate that spin-coated $CuInS_2$ QD layers either standalone or in a polymer matrix offer a scalable, eco-friendly strategy for improving commercial silicon solar cell efficiency.

Poster Abstracts

Molecular, Chemical, and Materials Discovery

Poster #206

Fabrication And Characterization of Europium(Iii) Oxide (Eu_2O_3) Doped Cerium Dioxide (CeO_2) Surrogate Pellets

Julian Valdez, Anthony Horsman, Jacob Flowers, Elizabeth Sooby

Development of ceramic nuclear fuel forms is motivated by the low cost and ease of accessibility for experimentation efforts. Particularly, the use of chemical surrogates in fundamental research reduces the cost and hazards of experimental efforts. In particular, Cerium dioxide (CeO_2) plays an important role in the study of oxide fuels to better understand irradiated mixed-oxide fuel, (U,Pu) O_2, due to its similar crystal structure, mechanical and chemical properties. Pure CeO_2 is reported here to have grain size of 20.9 µm/grain. The present investigation elucidates how grain size, porosity, and fluorescent signal change as concentration of europia (Eu_2O_3) is increased. Evidently, as concentration increased the intensity of fluorescent peaks are increased. The nature of this increase is investigated and show the intensity increases with no signs of peak broadening. Lastly, the lowest wt% of europia (0.05%) was determined to have the largest effect on the grain structure as the average grain size increased by approximately 8.6 µm/grain. The growth in grain size could be caused by the disruption of the CeO_2 grains when pellets undergo thermal treatment accommodating the europia in the CeO_2 lattice.

Poster #207

Probing the Structure-Function Relationship of Delta Opioid Receptor Ligands

Kallee Diaz, Marina Vargas, Daniel Rounds, Hadi Arman, Nicholas Clanton, Kelly Berg, William Clarke, Stanton McHardy

More than 100 million adults suffer from chronic pain daily and currently the most effective clinical treatment of chronic pain is the prescription of opioids. Most FDA approved opioids function through agonism of the mu opioid receptor (MOR) which is associated with several negative side effects including respiratory depression, euphoria, tolerance, and addiction. Further investigation into novel therapeutics targeting the other opioid receptors, specifically the delta opioid receptor (DOR), is of interest. It is well known that selectivity for DOR can be achieved through the message address concept however, functional activity at DOR due to conformational restriction of ligands has not been previously studied as it has in MOR and KOR. In this study we leveraged a novel hybrid opioid scaffold which combines a conformationally restricted biomimetic phenol core and a delta message address to probe functional activity. We successfully synthesized a novel hybrid opioid scaffold that displays functional activity for DOR dependent upon conformation of the biomimetic phenol. Thus far, several analogs have been synthesized through a 13-step synthesis that allows for late-stage diversification and separation of the two isomers. Further SAR efforts are currently underway, including the synthesis of additional amine side chains and DOR message address moieties.

Poster Abstracts

Molecular, Chemical, and Materials Discovery

Poster #208

Divergent Strategies in Enantioselective and Regioselective Reactions

Maksym Pavlenko, Christopher Sandford

Switchable catalysts can be triggered by an external stimulus such as light or a redox event to favor a reaction product at will. The switching property enables to use a single catalyst to access both products, which serves as an atom-economical alternative to one-catalyst-one-product examples. Our ongoing work is centered around developing electroswitchable catalysts or regioselective methods for selective acylation or demethylation reactions.

Poster #209

Switchable Near-Infrared Cyanine Probes: Cyclization Strategy for Intracellular Protein Targeting

Buddhini Kumarasiri, Katie Jeewarathnam, Syed Muhammad Usama

Fluorescence imaging provides high spatial and temporal resolution and is widely used for real-time, non-invasive visualization of biological structures in both pre-clinical and clinical settings. Among available fluorophores, heptamethine cyanines (Cy7) are especially attractive for in vivo applications due to deep tissue penetration, minimal autofluorescence, and favorable biocompatibility. However, most commercially available dyes (e.g., always-on, highly charged fluorophores) suffer from nonspecific background signals that limit imaging specificity. Thus, fluorogenic near-infrared (NIR) probes capable of selective activation in biological environments remain an important unmet need. Here, we report cyclizing heptamethine cyanines (c-Cy7), a new class of environment-responsive fluorogenic probes that reversibly switch between a non-fluorescent, neutral cyclized state and a fluorescent, charged open state. This transition is governed by the surrounding dielectric environment. The OFF/ON equilibrium was characterized by NMR. Ring-opening behavior was quantified using water–dioxane mixtures (D50 measurements), and structural modifications enabled tuning of switching thresholds. Notably, c-Cy7 did not change its structure across a broad pH range. We further developed an unsymmetrical c-Cy7 platform to enable ligand conjugation and are currently targeting DNA and tubulin using Hoechst- and cabazitaxel-based conjugates. These probes are expected to provide high-contrast molecular imaging tools for studying biological processes in disease models.

Poster #210

Polaritonic Properties of Van der Waals Materials Under High Pressure

Jeffrey Knoop, Xuan Zhou

Pressure engineered van der Waals (vdW) materials have become the subject of intense study in recent years. This is due to their potential for use in ultrathin photonic and electronic devices. High pressures can cause permanent changes in the structures and interlayer bonding of materials. Additionally, understanding the high pressure polaritonic behavior of these systems is essential for applications in extreme environments. This study aims to explore the pressure induced changes in vdW materials.

Poster Abstracts

Molecular, Chemical, and Materials Discovery

Poster #211

Synthesis, Electrochemical, and Spectroscopic Analysis of Bimetallic Ruthenium Corrole Complexes

Md Shalauddin, Christopher J. Reyes, Hadi D. Arman, and Zachary J. Tonzetich

Ruthenium corroles are a rare class of 4d metallocorroles that often form metal-metal-bonded dimers with distinctive structural and redox properties. Herein, we report the synthesis of the ruthenium corrole dimer $[Ru(TPC)]_2$ (TPC = trianion of 5,10,15-triphenylcorrole) and its physicochemical characterization by single-crystal X-ray diffraction, 1H NMR, IR, UV-vis spectroscopy, and cyclic voltammetry. Chemical reduction of $[Ru(TPC)]_2$ with KC_8 affords a reduced ruthenium corrole species, tentatively assigned as [K(THF)Ru(TPC)] based on spectroscopic and electrochemical evidence. Comparison of spectroscopic and electrochemical analyses of the neutral dimer and its reduced species reveals clear changes in electronic structure upon reduction. These findings expand the redox chemistry of ruthenium corroles and provide further insight into the electronic effects of reduction in Ru-corrole systems.

Poster #212

High-Temperature Steam Oxidation Performance and Microstructural Evolution of UN-UB_2 Composites Across 0-10wt% UB_2 Concentrations

Jesus Facundo Jr, Mira Khair, Elizabeth Sooby

Uranium mononitride (UN) is a promising ceramic fuel for advanced nuclear technologies, but its oxidation behavior in steam remains a key performance limitation. This work examines how uranium diboride (UB_2) additions (0–10 wt%) influence oxidation resistance and microstructural evolution in UN–UB_2 composites. UN powder was synthesized via carbothermic reduction and nitridation (CTR-N) at Los Alamos National Laboratory, and a UB_2 button was fabricated at UTSA's Extreme Environment Materials Lab (EEML) by arc-melting elemental uranium and boron. The UN feedstock and UB_2 button were consolidated into four high-density UN–UB_2 pellets (0, 2.5, 5, 10 wt% UB_2) by the Advanced Materials Laboratory at Boise State University and sintered via spark plasma sintering by NASA. The as-fabricated pellets were received by the EEML for pre-oxidation characterization by scanning electron microscopy (SEM) and x-ray diffraction (XRD). High-temperature steam exposures in a simultaneous thermal analyzer (STA) furnace are used to determine oxidation onset and identify composition-dependent degradation mechanisms, including oxide-scale formation and phase-selective oxidation. By coupling STA, XRD, and SEM data, we will determine oxidation kinetics in UN–UB_2 and support a low-boron design strategy to identify the minimum UB_2 addition needed to delay oxidation while maintaining high density and microstructural stability.

Poster Abstracts

Molecular, Chemical, and Materials Discovery

Poster #213

Surface Plasmon Propagation in Silver Nanowires Under High Pressure

Kade Johnson

We demonstrate that surface plasmon polariton propagation lengths in plasmonic nanomaterials increase significantly under high pressure conditions, revealing a counterintuitive pressure-enhancement mechanism in confined plasmonic systems. Using diamond anvil cell (DAC) technology, we investigated the pressure-dependent optical properties of silver nanowires and discovered that applied pressures up to several gigapascals (1 GPa = 10000 atm) lead to enhanced SPP propagation distances contrary to conventional expectations of increased damping under compression. The ability to enhance rather than degrade plasmonic performance under pressure opens new avenues for robust optical technologies operating in high-pressure environments and established pressure as a powerful tool for optimizing plasmonic propagation in ways not achievable through conventional material engineering approaches.

Poster #214

Understanding Palladium Transport in Coated Advanced Nuclear Fuel (TRISO) Particles at High Temperatures

Sabiha Younus, Jerod Siguaw, TyRon Jones, Mira Khair, Patrick Warren, Elizabeth Sooby

The Tristructural Isotropic (TRISO) particle is a composite fuel particle with multiple layers providing structural integrity while preventing the escape of fission products in advanced high-temperature gas-cooled nuclear reactors. Palladium is a fission product that has been identified in the inner pyrolytic carbon (PyC) layer to SiC layer interface and within the SiC layer of TRISO particles. Migration of Pd to the SiC layer has also been associated with U contamination within the SiC grain boundaries. Excessive Pd accumulation in the PyC and SiC layers ultimately leads to reduced performance and eventual failure of the TRISO particle. The mechanism of this Pd transport has still not been fully captured. In this study, Pd-SiC diffusion couples were annealed at 900°C, 1000°C, and 1100°C for 1, 4, 8, 16, and 32 hours at each temperature. Scanning electron microscopy, energy-dispersive X-ray spectroscopy, Raman spectroscopy and nanoindentation were used to characterize Pd diffusion and compounds formed within the post-anneal microstructure. This analysis was then repeated with surrogate TRISO particles (sourced from Oak Ridge National Laboratory) coated with Pd using physical vapor deposition. The resulting corrosion data will improve our understanding of how the mechanical properties of SiC may impact Pd transport within TRISO particles.

Poster Abstracts

Molecular, Chemical, and Materials Discovery

Poster #215

Synthesis and Characterization of Chalcogen-Containing Transition Metal Complexes

Emily El-Shaer, Hadi D. Arman, Zachary J. Tonzetich

The production of pharmaceuticals and industrial goods relies heavily on nonrenewable fuels to synthesize foundational chemicals. There is growing interest in developing alternative synthetic procedures that utilize sustainable sources. This project aims to develop transition metal catalysts capable of promoting hydrofunctionalization and C-C coupling reactions using unsaturated hydrocarbon substrates to selectively produce desired compounds. Inspired by successful catalysts, this project utilizes transition metal complexes supported by a pyridine diimine (PDI) ligand framework containing Group 16 atoms that function as soft Lewis acids to enhance catalytic activity and product selectivity. The ligand design contains a central pyridine donor and two N-heterocyclic donors containing selenium or tellurium (RNNNE, R = tbutyl, E = Se or Te) positioned near the metal center. These ligands were coordinated to both Zn(II) and Co(II) to investigate how the chalcogen atoms influence metal coordination and catalytic behavior. Crystallographic data confirmed the structures of all complexes and the presence of chalcogen bonding interactions. NMR spectroscopy, UV-Vis spectroscopy, and cyclic voltammetry provided insight into the behavior of these complexes in various solutions and their interactions with Lewis basic substrates. These results will guide the development of catalytic activation protocols and binding parameters for hydrofunctionalization and C-C reductive coupling catalysis.

Poster #216

Molecular Stacking of Dye Molecules Under High Pressure

Elisabeth Wang, Kade Johnson, Xuan Zhou

Applying high pressure to dye molecules can affect their physical properties and behaviors such as structural changes and molecular packing. Methylene blue is a dye molecule and redox agent with many medical applications such as treatments for methemoglobinemia. Previous studies have shown the effect of pressure on other dye molecules and the behavior of methylene blue using UV-Vis absorption spectroscopy, but less is known about the specific structural effects of high pressure on methylene blue. In this research, methylene blue was compressed using a diamond anvil cell, and effects at various pressures were measured using Raman spectroscopy. Two solvents (isopropol alcohol and 4:1 methanol:ethanol) were used. Preliminary results show some shifts in the Raman spectra, which indicate alterations in the energy of chemical bonds.

Poster Abstracts

Molecular, Chemical, and Materials Discovery

Poster #217

Dispersion-Enhanced Nitrogen-Centered Photocatalysis of the Direct Hydrogen Atom Transfer

Babu Dhungana, Jiasong Zhang, Kaitong Zhuang, Ramon Trevino, Huiying Sun,Shuyu Yin, Yuting Li, Jacob A. Sanchez, Xiaoyu Xia, Ramy Elerian, Yao Sun, Seth O. Fremin,Chao Huang, Min He, Maosheng Cheng, Oleg V. Larionov, Shengfei Jin

Direct hydrogen atom transfer (HAT) photocatalysis has emerged as a powerful strategy for the activation and functionalization of strong C–H bonds. However, the development of structurally diverse and highly efficient direct HAT photocatalysts remains limited. In this study, we report the design and development of nitrogen-centered photocatalysts based on an acridine framework for direct HAT processes. The incorporation of a C9 ortho-biaryl substituent plays a crucial role in enhancing photocatalytic performance by promoting stabilizing dispersion interactions between the photocatalyst and substrate, thereby facilitating selective hydrogen atom transfer. Computational and mechanistic studies indicate that these noncovalent interactions stabilize the HAT transition state, lowering the activation barrier and improving catalytic efficiency. The developed acridine-based photocatalytic system enables a broad range of carbon–carbon and carbon–heteroatom bond-forming transformations under diverse reaction conditions, including cryogenic environments. These findings highlight the importance of catalyst–substrate interactions in improving photocatalytic efficiency and provide a general design strategy for the development of next-generation direct HAT photocatalysts with enhanced reactivity and selectivity.

Poster #218

Asymmetric Diastereodivergent Tandem Michael/Elimination/Diels-Alder Reactions Catalyzed by Modular Designed Organocatalysts

Prabhupada Choudhury, Pranjal P. Bora, Manisha Bihani, John C.G. Zhao

Michael addition reactions play a crucial role in synthesizing diverse bioactive compounds, such as (+)-asenapine, an antipsychotic for schizophrenia; (+)-α-lycorane, a compound with analgesic, antiviral, and antiproliferative properties; (-)-strychnofoline, an antimitotic agent; and (-)-trans-dihydronarciclasine, a compound known for its antiproliferative effects. These optical active compounds are essential for the synthesis of bioactive compounds, such as (R)-pregabalin, oseltamivir, and (R)-rolipram. Herein, we propose the use of modularly designed organocatalysts (MDOs) self-assembled from the precatalyst modules to promote asymmetric Michael additions to yield highly enantiopure products. Optically active medium-sized cyclic compounds are key targets in organic synthesis due to their prevalence in natural products. Here we develop a diastereodivergent tandem Michael addition/elimination/Diels-Alder reaction between β-nitrostyrene acetate and furyl aldehyde derivatives using the MDOs as the catalysts, which leads to the formation of products features a complex chiral ring framework, closely resembling those found in natural products with significant biological activities. Our method aims to overcome the challenges in achieving high diastereodivergence in organocatalysis, producing multiple diastereomers of the same product in diastereomeric and enantiomeric excesses using the MDOs. The proposed research has the potential to develop environmentally friendly and highly efficient synthetic routes, advancing pharmaceutical and natural product synthesis.

Poster Abstracts

Molecular, Chemical, and Materials Discovery

Poster #219

Microstructural and Mechanical Evolution of Arc-Melted Zirconium Nitride, a Surrogate Fuel with Elemental Fission Products

Anthony Horsman, Mira Khair, Patrick Warren, Elizabeth Sooby

Uranium nitride (UN) fuels are promising candidates for next-generation high-temperature reactors due to their high thermal conductivity and high uranium density when compared to other ceramic fuels. However, the accumulation of fission products during operation can significantly influence fuel microstructure, performance, and safety. In this work, zirconium nitride (ZrN) is employed as a non-radioactive surrogate system to investigate the microstructural and mechanical evolution of nitride fuels containing fission product elements. ZrN samples were fabricated through the arc melt method under a flowing nitrogen-argon atmosphere with trace additions of selected fission products at concentrations representative of 17% enriched fuel compositions at full burn-up. Post-fabrication heat treatments were applied to promote phase homogenization and stabilize the resulting microstructures. Microstructural characterization was performed using scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS), and X-ray diffraction (XRD) to identify phase composition, evaluate fission product interactions with ZrN, and assess solubility. Nanoindentation measurements were conducted to determine hardness and reduced modulus across distinct microstructural regions, enabling assessment of the mechanical effects of fission products in ZrN. Heat treated ZrN exhibited minimal change in hardness, while the ZrN containing fission products displayed increased hardness accompanied by a reduction in intermetallic phases. These results provide experimental input for our DFT collaborators in modeling the effects of fission products on UN properties.

Poster #220

Metal-Free Hydrogenation/Deuteration of Alkenes and Alkynes Assisted by Visible Light

Roshan Baral, Nav Raj Khanal, Dhiraj K. Jha, and John C.-G. Zhao

The hydrogenation/deuteration of alkenes/alkynes has been achieved by using triphenyl phosphine (PPh_3) and iodine (I_2) in dichloromethane under neutral reaction conditions mediated by electron-donor-acceptor (EDA) complex. This straight-forward hydrogenation method provides the desired alkanes in good to high yields (65% to 91% yield) and a wide range of alkenes/alkynes serve as substrates in this hydrogenation reaction. A radical mechanism, supported by the results of a radical trapping experiment and radical clock experiment, has been proposed to explain the reaction outcomes.

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Poster #221

Visible Light-Mediated Direct Hydrohalogenation and Deuterohalogenation of Unactivated Alkenes and Alkynes

Nav Raj Khanal, Roshan Baral, Dhiraj K. Jha, and John C.-G. Zhao

Alkyl iodides are highly valuable motifs in pharmaceuticals, natural products, and synthetic intermediates. We have developed a direct hydrohalogenation and deuterohalogenation method for unactivated alkenes and alkynes using H_2O/D_2O as a source of Hydrogen/Deuterium via a halogen-bonding complex strategy under visible light irradiation. The halogen-bonding complex is formed between N-iodosuccinimides (as halogen bond donors) and triarylphosphines (as halogen bond acceptors). Upon visible-light excitation, corresponding are obtained alkyl iodides in good to excellent yields. Furthermore, a broad substrate scope was explored, and mechanistic investigations, including radical clock and radical trapping experiments, were conducted to support the proposed radical-based mechanism.

Poster #222

Mechanistic Studies for Construction of Sulfur Stereocenters by Asymmetric Geminate Recasting

Ramon Trevino, Arka Porey, Sachchida Nand, Seth O. Fremin, Shree Krishna Dhakal, Babu Raj Dhungana, Arko Das, Vy T. B. Nguyen, William T. Thompson, Dylan P. Moran, Chandan Kumar Giri, Hadi D. Arman, Daniel J. Wherritt, Oleg V. Larionov

Asymmetric geminate recasting in sulfinamides was elucidated through quantum-chemical analysis of S-N bond homolysis and recombination pathways. Density Functional Theory (DFT) calculations showed homolysis is strongly favored over inversion at the sulfur center, supporting deracemization mechanism that proceeds via in-cage radical pairs. Energetic profiles for the sulfinamides and indium-salen complexes were mapped on singlet and triplet manifolds, revealing that photocatalytic excitation produces a triplet radical pair whose efficient recombination is enabled by large spin-orbit coupling associated with the sulfinyl radical and the heavy-atom indium-bromide system. These results highlight the critical role of the catalyst in promoting fast triplet-singlet interconversion and enantioselective geminate recombination, consistent with experimentally observed sensitivity to enantioselectivity to metal, halide, and ligand modifications. These computational insights provide a mechanistic understanding for designing chiral photocatalyts that control radical-pair spin dynamics for an efficient deracemization of sulfur-stereogenic centers.

Poster Abstracts

Molecular, Chemical, and Materials Discovery

Poster #223

Investigation of the Stability and Properties of ZrN Fission-Product Nanoalloys

Sean Mullins, Jacob Coffman, David G. González Alcántara, Xóchitl López Lozano

The qualification of next-generation high-temperature reactors depends on the development and certification of advanced fuel technologies. Uranium mononitride (UN) has attracted attention because its superior thermal conductivity can mitigate thermal stresses which is expected to reduce the likelihood of fuel cracking. As irradiation proceeds, fission products (FPs) accumulate continuously. FPs are expected to play a significant role in the evolution of mechanical and thermal properties in UN fuel. Consequently, a thorough understanding of these fission-product characteristics is essential for ensuring the safe operation of UN nuclear fuel. To circumvent the practical challenges associated with handling UN compounds, the zirconium mononitride (ZrN) nanoalloy is frequently employed as a surrogate material owing to its comparable lattice dimensions and physical properties.In this current study the structural properties of bulk ZrN and derived nanoalloys were calculated using Density Functional Theory through the SIESTA code. Convergence tests were then performed to determine appropriate simulation parameters and atomic relaxations were done to obtain optimized atomic structures. This project will also consider FPs of different atomic species to include Mo, Pd, Ce, Nd, and Ru. In addition to the structural and electronic properties, the X-ray and optical properties will be simulated to compare to experimental results.

Poster #224

Enantioconvergent Access to Chiral S(VI) Stereocenters by Kinetic Resolution of Sulfonimidoyl Chlorides

Shree Dhakal, Ramon Trevino, Vy T. B. Nguyen, Sachchida Nand, Chandan Kumar Giri, and Oleg V. Larionov

Chiral sulfur (VI) compounds are increasingly recognized as privileged motifs in drug discovery, agrochemicals, and chemical biology, yet their asymmetric synthesis remains challenging. In particular, sulfonimidoyl chlorides are versatile electrophiles that could unlock broad access to enantioenriched sulfonimidates, sulfoximines, and sulfonimidamides, but general catalytic methods for their stereocontrolled preparation are lacking. We address this challenge by developing a catalytic approach for the kinetic resolution of racemic sulfonimidoyl chlorides, demonstrating a previously unexplored method for accessing sulfur (VI) stereogenic centers and expanding the toolkit for kinetic resolution beyond traditional carbon-based systems. Using a chiral bis-oxazoline ligand and Cu-based catalyst system under mild conditions, we resolved sulfonimidoyl chlorides from their racemate along with the formation of sulfonimidate esters in enantiomerically enriched form. This method consistently delivered products in >90% ee with s-factors up to >200. Our mechanistic studies show that mononuclear Cu-L complex acts as an active catalyst. Also, from DFT study we found that noncovalent interactions between the catalyst and the substrate are critical for achieving high selectivity. Surprisingly, the unfunctionalized backbone of the catalyst, often considered chemically inactive, was found to play a decisive role in controlling enantioselectivity. This strategy not only establishes a general catalytic method for accessing chiral sulfur (VI) electrophiles but also expands the scope of kinetic resolution beyond carbon-based systems, offering new opportunities in asymmetric catalysis at sulfur.

Poster Abstracts

Molecular, Chemical, and Materials Discovery

Poster #225

DNA Methylation in Neurodevelopment of Alzheimer's Risk Genes

Jacqueline Kelly, Uchit Bhaskar, Melanie A. Carless

Familial Alzheimer's Disease (FAD), a form of Alzheimer's Disease (AD), is caused by genetic mutations in promoter regions of genes involved in the amyloid pathway. In the amyloid pathway, BACE1 codes for the enzyme Beta (β) Secretase, while PSEN1 and PSEN2 both code for Gamma (γ) Secretase. β and γ secretase work downstream of the APP protein and cleave that into amyloid-β peptides which accumulate plaques in the brain to become a driving force for AD development (Hardy and Selkoe 2002). DNA methylation at a gene's promoter regions is known to regulate gene expression (De Plano et al. 2024). It is unknown if there are methylation differences at promoters of AD-causing genes between AD cells and non-AD cells, and if methylation differences in those gene promoter regions are present throughout neurodevelopment. If differences in methylation are present, researchers could use methylation to regulate gene expression and decrease β-secretase and γ-secretase production as an early intervention. This research to determine whether methylation of the promoter regions of BACE1, PSEN1, and PSEN2 differs between AD samples and age-matched healthy control samples in pluripotent and neuronal stem cells. Research into methylation of PSEN2 promoter regions found that differences were not statistically significant.

Poster #226

Oxidation of Uranium Diboride in Steam Atmospheres

Natasha Engel, Mira Khair, Jesus Facundo, Elizabeth Sooby

Off-normal reactor scenarios, such as cladding breaches, expose fuel to coolant and necessitate the development of advanced technology fuels. Uranium diboride (UB_2) is a promising candidate due to its high thermal conductivity and uranium density. While UB_2 has been shown to improve the oxidation resistance of fuels like UN and U_3Si_2, an in-depth study of UB_2 steam oxidation remains missing. In this work, UB_2 was fabricated via arc-melting and oxidized in steam environments using a simultaneous thermal analyzer (STA). Thermogravimetric analysis (TGA) was employed to measure mass gain and oxidation rates. Post-oxidation characterization included X-ray diffraction (XRD) for phase identification and scanning electron microscopy (SEM) for cross-sectional analysis of oxide growth. Results indicate that UB_2 has the terminal oxide of UO_2 under steam with possible intermediate oxides. Notably, a double oxide layer was observed, suggesting the formation of a protective barrier. These findings elucidate the oxidation mechanisms of UB_2 and explain its role in enhancing the stability of composite fuel systems, ultimately supporting the innovation of future advanced nuclear fuels for complex reactor designs.

Poster Abstracts

Molecular, Chemical, and Materials Discovery

Poster #227

FT-IR Characterization of Chemically Synthesized Silicon Quantum Dots

Jorge Vargas, K. Knebel , A. Mancha, G Cornet, K. Soto, A. Ayon

Silicon quantum dots are considered valuable for a variety of optical and electronic applications. However, as a result of the chemical synthesis method employed, a variety of radicals are present on the surface of said quantum dots that can affect their performance when considered for specific applications. Thus, there is a pressing need for a detailed characterization of the nature of the aforementioned radicals in considered crucial. In order to address this issue, Fourier-transform-Infrared-spectroscopic (FTIR) techniques are presently being employed to elucidate what radicals are present after synthesis.

Poster #228

Development of Monolithic Aerogel Frameworks: Establishing a Sodium-Free Platform for Advanced Material Integration

Ken Soto, Gabriel Cornett, Kevin Knebel, Angelica Mancha, Jose Raul Montes-Bojorguez

Silica Aerogels are of interest in advanced materials research due to their extraordinary porosity, high specific surface area, and exceptional thermal and optical properties. These structures, colloquially known as ‘frozen smoke’ structures, represent an ideal host matrix for solar technologies and catalytic systems. The primary goal of this research is to establish a high-purity synthesis protocol for producing crack-free silica monoliths that can serve as a robust scaffold for functional materials.

Poster #229

Microindentation Hardness Analysis of Zirconium Nitride Phases

Britney Vargas, Patrick Warren, Mira Khair, Elizabeth Sooby, Anthony Horsman

Zirconium nitride (ZrN) is a hard ceramic material commonly investigated for applications in protective coatings and extreme environment materials due to its high mechanical strength and wear resistance. In this study, Vickers microindentation testing was performed to characterize the hardness of ZrN-containing samples and compare the results with previously obtained nanoindentation measurements. Microindentation measurements were conducted using varying applied loads to determine Vickers hardness (HV) across multiple regions of the sample. The measured hardness values were then converted to gigapascals (GPa) to allow direct comparison with nanoindentation data. The microindentation results produced hardness values slightly lower than the nanoindentation hardness reported for the ZrN phase (21.6 GPa). Variations in measured hardness were observed across indentation sites and are likely influenced by phase diversity, including the presence of Zr_2N regions, as well as factors such as indentation geometry and surface cracking. Because microindentation samples a larger material volume than nanoindentation, measurements may include multiple phases or boundary regions, leading to intermediate hardness values. These results demonstrate reasonable agreement with nanoindentation trends while highlighting the influence of phase composition and indentation scale on hardness measurements.

Molecular, Chemical, and Materials Discovery

Poster #230

Exploring the Thermodynamics of Porphyrin and rHSA Complexes

Kayton Sanchez, Omar Castillo, Lorenzo Brancaleon

This study investigates the thermodynamic aspects of the non-native interactions between the photosensitizer protoporphyrin IX (PPIX) and recombinant human serum albumin (rHSA). While the self-assembly of porphyrin-protein complexes have been investigated, the detailed energetics of their binding interaction remain unknown. This study focuses on the effect of temperature on the non-covalent assembly of metal-free PPIX and a series of metal-coordinated porphyrins with rHSA. This interaction is crucial to a range of biomedical applications including photodynamic therapy, drug delivery, and biosensing. The presence of coordinated metal ions within the porphyrin ring is hypothesized to alter the thermodynamic profile of binding by altering electronic structure and intermolecular interactions. By utilizing dialysis and centrifugation to separate aggregates, binding was observed with optical spectroscopy. Porphyrin and protein concentrations were determined from absorbance measurements, allowing equilibrium constants to be calculated at various temperatures using Beer-Lambert law. Thermodynamic parameters of the porphyrin-protein binding can be extracted through a Van’t Hoff analysis of ln(Keq) as a function of the inverse temperature. These findings contribute to the development of a protocol that optimizes the yield of porphyrin-protein complexes and enhances ligand binding efficiency as well as providing insight into the influence of metal coordination on the interaction.

Poster #231

Acyl Fluoride Chemistry as an Alternative Strategy for Fluorescent Antibody Labeling

Alyssa Kornegay, Emilia Gomez, Mohan Kodisada, Syed Muhammad Usama

Antibody labeling with fluorescent dyes commonly relies on NHS ester chemistry to target lysine residues. However, this approach often produces heterogeneous conjugates and can induce aggregation at higher degrees of labeling. To address these limitations, acyl fluoride chemistry offers a promising alternative conjugation strategy by exploiting the rapid hydrolysis of acyl fluorides in aqueous conditions, thereby restricting bioconjugation to solvent-exposed lysine ε-amines under physiological conditions. To test this hypothesis, matched NHS ester and acyl fluoride derivatives of aggregation-prone SAT-NIR fluorophores were evaluated across a range of degrees of labeling. NHS-activated dyes exhibited significant antibody aggregation and limited mAb labeling. In contrast, acyl fluoride derivatives enabled efficient mAb labeling without aggregation and supported higher achievable degrees of labeling. These results demonstrate that conjugation chemistry can dictate stability and functional performance independent of fluorophore structure, and that this principle can be extended across SAT-NIR fluorophore classes. Future work will explore the application of this strategy to antibody-drug conjugates (ADCs), further expanding its utility for monoclonal antibody platforms.

Poster Abstracts

Molecular, Chemical, and Materials Discovery

Poster #232

Experimental Investigation of Organic Matter Sequestration in Magnesium Sulfate Minerals on Mars

Dakota Ortega, Kelly Miller, Krishnakumari Pamula, Kaushik Mitra

Recent studies have demonstrated the likely presence of organic molecules trapped in magnesium sulfate salts on Mars. Sulfate salts are common minerals that form when water evaporates, and they may be able to trap organic materials while they crystallize. This study investigates whether organic compounds can be trapped inside sulfate salts during evaporation of sulfate-rich brines that are common on the martian surface. We conducted laboratory experiments in which different sulfate-rich brines were synthesized in the lab with varying amounts of organic molecules in the solution. Magnesium sulfate ($MgSO_4$) was used as the sulfate salt, and two organic materials were tested: polyethylene powder and glycine. Five different mixtures were prepared using 50 mL of a 1 moles per liter $MgSO_4$ solution. Polyethylene powder was added to the solution in varying amounts: 1 gram, 0.5 grams, and 0.25 grams; two different concentrations of glycine was added: 1 gram and 0.5 grams. Each organic material was mixed into the magnesium sulfate solution. We are currently running evaporation experiments and observe formation of white crystals of magnesium sulfate salts in all experimental solutions. Detailed mineralogical analysis will be conducted on these evaporites, and results will be presented at the symposium.

Poster #233

Study of Si-SiO_2 Core—Shell Quantum Dots Formed Under Ambient Conditions by Transmission Electron Microscopy and Other Methods

TEAM: Physics and Astronomy

G. Cornett, I. Garcia, J. Lerma, A. Mancha, K. Soto, J. Vargas, A. Ponce, A. Ayon

Silicon (Si) quantum dots (QDs) have multifarious applications in optical as well as in biotechnology applications due to its reported biocompatibility. However, an unanswered question remains regarding whether Si QDs will naturally oxidize on the grounds that silicon is an oxygen getterer and is known to form what is termed a “native oxide” on bulk silicon samples. To address the aforementioned issue, the present research plan is to discover whether as synthesized Si QDs will spontaneously form a SiO_2 shell under ambient conditions by exposing them to a battery of tests including TEM, STEM, EDS and Raman to chemically and structurally characterize said QDs.

Molecular, Chemical, and Materials Discovery

Poster #234

Study of Irradiated and Oxidized Iron Chromium by Transmission Electron Microscopy

TEAM: Physics and Astronomy

A. Horsman, J. Facundo, R. Salazar, S. Younus, T. Jones, A. Ponce

Understanding how structural materials degrade under the simultaneous effects of radiation and corrosion is critical to the enhancement of next-generation nuclear reactors. This body of work investigates the influence of helium (He) irradiation dose on the oxidation behavior and microstructural evolution of Fe-18 wt% Cr alloy. Samples were fabricated at the Extreme Environment Materials Laboratory (EEML) at UTSA and subsequently irradiated with varying doses of He at UC Berkeley, then oxidized at EEML (UTSA). For the general project, post-irradiation and post-oxidation characterization was performed at UTSA (EEML and KAMC) using scanning electron microscopy (SEM) and scanning transmission electron microscopy (STEM) with energy dispersive X-ray spectroscopy (EDS). STEM analysis confirms that the Fe-18Cr alloy retains a body-centered cubic crystal structure as the dominant phase. EDS mapping reveals the formation of a duplex oxide layers, Cr_2O_3 and an iron oxide (theorized to be Fe_2O_3). Notably, the blister area formed from helium irradiation sizes and interaction increases systematically with dosage. These results provide nano-scale insight into the coupled degradation mechanisms relevant to extreme nuclear reactor environments.

POSTER ABSTRACTS

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Poster #300

Calculation of the Properties of ZrN Cubic Nanocrystals Containing Mo and Pd as Fission Products

David Gonzalez Alcantara, Jacob Coffman, Sean Mullins, Xóchitl López-Lozano

Uranium mononitride (UN) has been proposed as a novel nuclear fuel for next generation nuclear reactors due to its superior properties. As part of the nuclear fuel cycle, uranium-fission-products gradually accumulate and nanocrystals (NCs) naturally form in the nuclear fuel with properties vastly different from the main UN bulk material. Therefore, as part of the nuclear fuel qualification process, it is crucial to understand how these properties change and their effect on performance and safety. To facilitate this qualification process, zirconium mononitride (ZrN) is used as a surrogate material due to its similar properties with UN. This study applies first-principles calculations based on Density Functional Theory to develop models of the stable and dominant cubic morphology of ZrN NCs to study their properties with uranium-fission-products Mo and Pd at different concentrations. Cubic shaped NCs of different sizes were modeled, capable of representing uranium-fission-products concentrations as low as 0.4 weight%. Calculation of the formation energy indicates that cubic ZrN NCs with Mo are more stable than with Pd, where the stability was higher at increased Mo concentration, whereas at increased Pd concentration the stability was lower. Suggesting that the solubility of Mo is higher than Pd in cubic ZrN NCs.

Poster #301

Fractional-Order Spiking Neural Networks for Robust Control

Erick Olivares Bravo, Fidel Santamaria

Neuromorphic computing offers a promising paradigm for energy-efficient computation, largely due to the intrinsic memory characteristics of its constituent elements, such as memristors and memcapacitors. These memory effects can be effectively modeled using fractional-order differential equations. Traditional artificial neural networks, on the other hand, often rely on recurrent neural networks (RNNs) to handle time-dependent tasks. We propose that neurons incorporating fractional-order dynamics can outperform conventional RNNs in such applications. As a proof of concept, we developed a compact, non-recurrent neural network composed of fractional-order leak-integrate-and-fire (FLIF) neurons. We optimized this network to control the classic cart-pole balancing problem. Our results demonstrate that this simple FLIF network achieves state-of-the-art performance, even when the physical model's derivatives are unavailable to the controller, a scenario that poses significant challenges for traditional control methods. This work suggests a novel and powerful approach to time-dependent control tasks, leveraging the inherent memory of fractional-order systems.

Poster Abstracts

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Poster #302

Aerosol Pollution and Data Scarcity: Citizen Sensing of Glycol-Based Theatrical Fog Exposure in Theme Parks

Jina Wilde

The lack of a regulatory framework for theatrical fog in entertainment venues represents a significant lapse in environmental auditing, particularly in high-volume, year-round indoor theaters and theme parks. Industry claims of product safety are not supported by independent long-term studies and conflict with the reality of chronic exposure experienced by guests and employees. A monitoring deficiency compounds this situation: existing air quality sensors are not purpose-built for the chemical profile of theatrical fog, leaving regulators and the public without adequate assessment tools. The study presents a qualitative exploration using a low-cost ubiquitous sensor to generate and analyze air quality data in this data-poor setting. Grounded in personal informatics, the methodology demonstrates that theatrical fog events correlate with spikes in PM2.5 levels, often exceeding EPA hazardous thresholds. Results illustrate how an imperfect, accessible sensor serves as a powerful qualitative hazard indicator, underscoring a correlation between exposure and health outcomes. The work proposes a research agenda for the computer science community to investigate inspection frameworks and develop purpose-built software for environmental informatics, laying the groundwork for data-driven accountability.

Poster #303

Crystal Math: Modeling Continuous Distributions of Ellipsoids in Radiative Transfer Models

Sean Dillon, Angela Speck, B. Sargent, Tiffany Jensen, Yulian Humaran-Humaran

Dust contributes to many astrophysical environments and processes including star and planet formation, stellar death, and creation of both simple and complex molecules. However, the precise nature of dust has a huge impact on how it affects its environments. Just as cosmic dust grains come in many different compositions and crystal structures, it can also occur in different shapes and sizes which affect how light interacts with dust. For simplicity, we often assume dust grains are spherical, but the deviation from sphericity may have a big impact on light-matter interactions. Although a great deal of work has been done on investigating grain shape, those calculations have not been implemented into current radiative transfer models. Here we develop a new software that allows the user to specify the shape and size distributions of dust grains, and outputs the wavelength-dependent absorption and scattering cross sections. The file is formatted to be input into the radiative transfer (RT) code DUSTY. We developed a new, versatile code that allows incorporation of light interactions with grains of different shapes into models of dust applied to astrophysical environments. This directly supports laboratory astrophysics investigations by allowing more realistic modeling of cosmic dust using laboratory astrophysics results.

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Poster #304

A Statistical Investigation of Evolutionary Parameters in Planetary Nebulae

Finis Stribling IV, Dr. Angela Speck

Planetary nebulae (PNe) display a wide range of morphologies, yet the physical mechanisms driving their shaping remain uncertain. We compiled a homogeneous database of physical and chemical parameters—including kinematic age, radius, electron temperature and density, effective temperature, progenitor mass, expansion velocity, and elemental abundances—for a large PN sample.Pairwise linear correlations were evaluated using R2 heat maps, with F-tests applied to assess statistical significance. The dataset was subdivided by morphology (elliptical, bipolar), chemistry (carbon-rich, oxygen-rich), and progenitor mass to identify trends that may be obscured in the full sample. Temperature–time evolutionary tracks were also constructed to examine how stellar heating timescales relate to nebular expansion.This multi-parameter statistical approach allows us to test whether stellar mass, chemical enrichment, and evolutionary stage contribute to PN morphology.

Poster #305

Eccentric vs Non-Eccentric Accretion Disks

Joaquin Duran, Brandon Curd, Richard Anantua

Accretion disk around supermassive black holes are commonly modeled as geometrically thick, circularized flows in quasi-steady equilibrium. However, in environments such as tidal disruption events (TDEs), disks may retain significant orbital eccentricity. In this works, we investigate the structure and evolution of eccentric accretion disks using three-dimensional general relativistic magnetohydrodynamic (GRMHD) simulations. We directly compare eccentric and circularized disk across multiple black hole spins and magnetization regimes, including Standard and Normal Evolution (SANE) and Magnetically Arrested Disk (MAD) configurations. We find that orbital eccentricity, once initialized, persists well into the turbulent, quasi-steady state rather than being rapidly damped by magnetorotational instability driven stresses. Eccentric disk develop sustained non-axisymmetric morphology, structured inflow patterns, and systematic deviations from keplerian rotation. These features modify angular momentum transport and redistribute magnetic stresses relative to circularized models. Differences between SANE and MAD configurations further demonstrate that magnetic flux accumulation influences the evolution and maintenance of eccentric structure. These results establish eccentricity as dynamically significant and potentially long-lived property of black hole accretion flows, with direct implications for modeling recently formed disks in TDEs systems.

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Poster #306

Determining Where and When Magnetic Reconnection Occurs

Destiny Howell, Stephen Fuselier

Magnetic reconnection is a fundamental process that converts magnetic energy into particle energy and plays a key role in plasma transport across Earth's magnetopause. Despite its importance, determining the precise locations and solar wind conditions under which reconnection occurs at the magnetopause remains a challenge. In this project, I analyze data from the Magnetospheric Multiscale Mission (MMS) and Time History of Events and Macroscale Interactions during Substorms (THEMIS) missions to investigate reconnection signatures during magnetopause crossings. I examine approximately 300 conjunction events using high-resolution electron and ion measurements to identify indicators of magnetic reconnection. The analysis focuses on two primary objectives: determining the location of reconnection and examining how this location evolves. These results are compared with previous studies and visualized using standard mission data plots. By characterizing these events, this study contributes to a better understanding of when and where magnetic reconnection occurs at the magnetopause, with implications for space weather and plasma physics.

Poster #307

Temperature Effects on Inelastic Light Scattering in Plasmonic Nanocubes

Alex Ferere, Nicolas Large

Confined acoustic vibrations (phonons) in metallic nanoparticles induce small changes in their size and shape, which in turn modulate the localized surface plasmon (LSP) modes and introduce high frequency modulations in the optical response on the order of GHz. While plasmonic nanoparticles are often treated as static systems interacting with an incident electromagnetic field, the coupling between acoustic vibrations and plasmons plays an important role in inelastic light scattering processes such as Raman scattering.In this work, we develop a multiphysics computational framework based on the finite element method (FEM) to investigate temperature dependent inelastic light scattering in plasmonic nanocubes. Vibrational eigenmodes of the nanocubes are first computed to characterize confined acoustic phonons and their associated surface displacement patterns. These vibrational modes are then incorporated into electrodynamic simulations to evaluate their influence on plasmonic resonances and the resulting Raman response.The Raman scattering process is described using the Fermi golden rule through the Raman energy density (RED), a local quantity that captures the electromagnetic energy density modulated by the vibrational motion of the nanoparticle. By incorporating temperature dependent material properties, we examine how thermal effects influence both plasmonic and vibrational modes and their signatures in the Raman spectra.

Poster Abstracts

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Poster #308

Focal-Series Matching for Thickness and Defocus Determination in HRTEM

Carlos Aguilar Brand, Gabriela Azcarate, Arturo Ponce

High-resolution transmission electron microscopy (HRTEM) provides atomic-scale information, but quantitative interpretation remains challenging because image contrast depends strongly on parameters such as defocus, specimen thickness, and multiple scattering. Previous studies have explored the use of simulated HRTEM image databases combined with pattern recognition and neural network approaches to determine thickness and defocus from experimental images. This work showed that simulated image sets spanning different imaging conditions can relate image contrast to underlying physical parameters. The objective of this work is to explore the use of simulated HRTEM focal series to estimate specimen thickness and defocus. Experimental images were obtained from the silicon region of an AlN:Mn film grown on silicon by molecular beam epitaxy using a JEOL JEM-2010F transmission electron microscope. The thickness of the experimental region used for comparison was independently determined by off-axis electron holography, providing a reference for the analysis. The study combines experimental focal-series imaging with HRTEM simulations to generate a database of simulated silicon images across a range of defocus and thickness conditions. These simulated datasets were compared with experimental images using a MATLAB-based image matching framework. The results show promising agreement in identifying the experimental defocus conditions when compared with the simulated dataset. Thickness estimation was not achieved, indicating that additional simulated thickness values are needed for better matching. These results suggest that focal-series simulations provide a promising approach for determining imaging parameters such as defocus and specimen thickness.

Poster #309

Optimizing Chromium for Grain Refinement in Ni-Cr alloys

Santiago De Stefano Cavazos, J. Christudas, M. S. Harris, K. Yano, M. Khair, T. Kaspar, E. Sooby

Nickel-chromium (Ni-Cr) alloys are regarded as promising structural materials for nuclear reactors due to their excellent mechanical strength and corrosion resistance. This study investigates the effect of varying chromium (Cr) concentrations on grain size to better understand microstructural refinement mechanisms. Alloys containing 8%, 12%, 16%, and 20% Cr were synthesized using the arc melt method to ensure homogeneity. Microstructural characterization was conducted via electron backscatter diffraction (EBSD) to measure grain size distributions. The results revealed a clear trend of grain size reduction with increasing Cr content, with the finest grains observed at 16% Cr. To evaluate the impact of grain size on corrosion resistance, the samples were subsequently exposed to chloride-based molten salt. These findings provide important insight for optimizing Ni-Cr alloys in high-temperature nuclear environments where grain size affects mechanical performance on corrosion behavior.

Fundamental and Applied Physical & Mathematical Sciences

Poster #310

Mapping Surface Phonon Modes for Different Surface Chemistries in Semiconductor PbS Quantum Dots

Gabriela Rodriguez De La Concha Azcarate, Domingo I. Garcia-Gutierrez, Diana F Garcia-Gutierrez, Jordan A. Hachtel, Arturo Ponce

Quantum dots (QDs) are semiconductor nanoparticles whose optical and electronic properties are governed not only by quantum confinement effects but also by surface chemistry, including the nature of the capping ligands attached to their surfaces. Variations in size and surface ligands can influence surface phonon behavior and electron–phonon coupling, making low-energy phonons (<15 meV) an important factor controlling QD optoelectronic properties such as luminescence and charge transport . Achieving the energy resolution required to probe these low-energy excitations demands specialized instrumentation. Electron energy-loss spectroscopy (EELS) enables vibrational spectroscopy in the electron microscope, providing high spatial and energy resolution to probe phonon and plasmon excitations at the nanoscale. Monochromated STEM-EELS can resolve low-energy vibrational modes and reveal local bonding, defects, and interfacial properties in materials. In this work, low-energy surface vibrational modes in PbS QDs capped with myristic acid and oleic acid ligands are mapped using EELS in a Cs-corrected monochromated HERMES Nion transmission electron microscope operated at 60 kV at Oak Ridge National Laboratory (ORNL), achieving an energy resolution of ~6 meV. These measurements aim to provide insight into the vibrational response of surface ligands and their influence on the phononic properties of PbS quantum dots.

Poster #311

Exploring Symmetry-Breaking Nonlinear Cavity Structures for Enhanced Optical Limiter Performance

Leonardo Salvini, R. Kononchuk, A.A. Chabanov, I. Anisimov, I. Vitebskiy, F. Tommasi, W. Du, S. Cavalieri, D.S. Wiersma, F. Riboli

We present an investigation of passive optical limiters (OLs) that utilize symmetry breaking of reflectionless scattering modes at exceptional points of degeneracy in nonlinear coupled-cavity systems. In our study, we analyze how structural parameters, including intercavity coupling strength and external losses, influence key performance metrics of these devices. Through numerical simulations and optical measurements, we demonstrate that tuning these parameters can effectively optimize the limiting threshold and operational bandwidth of the OLs. Furthermore, we show that increasing the fraction of nonlinear cavities enhances device performance in the nonlinear, broken-symmetry regime, resulting in a faster suppression of transmission. These findings indicate a pathway for developing compact, self-activating OLs with wide bandwidths and rapid response times, with critical applications in protecting sensors and vision systems from laser damage.

Poster Abstracts

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Poster #312
withdrawn

Poster #313
Synthesis of Iron Oxide@Gold Core–Shell Nanoparticles
Hassina Metref
Magnetic nanoparticles have attracted significant interest due to their unique properties and potential applications in biomedicine, sensing, and catalysis. Combining magnetic iron oxide with a noble metal such as gold in a core shell structure offers a promising strategy to create multifunctional nanomaterials with enhanced stability and surface functionality. However, achieving controlled synthesis of iron oxide@gold (Fe_3O_4@Au) core–shell nanoparticles remains challenging, particularly in ensuring uniform core formation prior to gold shell growth. Careful structural verification is essential before further functionalization and property evaluation. The goal of this project is to synthesize Fe_3O_4@Au core shell nanoparticles and investigate how the addition of a gold shell influences their structural and physical properties. To achieve this, iron oxide nanoparticles were synthesized using a controlled chemical method as the first step toward core shell formation. Transmission electron microscopy (TEM) was used to characterize particle morphology and confirm successful formation of the iron oxide core. Preliminary TEM results confirm the formation of well-defined iron oxide nanoparticles. Ongoing work focuses on optimizing gold shell deposition and evaluating the resulting structural and functional properties. This study aims to contribute to the development of multifunctional nanomaterials for future biomedical and sensing applications.

Poster #314
Atomic-Scale Structural Evolution of ZrN Nanowires Under Fission Product Doping: A DFT Study
Jacob Coffman, David G. González, Sean M. Mullins and Xóchitl López-Lozano
Uranium nitride (UN) has emerged as a promising fuel for advanced nuclear reactors owing to its high melting point, chemical stability, and favorable neutron economy. Zirconium mononitride (ZrN) serves as a widely used surrogate for UN due to its similar crystal dimensions and physical properties, circumventing the experimental difficulties associated with handling uranium compounds. Understanding these materials at the nanoscale is critical, as their properties differ substantially from bulk behavior. In this work, we employ first-principles density functional theory (DFT) calculations to investigate the structural properties of ZrN nanowires (NWs) and fission product-doped ZrN systems. Calculations were performed using the SIESTA code within the GGA-PBE approximation and Norm-conserving Vanderbilt pseudopotentials to establish ground-state simulation parameters — including unit cells, basis sets, mesh cutoff, k-points, and vacuum layers. Atomic models of ZrN NWs with square transverse cross-sections were developed to study structural evolution in the presence of fission product dopants, specifically Mo. Our results provide a foundational atomic-scale understanding of fission product-induced structural changes in ZrN, with direct implications for accident-tolerant nuclear fuel design.

Poster Abstracts

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Poster #315

Artificial Intelligence for Tracing Black Hole-Driven Outflows in Galaxies

William Olson, John Schneider, Lulu Zhang, Chris Packham

Active supermassive black holes can release large amounts of energy into their host galaxies, influencing how galaxies grow and evolve. In many systems, this energy propagates outward in structured, directional outflows of ionized gas. Identifying the geometry of these outflows is important for understanding how energy couples to the surrounding interstellar medium. However, their delineation in observational data is often manual and dependent on user-defined thresholds, limiting reproducibility and large-scale comparison.We present the development of a physics-informed machine learning framework designed to systematically identify and trace structured ionized outflows in two-dimensional spectroscopic observations. A central component of this effort is a physically motivated synthetic data generator that produces simulated maps with controlled geometries and noise properties. This enables quantitative evaluation of model performance and provides a controlled bridge between idealized training conditions and real observational datasets.This framework is designed to support scalable, reproducible studies of black hole driven feedback while reducing subjective bias in structural identification.

Poster #316

Quantum Stochastic Gradient Descent in the Continuous-Time Limit by the Wigner Form of Open Quantum Systems

Avery Tovar, Brandon Lippe, Jose Morales

The main ideas behind a research plan to use the Wigner formulation as a bridge between classical and quantum probabilistic algorithms are presented, focusing on a particular case: Quantum Stochastic Gradient Descent in its continuous-time limit based on the Wigner formulation of Open Quantum Systems. We present both theoretical and computational studies of its convergence for the benchmark case of a quadratic/harmonic potential function. The independence of the mixing time (convergence rate) as the problem dimension increases is proved in our study.

Poster Abstracts

Fundamental and Applied Physical & Mathematical Sciences

Poster #317

Studying Cosmic Dust Around AGB Star W Hya

Smruthi Shashidhar, Dr. Angela Speck

Cosmic dust is present almost everywhere in the universe and contributes to a multitude of astrophysics processes including star and planet formation. By studying the nature of dust surronding these dying stars, we can understand more about them and their contributions to the cosmos. In particular, we have been studying the dust around the asymptotic giant branch (AGB) star W Hydra. We have collected observational data for this star, including infrared (IR) spectra collected by the IR Space Observatory (ISO). We then used the one-dimensional radiative transfer modeling code DUSTY to simulate spectral energy distributions (SEDs) to compare to the observational data on W Hya. DUSTY's input parameters include the different dust grain compositions, the density distributions of the dust shells, and the temperature of the innermost dust. Preliminary modeling shows that the dust shell around W Hya is composed of the usual suspect: silicate, but a significant fraction seems to be due to amorphous alumina, metallic iron, and a combination of magnesium and iron sulfide. Minor components of corundum and iron oxide needed to explain specific spectral features. Our initial modeling efforts suggest that alumina and iron are fundamental components of the dust around W Hya, and further work would include connecting these features to other observations surrounding this star and others similar to it.

Poster #318

Analyzing Stardust Surrounding AGB Star R Hya with Radiative Transfer Modeling

Alexandra Brown, Angela Speck

Asymptotic giant branch (AGB) stars, in their late evolutionary stages, generate dense outflows where gases condense into solid particles—commonly referred to as stardust. As abundant sources of cosmic dust, these stars provide an optimal environment for studying dust formation and composition. Radiative transfer modeling using the DUSTY code enables simulations of spectral energy distributions (SEDs) that can be directly compared with observational data from missions such as ISO and IRAS. In modeling the AGB star R Hya, several combinations of dust shell parameters—such as grain composition, density profile, and inner dust temperature—can reproduce nearly identical SEDs. However, among the best-fitting models, a consistent feature is the dominance of metallic iron and aluminum oxides in the dust composition, with silicate contributing only a minor mass fraction. This result highlights the challenge of disentangling unique dust properties from degenerate spectral signatures.

Poster Abstracts

Fundamental and Applied Physical & Mathematical Sciences

Poster #319

Optical Darkfield Scattering Microspectroscopy of Individual Nanostructures

Julien Whitehead, Kathryn M Mayer

Darkfield scattering microspectroscopy is a valuable technique to observe the optical properties of individual plasmonic nanostructures. Our system comprises an imaging spectrograph setup, which means our raw data is in the form of spectral images forming streaks of intensity across a range of pixels on a CCD camera. To map these pixel locations to wavelengths, a calibration of the system using known wavelengths is required. To accomplish this calibration, we applied a sample of white latex nanospheres to a slide and located two areas in which there were isolated particles. Optical filters were applied to the scattered light to isolate selected wavelengths, enabling the subsequent pixel-to-wavelength calibration of the spectrometer. A linear fit was applied to the data and interpolated to assign discrete wavelengths to each pixel row. The successful calibration of the system was marked by the creation of this pixel-to-wavelength line. The ability to accurately measure the scattering spectra of individual nanoparticles will allow for the future comparison of measured optical properties with theoretical predictions. These measurements enable us to understand how these properties can be refined with nanoparticle composition and geometry, which guides the selection of nanoparticles with desired characteristics for applications in sensing and nanomedicine.

Poster #320

Determining the Nature of Lab-Produced Carbon Quantum Dots: Are They Graphene Quantum Dots?

Angelica Mancha, Gabriel Cornett, Jorge Vargas, Kevin Knebel, Ken Soto, Maria Fernanda V. Bracamones, Arturo A. Ayon

Carbon quantum dots (CQDs) synthesized in the laboratory are of significant interest for their potential applications in bioimaging, sensing, and optoelectronics, owing to their biocompatibility and distinctive optical properties. A critical question, however, is whether these CQDs are genuinely graphene quantum dots (GQDs) with a crystalline graphene core, or if they are carbon nanostructures without the characteristic properties of graphene. To address this issue, a combination of advanced characterization techniques, including transmission electron microscopy (TEM), scanning transmission electron microscopy (STEM), energy-dispersive X-ray spectroscopy (EDS), Raman spectroscopy, and other advanced methods, will be employed. This comprehensive analysis aims to elucidate the structural and chemical nature of the CQDs and determine whether they exhibit a graphene-like crystalline structure, thereby confirming their classification as GQDs.

Poster Abstracts

Fundamental and Applied Physical & Mathematical Sciences

Poster #321

Physics-Informed Neural Networks for Open Quantum Systems

TEAM: Physics and Astronomy

Mariano Alcalde, Aaron Weymouth, José Morales

Open quantum systems are central to quantum information, quantum thermodynamics, and the development of fault-tolerant quantum technologies. Because realistic quantum systems inevitably interact with their environments, their dynamics depart from ideal unitary evolution and instead exhibit decoherence, dissipation, and information loss. A standard framework describes this behavior through the reduced density operator, obtained by tracing out environmental degrees of freedom, leading to effective master equations for the system alone. In this work, we combine a microscopic open-system model with a data-driven solver. Starting from a system-bath Hamiltonian with a thermal Gaussian environment and Ohmic spectral density, we derive the bath correlation functions together with the corresponding drift, diffusion, and friction coefficients. In the Markovian high-temperature Caldeira-Leggett regime, the dynamics reduce in the Wigner representation to a Wigner-Fokker-Planck equation on phase space. We then employ physics-informed neural networks to reconstruct the full Wigner distribution in position, momentum, and time while simultaneously inferring the friction and diffusion coefficients from sparse or noisy data. The method enforces both physical consistency and data fidelity, providing a quantitative Markovian benchmark and a foundation for future non-Markovian extensions.

Poster #322

Study of Nanoparticle Structure and Morphology by Transmission Electron Microscopy

TEAM: Physics and Astronomy

Hassina Metref, Gabriela Azcarate, Leonardo Salvini, Carlos Aguilar, Rafael Flores, Arturo Ponce, Kathryn Mayer

Transmission electron microscopy (TEM) is a powerful technique for investigating the morphology, crystallographic structure, and phase composition of nanoscale materials with high spatial resolution. In this work, TEM was used to study the structure and morphology of nanoparticles containing iron oxide and gold. Bright-field (BF), dark-field (DF), high-resolution TEM (HRTEM), and selected area electron diffraction (SAED) were used to analyze the crystallographic structure, particle size, and phase composition. SAED patterns were indexed using crystallographic data and visualization software, allowing the identification of gold with a face-centered cubic (FCC) structure and iron oxide phases such as hematite (αFe_2O_3) and magnetite (αFe_3O_4). TEM images revealed a heterogeneous population of nanoparticles with different shapes, including triangular, semi-spherical, and irregular hexagonal forms. Dark-field imaging highlighted different crystallographic regions within individual particles and showed features such as defects and bending contours. Particle size analysis was performed using ImageJ and the equivalent circular diameter method. The measured nanoparticles showed an average size of about 5.1 ± 1.1 nm for the smaller particles and 10.6 ± 1.8 nm for clustered iron nanoparticles. TEM analysis revealed that the sample contains nanoparticles with heterogeneous morphologies and multiple crystalline phases, rather than forming a uniform iron oxide-gold core-shell structure, highlighting the structural complexity of the synthesized system.

Fundamental and Applied Physical & Mathematical Sciences

Poster #323

Structural Characterization of $BaTiO_3$ Nanoparticles Using Transmission Electron Microscopy

TEAM: Physics and Astronomy

Natasha Hieu Engel, Safira Michael Heridia, Dylan Robert Leskovsky, Avery Q Tovar, Ayush Raj Neupane

Barium titanate ($BaTiO_3$) nanoparticles are widely studied because of their ferroelectric and piezoelectric properties, which make them useful for applications such as capacitors, sensors, and nanoelectronic devices. At the nanoscale, the structural properties of $BaTiO_3$ particles can strongly influence their electrical and dielectric behavior. In this study, $BaTiO_3$ nanoparticles were characterized using Transmission Electron Microscopy (TEM) to investigate their morphology and nanoscale structural features. TEM imaging provides high spatial resolution, allowing direct observation of particle shape, size distribution, and aggregation behavior. The obtained TEM images reveal nanoscale particles with variations in morphology and particle size. These structural observations provide insight into the microstructural characteristics of $BaTiO_3$ nanoparticles and help better understand how nanoscale features influence their functional properties. Understanding the morphology and structure of $BaTiO_3$ nanoparticles is important for improving their performance in ferroelectric and electronic applications. This work demonstrates how TEM can be used as an effective tool for analyzing nanoscale materials and evaluating their structural characteristics.

POSTER ABSTRACTS

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Poster #400

Structural Evolution of Stardust Aanalogs due to Electron Dose

Rakibul Alam Shohan, Cody Cly, Angela Speck, Benjamin Sargent, Joseph A. Nuth III, Alan Whittington, Arturo Ponce

The presence of amorphous alumina and crystalline polymorphs, including corundum, around evolved stars has been found by both astronomical observations of mid-infrared spectroscopic features and laboratory analyses of presolar grains. However, the precise mechanisms governing the formation and structural evolution of alumina dust remain poorly understood. In this work, structural evolution of a chaotic aluminum oxide stardust analog has been studied through ex-situ heat treatment and electron beam irradiation to elucidate the amorphous-crystalline transition process and mechanisms. Electron bombardment is proposed as a dust processing mechanism capable of producing the transitional η-Al_2O_3 phase which also forms through thermal annealing. Experiments conducted under varying electron energies and flux conditions reveal that a critical threshold cumulative electron dose of approximately 1024 e-/m2 is needed for crystallization, suggesting that electron interaction with the amorphous matrix drive this crystallization process through atomic rearrangement. Throughout the transition from amorphous to η-Al_2O_3 phase, the average interatomic distance between neighboring atoms was measured by the pair distribution function analysis applied to collected selected area electron diffraction patterns. Our findings suggest that electron bombardment may play a significant role in the crystallization of stardust grains, highlighting its potential importance in astrophysical environments.

Poster #401

Infiltration Berm Installation Impacts Soil Microbial Community Function and Nutrient Availability

Pierce Lynch, Jewell Cozort, Allison Veach

Soil microorganisms mediate nutrient cycling, driven largely by water and nutrient availability, in arid environments. Infiltration berms are nature-based landscape features designed to intercept stormwater and promote diffuse recharge, which is critical in drought-prone regions like Central Texas. This study evaluates how soil infiltration berms and position within the berm affects soil physiochemical properties and microbial community structure and activity in the Edwards Aquifer recharge zone. Composite surface soil samples were collected from two berms across three positions (above swale, within swale, and behind berm mound) and a reference site. Sampling occurred biannually over 2 years (N = 84). We assessed gravimetric water content (GWC), total nitrogen (TN), soil organic matter (SOM), soil organic carbon (SOC), active carbon, microbial respiration, aggregate stability, and hydrolytic extracellular enzyme activity (b-glucosidase, b-xylosidase, cellobiohydrolase, N-acetylglucosiminidase, and leucine aminopeptidase). Results revealed that berm position significantly influenced TN, SOC, active carbon, microbial respiration, and all enzyme activities. Season significantly impacted GWC, SOM, SOC, active carbon, and all enzyme activities. These results reveal that bermed landscapes do alter nutrient availability and microbial activity. These results coupled with diversity indices will provide a more holistic view of soil health responses to infiltration berm installation. Ongoing work includes microbial community structure analysis using targeted amplicon sequencing of 16S and ITS2 rDNA via Illumina NovaSeq platform.

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Poster #402

Dissecting Biogeochemical Cycling and Vulnerability Analysis Using Metagenomic Profiling of Groundwater Microbiomes in the Contributing and Recharge Zones of the Edwards (BFZ) Aquifer

Presenter, Jessica Quintanilla, Brent Doty, Allison Veach

The Edwards (Balcones Fault Zone) Aquifer is a highly productive karst aquifer system in the south-central region of Texas that serves as the primary water source for over 2.5 million individuals. Viability of this natural aquifer system is largely reliant on basal stream flow over the contributing zone, and lateral subsurface flow from the adjacent Trinity Aquifer. Surface water originating from the Edwards Plateau catchment, which overlies the Trinity Aquifer and is considered the contributing zone of the Edwards (BFZ) Aquifer, directly recharges the Edwards (BFZ) Aquifer by infiltrating Edwards limestone outcrops in the Balcones Fault Zone. Resident microbiota of groundwater are evolved to survive unique nutrient and physical conditions of the subsurface environment and are primary drivers of biogeochemical cycling within groundwater. Consequently, recharge events have the capacity to alter typical microbial signatures as well as dominant metabolic processes upon the introduction of water with differing chemistry. Targeted 16S rRNA gene amplicon sequencing and shotgun metagenomic sequencing were utilized to identify the taxonomic structure of bacterial and archaeal communities as well as their metabolic potential within river water and groundwater from the Edwards (BFZ) Aquifer contributing and recharge zones.

Poster #403

Developing a Bioenergetics Model for Southern Flounder

Jason Jaworski, Matthew Troia

Southern Flounder (*Paralichthys lethostigma*, hereafter SF) are large benthic flatfish inhabiting nearshore waters of the Texas coast, as well as the rest of the Gulf of Mexico and southern Atlantic coast of North America. SF are a recreationally and commercially valuable species in Texas, representing over 90% of the flatfish harvest in the state. Declining catch rates pointing to declining populations have prompted research into their physiology, life history, and ecology [MT1]. The purpose of this research is to develop a bioenergetics model (hereafter BEM) for SF in order to characterize growth as a function of energy demands of the fish at different temperatures and salinities. SF juveniles sourced from two different populations are being assayed at high salinity characteristic of open ocean (32 parts per thousand [MT2]) for temperature-dependent and mass-dependent rates of consumption and respiration in 2026. A range of low to high temperatures will be used representing ranges that can be observed on the Texas coast. The same assays will be conducted at low salinity characteristic of Texas estuaries (20 ppt) in 2027. The development of this BEM is intended to show at what temperatures and salinities SF direct optimal energy to growth. This can help to spatially define where SF may have better survival and recruitment by comparing the BEM projections across known gradients of temperature and salinity along the Texas coast. This data will also help stock enhancement efforts for SF by improving hatchery protocols and knowledge on better stocking locations based off environmental conditions [MT3]. This will be vital as anthropogenic-rooted stressors such as rising sea temperatures and changing salinity regimes due to water usage will continue to impact the population and therefore management of this species.

Poster Abstracts

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Poster #404

Exploring Thermal Physiology and Vulnerability of Spring-Associated Fishes in Central Texas

Riley Taylor, David Young, Matthew Troia

Temperature strongly regulates physiological performance in ectotherms, influencing metabolism, growth, survival, and reproduction. These performance metrics at the organismal level ultimately scale up to population level and affect the persistence of species. Metabolic scope (MS), is the difference between maximum and standard metabolic rate, represents the energetic capacity available for activity, growth, and reproduction, etc., therefore providing a mechanistic link between physiology and ecological performance. This study integrates field temperature monitoring, laboratory assays, and spatial modeling to evaluate thermal vulnerability of six fish species endemic to springs arising from the Edwards Plateau in central Texas. Water temperature and hydrologic conditions will be monitored across nine drainage basins from 2026 to 2027 using in situ temperature loggers. Laboratory experiments will measure standard and maximum metabolic rates of each species across five temperatures (8–32°C) using intermittent-flow respirometry for metabolic scope and estimation of thermal optima. Statistical models incorporating climate, hydrology, and landscape variables will predict stream temperatures under current and future climate scenarios. By integrating modeled temperatures with optima, thermal safety margins will be estimated to assess species vulnerability to warming caused by climate change and groundwater pumping. Our findings will inform conservation and management of spring-influenced streams and endemic fishes.

Poster #405

Controls on Terrestrial Arthropod Inputs and Impacts to Benthic Macroinvertebrate Communities in Ephemeral Streams of the San Antonio Region

Cidney Williams, Brian Laub

Ephemeral and intermittent streams comprise a large proportion of river networks in semi-arid and rapidly urbanizing regions, yet remain underrepresented. These systems are highly sensitive to land-use change and riparian degradation, and their short hydroperiods increase reliance on terrestrial energy subsidies to sustain aquatic food webs. The magnitude and ecological role of terrestrial invertebrate inputs in urbanizing ephemeral streams remain poorly quantified. This study investigated how riparian vegetation structure and watershed urbanization influence terrestrial arthropod inputs and benthic macroinvertebrate communities in ephemeral pools of the San Antonio River Basin, Texas. We sampled isolated pools across a land-use gradient. We determined whether riparian vegetation enhances terrestrial invertebrate subsidies and whether these inputs influence benthic community diversity, functional feeding group composition, and tolerance structure. We hypothesized that pools with intact riparian buffers receive higher terrestrial input fluxes and support more diverse and sensitive benthic assemblages, whereas urbanized pools exhibit dominance by tolerant taxa. By linking riparian conditions, terrestrial subsidies, and aquatic community structure, this research provides insight into the functioning of ephemeral stream ecosystems in urbanizing watersheds. The findings will inform riparian buffer protection, green infrastructure planning, and watershed-scale management strategies to sustain ecological functions and biodiversity in ephemeral stream networks.

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Poster #406

LRO LAMP Far-Ultraviolet Spectral Mapping of the Compton-Belkovich Volcanic Complex

Sakshee Dhuru, Kurt Retherford, Akbar Whizin, Benjamin Byron, Saniya Sanada

The Compton-Belkovich Volcanic Complex (CB) is a rare example of non-mare silicic volcanism on the lunar farside, characterized by high reflectance, strong ultraviolet absorption, elevated thorium abundance, and unusual thermal properties. Located at 61°N, 99°E and spanning ~25 × 35 km, the complex includes volcanic domes, cones, boulder-rich mounds, and a collapsed central caldera, indicating a magmatic history distinct from typical basaltic lunar volcanism. Previous analyses using thermal infrared, visible, and near-infrared datasets suggest compositions ranging from andesitic to rhyolitic materials, but the spatial distribution of regolith maturity and UV-sensitive compositional variations remains poorly constrained.This study uses far-ultraviolet observations from the Lunar Reconnaissance Orbiter Lyman Alpha Mapping Project (LAMP) to characterize CB using the Off/On-band albedo ratio (175–190 nm / 130–155 nm). This ratio is sensitive to regolith maturity, submicroscopic iron (SMFe), and compositional differences between feldspathic, mafic, and silica-rich materials. Photometrically corrected LAMP data are used to generate spectral maps of key morphological units, including the central caldera, volcanic domes, ridges, and surrounding highlands.Preliminary results show elevated Off/On-band ratios within CB relative to surrounding terrain, suggesting reduced space-weathering and compositional heterogeneity consistent with silicic differentiation.

Poster #407

Laboratory Constraints on Alumina Polymorphs in AGB Circumstellar Dust Shells

Cody Cly, A. Speck PhD; A. Whittington PhD; A. Ponce PhD; B. Sargent PhD; J. Nuth PhD; T. Jensen; R. Montes PhD

Asymptotic Giant Branch (AGB) stars are major sources of dust, enriching the interstellar medium and seeding future star and planet formation. Among the dust species that form in their circumstellar envelopes, aluminum oxides are among the first to appear, condensing at higher temperatures before other minerals can form. Due to its high thermal stability, alumina (Al_2O_3) forms early and abundantly in the dust condensation sequence.Classically, cosmic dust models have assumed alumina is either amorphous or in the form of corundum (α-Al_2O_3). Thermodynamic equilibrium models predict corundum formation — consistent with most presolar grains discovered in meteorites — however, alumina exhibits various crystal structures (polymorphs) that are metastable, existing only within certain temperature regimes, suggesting that non-equilibrium condensation pathways may also play a role. To characterize the conditions under which alumina polymorphs form and transform, samples were analyzed using Differential Scanning Calorimetry, X-ray Diffraction, and Infrared Spectroscopy — probing their thermal, crystallographic, and optical properties respectively. These investigations examine temperature-time-transition paths to corundum from a variety of precursor materials, including aluminum hydroxide minerals (gibbsite, bayerite, boehmite) as well as amorphous material, to better constrain chemical and physical models of circumstellar dust shells.

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Poster #408

Comparative Study of Manganese Oxidation in Martian Fluids: Oxygen v. Oxyhalogens v. Nitrate

Lauren Malesky, Elena Brancaleon, Kaushik Mitra

Manganese oxides discovered within Martian rock fractures are indicators of past redox processes and potential biosignatures. On Earth, Mn(III/IV) phase formation is associated with abundant molecular oxygen (O_2) or microbial catalysis. Mars likely never sustained an atmosphere with abundant O_2, leaving pathways responsible for manganese oxidation on Mars uncertain. Although low O_2 has shown exceedingly slow oxidation in prior studies, its behavior in hydrothermal environments produced by bolide impacts remains undetermined. Bromate has been identified as a strong oxidant, but requires high concentrations or surface-catalyzed nucleation.We conducted laboratory experiments to evaluate the oxidizing capacity of hydrothermal O_2 (at 25 and 75°C), mixed oxyhalogen species (100mmol L-1 chlorate with 10mmol L-1 bromate), and nitrate in Mars-relevant fluids across a wide pH range. Preliminary analysis shows no measurable Mn(II) oxidation with nitrate, whereas mixed oxyhalogens efficiently promote Mn(II) oxidation across all pHs. O_2 was only effective under alkaline conditions, but produced mineral morphologies distinct from those formed by oxyhalogens. O_2 experiments are being repeated in an aerobic chamber with pure O_2 to minimize microbial interaction. Ongoing experiments also examine the effects of Zn, Ni, Cu, and REE on Mn oxidation alongside previous oxidants and are characterized using EXAFS and XANES.

Poster #409

Imaging (Sub) Solar Protoplanetary Disk Systems with SCExAO/CHARIS IFSP

Erica Dykes, Maria Vincent, Thayne Currie, Johnathon Williams, Julien Lozi, Olivier Guyon

In recent decades, extreme adaptive optics (ExAO) instruments have enabled precise Near-Infrared (NIR) scattered light imaging of protoplanetary disks down to scales of tens of astronomical units. These observations have contributed to significant advances in our understanding of the planet formation environment, including our ability to constrain the properties of the micron-sized dust grains and aggregates found away from the midplane of these disks. Despite their success, ExAO observations have been limited in their ability to target protoplanetary disks around Sun-like and low mass stars (i.e. T Tauri stars) as many such systems are too faint at visible wavelengths to operate most wavefront sensors and thus carry out the requisite atmospheric distortion corrections. As part of the AO3k upgrade, a NIR Wavefront Sensor was installed on the 8.2m Subaru Telescope. This allows the Subaru facility AO system to carry out its sensing for extreme adaptive optics corrections in H-band on systems with Hmag > 10, and thus enables CHARIS, the only high-contrast integral field spectrograph capable of polarimetric imaging currently operating, to target these systems. These JHK passband observations in simultaneous total and polarized intensity, yield spatially-resolved imaging and polarized light spectral measurements allowing us to analyze disk geometry and dust properties. We present preliminary imaging and analysis for a small sample of protoplanetary disks around solar and sub-solar mass stars in nearby star forming regions.

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Poster #410

SCExAO/CHARIS Astrometric and Atmospheric Characterization of HIP 99770 b

Danielle Bovie, Thayne Currie, Mona El Morsy, Brianna Lacy, Masayuki Kuzuhara, Jeffrey Chilcote, Taylor L. Tobin, Olivier Guyon, Tyler D. Groff, Julien Lozi, Sebastien Vievard, Vincent Deo, Frantz Martinache, Yiting Li, Motohide Tamura

We present results for the SCExAO/CHARIS follow-up characterization of the directly-imaged superjovian exoplanets HIP 99770 b. SCExAO/CHARIS data provide high-contrast detections, astrometry, and 1.1–2.4 micron spectra of the faint companion. HIP 99770 b was originally detected in the low resolution (R~20) broadband mode, while this follow-up revisited the planet in higher resolution H and K-bands (R~80). These new observations allow us to put further constraints on the planet's atmosphere, orbit, and dynamical mass.

Poster #411

Experimental Rheology of Three-Phase Lava: Bubble Lives Matter

James Landolfi, Brenna Halverson, Alan Whittington

Effusive basaltic eruptions, like the 2018 Kīlauea event, produce fast-moving, low-viscosity lavas that pose significant hazards. Lava rheology, which controls eruptive behavior, is primarily driven by melt composition, temperature, crystallinity, and bubble content. However, traditional viscosity measurements of crystallizing basalts often fail to account for all these factors, lacking the crystalline assemblage of natural samples and being typically bubble free. To address this, we developed a new high-temperature, three-phase viscosity measurement technique (Halverson and Whittington, 2025). This method uses lower temperatures and short experimental duration to preserve original crystals and significant bubbles. Using samples from the Kīlauea 2018 eruption, we conducted experiments at typical eruptive temperatures (1150−1105°C) and were able to retain bubble fractions of 20%-30%, i.e., the majority of the ~36% porosity in the starting material. Our results show significantly lower viscosities than those from traditional bubble-free experiments. Viscosities ranged from 116 Pa·s at 1150°C to a maximum of 1800 Pa·s at 1105°C, while traditional methods plateaued at approximately 14,000 Pa·s at 1115°C. These results underscore that bubbles, depending on their size, shape, and abundance, have a far greater effect on viscosity than predicted by two-phase models developed on crystal-free suspensions.Experiments were also conducted on samples from the Mauna Loa 1868 eruption, which is more vesicular (60±5%) and has a greater volume of large phenocrysts (~20% of the dense material). At 1175°C, the effective viscosity was 84 Pas, with a 25% bubble fraction. At 1150°C, the effective viscosity was 132 Pas, with a 50% bubble fraction. At 1125°C, the effective viscosity increased to >100,000 Pas in under 60 minutes, indicating extensive groundmass crystallization at this temperature. The results from Mauna Loa will help us better understand how bubbles interact with crystals that are of similar dimensions.

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Poster #412

Correlation and Analysis of Nutrients as Nitrates and Phosphates with Remote Sensing Data Across Texas Lakes

John Enyeart, Yongli Gao

This study investigates the correlation between nutrient concentrations of surface water nutrients and remote sensing data. Nutrients include species of nitrogen and phosphorus, which lead to eutrophication. Remote sensing data has a distinct correlation with trophic conditions within surface water, as related to algae and vegetative growth. Remote sensing, in particular the near-infrared spectrum demonstrated correlation with nutrient content beyond simple algae or vegetative content. Determining streamlined means of identifying and measuring nitrogen or phosphorus inputs to surface and groundwater systems with remote sensing data enables watershed managers to note changes in concentrations and isolate contributions to them. Analysis was conducted on several reservoirs across Texas to determine this relationship between nutrients and remote sensing data. Results support a viable regression model between observed values in the watershed for nutrient concentrations and near-infrared surface reflectance. Evaluation of the quality of this regression model includes the R2 (coefficient of determination) and the Standard Error (SER) for each regression. Additional nutrient data points beyond measured collection from surface water is also performed by the Soil and Water Assessment Tool (SWAT) model on the Colorado River.

Poster #413

Studying Siderite ($FeCO_3$) Dissolution in Mars-Relevant Environment Using Electrochemical Techniques

Soumyadeep Ghosh, Sheikh Imran Uddin Ahmed, Shrihari Sankarasubramanian, Kaushik Mitra

Carbonate minerals are universally recognized as important geological sinks for atmospheric CO_2. Recently on Mars, the Curiosity rover detected high concentrations (4.8 to 10.5 wt.%) of pure siderite ($FeCO_3$) in Gale Crater. Siderite dissolution rates hold important clues for the carbon cycle on Mars. To overcome the tedious workflow of conventional geochemical analytical technique like ICP-OES based measurement, we aim to develop a real time sensor to measure Fe(II) concentration in reaction solutions.This research employs electrochemical techniques to study siderite dissolution under simulated Martian conditions. Experiments were conducted anaerobically (<50 ppm O_2) over six weeks, dissolving siderite in a Mars-relevant 0.1 M $MgCl_2$ brine solution (initial pH 2.0). We utilized an optimized three-electrode system: activated carbon felt as working electrode, Ag/AgCl reference electrode, and Pt-wire counter electrode—to measure dissolved Fe(II) concentrations via voltammetry. By analyzing maximum oxidation current density, we calculate Fe(II) concentration in solutions once in a week for six weeks, and track dissolution of Fe(II) from siderite to solution over time. This data stoichiometrically correlates to carbonate breakdown and CO_2 evolution rates. These electrochemical measurements are cross-validated against conventional UV/Visible spectrophotometric data to establish accurate rate constants for siderite weathering in Martian condition.

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Poster #414

Integrated Lab Analog and Numerical Modeling Study of Chilean Torta Domes: Analogs for Venusian Pancake Domes

Lauren Schwartz, Alan Whittington

The Venusian pancake domes, discovered by NASA's Magellan mission, are immense, steep-sided domes whose composition, crystallinity, and emplacement remained uncertain. New models are needed for the formation of flat-topped, steep-sided lava domes because many existing models are limited by using single value or modeled parameters that do not account for temperature effects. I collected field samples from three Chilean lava domes (Chao, Chillahuita, Tocorpuri) for use as analogs for the pancake domes due to having similar shapes (steep-sides, axisymmetric) or size/volume. I measured chemical composition, density, heat capacity, thermal diffusivity, and viscosity of the Chilean lavas. Microscope images and thermal/composition measurements indicate the Chilean lavas have dacite-rhyolite compositions with highly crystalline (> 50%), but Tocorpuri is more silicic and crystalline than Chao and Chillahuita which are most alike. The Chilean lavas have high viscosities (109–1012 Pas) for 850–1000°C with viscosity increasing as deformation/strain increases. The more silicic/crystalline Tocorpuri has higher viscosities than Chao and Chillahuita at all temperatures. In the future, I will develop a dome emplacement model with the lab data and adjustable effusion rates and environmental conditions to try to constrain composition/crystallinity or emplacement conditions of the Venusian pancake domes.

Poster #415

Interactions of Phytohormones Auxin, Gibberellin, and Jasmonic Acid in Mutants of *Arabidopsis thaliana*

Isabella McWhorter, Dr. Valerie Sponsel

Arabidopsis thaliana is a small plant in the Brassicaceae (cabbage) family with a rapid generation time of 5–6 weeks and a fully sequenced genome. The following experiments were conducted with seedlings of four genotypes of *Arabidopsis*, namely wildtype (WT), transport inhibitor response 3 allele of the BIG gene (tir3), allene oxide synthase (aos), and the double mutant (tir3-aos). The mutants have altered levels of, or response to, three plant hormones, auxin, gibberellins, and jasmonic acid which affect their growth, development, and response to the environment. The experiments were designed to test whether these mutants responded differently to exogenous hormones, and if the hormones could rescue any of the mutant phenotypes. Two-week-old seedlings, grown in sterile culture, were treated with the synthetic auxin, 1-naphthaleneacetic acid (NAA), gibberellin A4 (GA4), and jasmonic acid (JA) for 7 days. NAA decreased primary root length and increased the number of lateral roots. Jasmonic acid decreased both the primary root length and the number of lateral roots. Gibberellin A4 gave inconsistent results though the response of aos was markedly different from that of other genotypes. Results are discussed in relation to what is known of auxin, GA, and JA interaction at the molecular level.

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Poster #416

Habitat Preferences and Seasonal Dynamics of Invasive Suckermouth (*Hypostomus plecostomus*) Armored Catfish in Spring Ecosystems

Cora Mickey, Riley Taylor, Joey Perez, Robert Mollenhauer, Monica McGarrity, Matthew Troia

Suckermouth armored catfish (SAC) of the family Loricariidae are native to South America but are globally invasive. Tropical ecosystems are most vulnerable to SAC invasion but thermally buffered spring-fed streams in subtropical climates are also vulnerable. SAC degrade habitat, alter biogeochemical cycles, and compete with and potentially negatively impact native benthic fishes. Our objective was to quantify habitat preference of SAC in spring-fed streams and assess habitat niche overlap with native benthic fish. We quantified these responses seasonally to assess habitat use, including use of thermal refuges by cold-intolerant SAC during the winter. We conducted snorkel counts of SAC and imperiled Rio Grande darters (*Etheostoma grahami*) seasonally from January 2024 to January 2026 at 36 transects arrayed along a 3 km gradient of spring influence in San Felipe Creek, Texas, USA. During each season, we monitored temperature regimes using in situ loggers and measured in-stream habitat variables (depth, velocity, substrate, etc.). First, we used the ordination technique, outlying mean index (OMI) analysis, to quantify multivariate niche dimensions of SAC and darters and assess niche overlap. Darters preferred higher velocities and coarser substrates in the midchannel, whereas SAC preferred bedrock substrates associated with undercut banks. Second, we fit occupancy models to evaluate variation in detection probability (p) and occurrence (Ψ). Occurrence was high in both channel margin ($\hat{\Psi} = 0.98$) and midchannel ($\hat{\Psi} = 0.79$) transects but was significantly lower in midchannel transects in spring ($\hat{\Psi} = 0.46$)—a habitat shift potentially associated with seasonal burrow spawning behavior. In order to most effectively manage populations of SAC, understanding seasonal habitat preference is fundamental in subtropical climates. Further, this project will assess other spring-fed streams within Texas to establish if habitat preferences are consistent among similar ecosystems. This research may inform mitigation techniques for the SAC to prevent impacts on native species.

Poster Abstracts

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Poster #417

Assessing Nutrient Export from Bioretention Basin Soils Under Different Treatments

Jibel Mendez, Brian Laub

Bioretention basins improve stormwater quality, but their effectiveness can decline if basin soils release nutrients such as nitrate and phosphorus into standing water. Understanding how vegetation and organic amendments influence nutrient leaching is important for improving basin performance. This study tests whether soils from a bioretention basin release nutrients during a 72 hour saturation period and whether mulch, organic material, or vegetation alter nitrate and phosphorus leaching. Soil from an established bioretention basin was homogenized and placed into 16 oz mesocosms fitted with side port tubing for leachate collection. Seven treatments were established: bare soil, soil with mulch, soil with organic material, soil with a native plant named frog fruit (Phyla nodiflora), soil with a non native plant named rescue grass (*Bromus catharticus*), and soils containing either plant species combined with organic material. Simulated stormwater was added and allowed to stand for 72 hours. Leachate, along with input water and water only controls, was filtered and analyzed for nitrate and phosphorus. We expect nutrient concentrations to increase during saturation, with bare soil and organic material treatments showing the highest levels. Vegetated mesocosms, particularly those with the native species, are expected to reduce nutrient leaching compared to non vegetated treatments.

Poster #418

Deducing the Occurrence of Superposition Events for Pc3, Pc4, and Pc5 Waves in the Terrestrial Magnetosphere from March to May 2024

Kelsey Smith, Dr. Mark B. Moldwin

Ultra-low frequency (ULF) geomagnetic wave superposition, events where different wave modes combine, are important phenomena to understand as well within the field of space weather. This research analyzes ULF wave superposition events within the Pc3, Pc4, and Pc5 frequency ranges (0–0.1 Hz) during a three month time period from March 2024 to May 2024. Ground based magnetic fluctuation data was obtained from MACCS, a network of magnetometers in Arctic Canada. Space based magnetic fluctuation measurements for the time period was retrieved from NOAA's GOES-16 magnetometer. A python program processed both of the datasets into detrended magnetic fluctuation graphs. Measurements were then put through scipy's welch function to create various graphs. Manual wave mode observations were recorded in a digital journal across the three months for all stations utilized. A strong pattern was found between the ULF wave power and amplitude and superposition events, demonstrating that superposition events do occur with variable ULF wave activity on the ground. However, space based measurements do not show a direct relationship between superposition events and ULF wave activity. Further investigation additional stations not located in the high latitudes is needed to better understand how often superposition events occur at different ground-based positions.

Poster Abstracts

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Poster #419

Oxidative Weathering of Pyrite and Pyrrhotite by Oxyhalogen Brines at 273 and 277 K: Implications for Martian Elemental Sulfur and Iron-Bearing Mineral Formation

Amber Miller, L.A. Malesky, K. Mitra

Bulk Mars is enriched in sulfur. Its surface is oxidized with primary and secondary sulfate salts, which are abundant and ubiquitous. The recent discovery of elemental sulfur at Gale Crater is the first native state sulfur detection on Mars. One possible geochemical pathway suitable for explaining the present of elemental sulfur on Mars is through the oxidative weathering of iron sulfide minerals. Minerals like pyrite and pyrrhotite produce elemental sulfur when oxidatively weathered by chlorate and bromate, oxyhalogen salts shown to be abundant on Mars. The oxidizing potential of chlorate and bromate brines on iron sulfides has been studied at room temperate, but their oxidizing effects under cooler temperatures remain undetermined. At ambient conditions, sulfide first oxidizes to elemental sulfur before oxidizing to a higher oxidation state as sulfate. At colder temperatures, it is likely the sulfide minerals will produce a higher elemental sulfur yield due to slow or incomplete reaction kinetics. Using laboratory experiments, we study the oxidative weathering of iron sulfide minerals pyrite and pyrrhotite by chlorate and bromate brines in two Mars-relevant background fluids at 277 and 273 K.

Poster #420

Urban Heat Island and Terrain Effects on Convective Storm Initiation and Evolution near San Antonio

Christopher Campbell, Mahsa Afra

Urban heat island (UHI) effects, driven by elevated surface temperatures in metropolitan environments, have been associated with enhanced rainfall in many cities. Storm systems, which may be viewed as semi-closed thermodynamic systems, are influenced by surrounding environmental factors such as barometric pressure, wind speed, and wind direction. Frontal cyclogenesis and other mesoscale processes often determine storm intensity and direction of travel; however, localized environmental factors may also influence storm evolution. One such factor is elevated surface temperature associated with the urban heat island, which may provide additional thermal energy to approaching storm systems. The terrain profile of the Balcones Escarpment may also serve as a source of forced convection for storms approaching San Antonio from the west, potentially enhancing uplift as air masses traverse the downward sloping escarpment and enter the urban environment. To test this hypothesis, archived radar data from the NOAA Weather and Climate Toolkit were analyzed alongside land cover data from the National Land Cover Database. An ArcGIS-based model was developed to examine storms approaching the San Antonio metropolitan area from the west to evaluate intensity changes. By comparing storm intensity across this terrain–urban transition, the model assesses the combined influence of terrain-induced uplift and urban thermal enhancement on convective storm systems. Unlike previous studies that focus primarily on long-term climatological datasets, this work analyzes the evolution of individual storm systems using archived radar and historical weather observations.

Poster Abstracts

Earth, Environment, and Planetary Systems

Poster #421

Sulfide Excavation and Informatics (SEI) : An Organics-Based Classification Model for Carbonaceous Chondrites

Elianna Moore, Dr. Kelly Miller

Carbonaceous chondrites are a rare class of meteorite defined by a high carbon content and the presence of small inclusions of melted silicates called chondrules. These meteorites record the early solar system's aqueous alteration history through their mineralogy and organic inventories. Our study investigates the transformations outlined by Li et al. (2023) involving the amino acids glutamate, alanine, and aspartate, catalyzed by iron and nickel sulfides. Using NASA's AstroMat database, the Ni content of pentlandite and pyrrhotite samples from Hayabusa2 and CI, CM, and CR meteorite classes was compared to assess these transformations at a large scale. The results demonstrate a split in synthetic pathways as alteration progresses, which implies that two asteroids of the same class may record distinct parent body alteration histories. These results will enable us to refine our current classification schemes using organic-based proxies and allow us to better contextualize future sample return missions.

Poster #422

Microbial Modulation of Freeze Thaw Dynamics and Ice Crystallization in Natural Hailstones

James Moore, Yongli Gao, Thomas Nordstrand, Rebecca Adams-Selin

Ice formation clouds is commonly initiated by heterogeneous nucleation on aerosols and biological particles. Certain microorganisms produce specialized ice nucleating proteins capable of organizing nearby water molecules and triggering freezing at relatively warm subzero temperatures, influencing precipitation processes and atmospheric cloud dynamics.This project investigates whether microbial communities present in natural hailstones influence freeze thaw behavior and ice crystal formation. Meltwater derived from archived hailstones collected during the In-situ Collaboration Experiment for the Collection of Hail In thr Plains (ICECHIP) field campaign, along with other older preserved samples, are used as a potential microbial source in laboratory hailstone analog system. Controlled experiments compare sterile water samples with hail-derived microbial samples to evaluate differences in freezing temperatures, crystal morphology, and structural stability across repeated freeze thaw cycles.By focusing on multi cycle freezing rather than single nucleation events, this study aims to better replicate natural hailstone growth processes within thunderstorms. Understanding how microbes influence ice crystallization may improve atmospheric precipitation models and provide insight into biological interactions with ice in cryogenic environments relevant to planetary and astrobiological research.

Poster Abstracts

Earth, Environment, and Planetary Systems

Poster #423

Temporal Change of Texas's Water Quality

Essohaana Assih, Indrayudh Mondal, Saugata Datta

Texas relies heavily on both groundwater and surface water for its activities, that being, agriculture, industry…, but also to support its population. Over the past decades, habits had changed, population expanded, and environmental issues increased, affecting the water quality across Texas' land. The study we are engaging in will analyze how water quality in Texas has changed since the 1960s, starting with groundwater and the major aquifers that Texas has, then surface water systems. Texas contains a total of nine recognized major aquifers. Not only do they supply agricultural and industrial use, they also provide an important portion of drinking water in the state. Groundwater is not the only water source used by the state; surface waters like rivers and lakes also play an important role when the groundwater supply is insufficient. That's why, in this research, we will primarily focus on groundwater, and later on, if the data allow, turn to surface water impact as well.Overall, this research aims at understanding how water quality was affected over the past decades, which aquifers are/is the most involved, and most importantly, how and to what extent the populations were affected.

Poster #424

Fossil Assemblages Used to Determine Paleoenvironment and Paleotectonic Implications for the Delaware Basin of West Texas During the Middle to Late Permian

Savanna De Leon, Janet Vote

Specimens found in the Pipeline Shale of West Texas show evidence of deep marine life in the Delaware Basin during the Middle Permian Period. Analysis of cephalopod fossil assemblages in contemporaneous strata in the Glass Mountains and the Guadalupe Mountains are used to show that the time-equivalent sedimentary strata around the Delaware Basin were deposited during the lower-to-middle Permian. However, the depositional environments between the two ranges are different. The Guadalupe Mountains preserve mainly slope and basin deposits whereas the Glass Mountains preserve shelf-to-slope deposits. This study focuses on the addition of two cephalopod specimens to known assemblages found in the Pipeline Shale Member of the Brushy Canyon Formation. With a comparative analysis of the stratigraphy in both mountain ranges as well as the fossil assemblages contained within them it will be possible to infer differences in the paleoenvironments at opposite sides of the Delaware Basin. The difference in the paleoenvironments may lead to a better understanding of the paleotectonic environment during the break up of Pangea.

Poster Abstracts

Earth, Environment, and Planetary Systems

Poster #425

Modeling Surface-Groundwater Interaction for a Karst Aquifer Under Active Recharge Conditions

Ethan Perez, Indrayudh Mondal, Saugata Data

Groundwater is a vital resource in Texas, supplying clean water to nearly half the state's population. This makes the protection of the recharge-zone essential for public health and water security. This study investigates the potential for contaminants to migrate from surface water into groundwater along Helotes Creek. Our study area is located within the recharge zone of The Edwards Aquifer in central Texas. An ensemble groundwater modeling approach is being developed using MODFLOW coupled with ModelMuse. This approach incorporates recharge and contaminant transport packages to simulate hydrological flow fields and compute contaminant transport. Model inputs include elevation data, recharge estimates and hydrologic characteristics of the Helotes Creek watershed. Initial results indicates that the highest recharge rates can occur in low-elevation areas and near the creek channel, identifying potentially vulnerable zones. Based on these results, we can hypothesize that the study area offers strong potential for contaminant transport from surface to groundwater. Preventing contamination in surface water systems is essential to protect groundwater quality and reduce potential risks to human health. This highlights the need for continued effort in establishing contaminant modeling on surface-groundwater water contamination to strengthen the understanding of contaminant transport processes in this karst recharge environments.

Poster #426

An Experimental Investigation to Study Evaporative Formation of Chloride, Sulfate, and Carbonate Minerals on Mars

Catherine Burke, Soumyadeep Ghosh, Eashan Das, Kaushik Mitra

Evaporite minerals like chloride, sulfate, and carbonate have been detected on the surface of Mars via different missions. Evaporites can form by the evaporation of leachates produced during the chemical alteration of basalt on Mars. Geochemical models have predicted possible evaporite mineral formation pathways upon the evaporation of different types of brines on Mars. However, experimental studies in laboratory conditions hold practical importance to validate model outputs. We utilized the ionic composition data of different Mars-relevant brines predicted to form during basalt weathering under a variety of basalt alteration scenarios, and prepared different solutions to achieve desired molal concentrations of Na^+, Ca^{2+}, Cl^-, SO_4^{2-} ions by dissolving NaCl, Na_2SO_4, $CaCl_2 \cdot 2H_2O$ salts in deionized water; fluid pH was also adjusted to the desired value. We stirred the solutions with a magnetic stirrer ensuring complete dissolution to form a homogenous mixture. The solutions were kept in an oven at 50°C until complete evaporation of the brines that led to evaporite mineral formation. We will collect X-ray Diffraction scans of the evaporite mixtures and identify the mineral assemblages. The results will be matched to the predicted mineral assemblage obtained by thermodynamic modeling in earlier studies.

Poster Abstracts

Earth, Environment, and Planetary Systems

Poster #427

Measuring Thermal Properties of Ordinary and Carbonaceous Chondrites

Brandon Schmitz, Alan Whittington, Daniel Ostrowski

Meteorites provide valuable insight into the composition and physical properties of early solar system materials. This study investigates the thermal properties of ordinary and carbonaceous chondrites in order to better constrain how different meteorite types transfer and store heat under entry-like conditions. Laboratory measurements were conducted on six meteorite samples, including two ordinary chondrites and four carbonaceous chondrites, all of unique classifications to ensure a wide spread of compositional variance. Density (ρ) was measured using a helium pycnometer. Heat capacity (CP) and thermal diffusivity (D) were obtained via laser flash analysis (LFA) at varying ranges from 25°C to 1200°C. Thermal conductivity (k) is provided by the relation k = DρCP.Initial results of the ordinary chondrites show that for both H and LL classifications, thermal diffusivity decreases when heating to ~700°C. The H fell from 0.596 to 0.511 mm^2/s (25°C baseline), while the LL dropped from 0.311 to 0.282 mm^2/s. Thermal conductivity followed a similar trend with lows hitting 1.956 W/m·K and 0.877 W/m·K respectively.The thermal properties of the meteorites are clearly compositionally dependent. The results of the experiments show a general trend of decreasing thermal diffusivity up until 800°C, after which the iron content melts and becomes mobile, flowing through and interconnecting the porous space.

Poster #428

Oxidative Alteration of Olivine by Oxyhalogen Salts: Insights into Clay Mineral Formation on Mars

Zoe Zoesch-Weigel, Elena Brancaleon, Amy Schoenenberger, Lauren A. Malesky, Kaushik Mitra

Martian surface mineralogy reveals widespread deposits of ferric iron [Fe(III)] minerals, which arise through aqueous alteration of ferrous iron precursor minerals like olivine and pyroxene at both low temperatures and hydrothermal (~50–200°C) conditions. While dissolved oxygen, UV-driven processes, and aqueous anions have been considered as oxidants, recent work has shown the oxyhalogen species chlorate and bromate as effective oxidizing agents in Mars-relevant fluids. Prior studies examined oxyhalogen reactions with dissolved Fe^{2+}, pyrite, and magnetite, but minimal work has quantified their effect on olivine.This study addresses this gap by examining chlorate and bromate interactions with terrestrial forsterite and fayalite in Mars-analog brines ($MgCl_2$ and $MgSO_4$) across pH 4, 5, 7, and 10. Experiments were conducted in an anaerobic chamber, and olivine alteration was determined as a function of the oxidant type, initial pH, and background fluid. To overcome the slow dissolution rates of olivine under ambient conditions, experiments were held at 95°C for 50 and 90 days. Solution color changes demonstrate that both olivine end-members underwent alteration, with acidic conditions producing a rust-colored hue. Alkaline solutions became cloudy due to mineral dissolution and oxidation. We will be presenting analytical data to provide evidence of olivine alteration because of exposure to oxyhalogen salts.

Earth, Environment, and Planetary Systems

Poster #429

Using Astrometry and RV to Identify New Exoplanets and Brown Dwarfs Amenable to High-Contrast Imaging from the Ground and Space

TEAM: Physics and Astronomy

Jie Li, Yiting Li, Thayne Currie, Mona El Morsy

Direct imaging surveys capable of probing the exoplanet population beyond the ice line have been plagued by a low rate of discoveries. Recently, efforts have switched to dynamics-selected surveys, primarily focused on imaging systems showing dynamical evidence for a planet from Hipparcos and Gaia astrometry (e.g. Currie et al. 2023, 2025; Mesa et al. 2023). Precision radial-velocity (RV) data may also reveal planets directly or hint at them (e.g. long-term RV trends; Crepp et al. 2014), especially for planets around older stars accessible with JWST or ELTs in thermal emission or Roman and HWO in reflected light. We have initiated a large campaign to identify new planets and low-mass brown dwarfs from newly-available precision RV data for this purpose.

Poster #430

withdrawn

Earth, Environment, and Planetary Systems

Poster #431

Electrical Resistivity Tomography Analysis of Subsurface Features at UTSA East Campus

TEAM: Earth and Planetary Sciences

Triniti Auzenne-Emebo, Kaylie Dana, Jose Gamez Barbosa

INTRO/BACKGROUND: Electrical Resistivity Tomography (ERT) was used to investigate subsurface characteristics in the East Campus area at the University of Texas at San Antonio (UTSA). The purpose of this study is to identify possible fracture zones, faults, or karst features beneath the campus surface for Best Management Practice (BMP). Karst terrains are commonly associated with subsurface voids, fractures, and dissolution features that can influence groundwater flow and infrastructure stability, making their identification important for campus planning and environmental management. METHODS: Field data collection involved the deployment of electrodes along an approximately 200-meter survey line across the study area. Prior to data acquisition, field preparation included careful placement of electrodes at consistent intervals along the transect. A Real-Time Kinematic (RTK) Global Navigation Satellite System (GNSS) survey was then conducted to obtain highly accurate positional data for each electrode. Electrical resistivity measurements were subsequently collected along the profile to measure variations in subsurface resistivity. Geographic Information Systems (GIS) and digital elevation models were used to analyze drainage networks, terrain features, and potential recharge areas. LITHOLOGY OF CAMPUS: The UTSA campus is located in the transition zone of the Edwards Aquifer.The local stratigraphy includes the Upper Cretaceous carbonate units, where the Buda Limestone and the Del Rio Clay Formations overlie the Edwards Formation. These lithologic units influence the groundwater movement because limestone formations usually have high porosity making aquifers extremely effective while the Clay units have low permeability. CONCLUSION/HYPOTHESIS: The resulting resistivity data will be processed and interpreted to generate two-dimensional subsurface models that highlight variations in electrical properties of the underlying materials. These models will help identify potential subsurface anomalies that may correspond to karst features, void spaces, or anthropogenic BMP structures. These models will help identify potential subsurface anomalies that may correspond to karst features, void spaces, or anthropogenic BMP structures. In particular, The ERT survey is expected to detect resistivity contrast between the Del Rio clay Formation and the more resistive limestone units of the Buda and the Edwards Formations. Zones with anomalous highs or lows in resistivity within these units may indicate fractures, dissolution pathways, or karst features. The findings from this research contribute to a better understanding of the subsurface geology of UTSA's East Campus and provide information useful for environmental management, infrastructure planning, and possible recharge zones.

Poster Abstracts

Earth, Environment, and Planetary Systems

Poster #432

Study of the Fusion Crust of Aguas Zarcas by Transmission Electron Microscopy

TEAM: Physics and Astronomy

K. Johnson, E. Austin, J. Knoop, C. Rooney, A. Ponce

The fusion crust of the CM2 carbonaceous chondrite Agua Zarcas was investigated to characterize its mineralogy and microstructure, and to elucidate the crystalline phases that develop under extreme thermal and pressure conditions of atmospheric entry. CM2 Chondrites are primitive, carbon-rich bodies that record early solar system water-rock interactions. Their fusion crusts, thin, glassy rinds formed by rapid surface melting and quenching during hypervelocity atmospheric transit, remain comparatively understudied relative to their interiors. A multi-technique analytical approach was employed, combining X-ray diffraction (XRD), energy dispersive spectroscopy (EDS), selected area electron diffraction (SAED), and high-resolution transmission electron microscopy (HRTEM) in both bright-field and dark-field imaging modes. Results indicate that the fusion crust is dominated by an amorphous silicate matrix, with localized crystalline domains. Phase identification and corroborating interplanar spacing measurements from SAED patterns consistently identify olivine as the principal crystalline phase, with trace elements of aluminum, chromium and gold. A systematic angular offset observed in the XRD spectrum is discussed in the context of potential shock- or thermally-induced lattice strain that occurred during atmospheric entry.

Poster #433

Reconstruction Analysis of the Laramide Deformation in West Texas and Northern Mexico

TEAM: Earth and Planetary Sciences

Edward Davila, Jack Beer, Sierra Young

The Laramide Orogeny was a mountain building event that occurred as a result of the subduction of the Farallon Plate beneath the western edge of North America. Starting in the Mesozoic and continuing into the Cenozoic, this event was responsible for uplift and deformation of the Rocky Mountains from southern Canada to northern Mexico. The area of study is West Texas and northern Mexico, this region is located at the boundary between thick-skinned and thin-skinned deformation, as a result we predict that the depth-to-detachment, and structural style will change throughout the study area. The objective of this project is to determine how the surface expression of the Laramide orogeny changes along strike between the Terlingua Quick Silver district and Tornillo Basin of west Texas and the Potosi Uplift of northeastern Mexico to interpret how they fit into a larger tectonic and stratigraphic framework. To date, limited research has been conducted on the local progression of Laramide deformation, so we aim to determine the style and magnitude of Laramide deformation present utilizing published cross-sections restored using MOVE software. This study will help improve the understanding of how Cenozoic deformation shaped west Texas and northern Mexico.

Earth, Environment, and Planetary Systems

Poster #434

Urban Heat Island Effects in San Antonio, Texas Based on 20-Year MODIS Land Surface Temperature Data via Google Earth Engine

TEAM: Earth and Planetary Sciences

Jonah Canlas, Steven DeMaagd, Yakira Johnson

Urban Heat islands are urban areas that experience higher air and land surface temperatures compared to suburban areas caused by increasing impervious surfaces and decreasing vegetation. Urban heat islands dominate the inner city of San Antonio, Texas due to the city's rapid urbanization and lack of vegetation. Using GEE and Python to visualize and analyze MODIS, USGS Land cover, and NOAA data, this study will characterize the UHI of San Antonio, Texas and compare the results with the city's different demographics from the U.S Census Bureau. It's expected that the urban portions of San Antonio will have higher land surface temperatures than surrounding suburbs suggesting urban areas experience the most daily temperature variability during extreme heat conditions. Regarding mitigation for the UHI of San Antonio, the city's disproportionately affected demographics in the city's urban areas should be taken into consideration.

POSTER ABSTRACTS

STEM Education and Workforce Development

Poster Abstracts

STEM Education and Workforce Development

Poster #500

Changing Student Perception of Learning and Studying Strategies in STEM

Blain Mamiya

Students come into our classroom with a sense of an "imaginary audience," constantly self-conscious of being judged, compared, and evaluated. Add to the performance-based academic, social, ethnic culture, these likely have led to a rise of mental health conditions like anxiety and depression. Changing student perception of the learning and study strategies entering their post-secondary education can be a benefit to both learning and their mental health. Basic Chemistry tried to create a classroom environment to guide and encourage changing learning and study strategies to benefit students both academically and professionally. The course was designed for students to adopt the "Six Strategies for Effective Learning and Studying" by introducing students to changing from mass practice to spaced practice learning to minimize knowledge decay and increasing retention using interleaving. Teaching students to use retrieval practice to improve cognitive memory. In class, using activities to help students develop dual coding, elaboration, and concrete examples connecting conceptual understanding of topics. Our two-year investigation attempted to correlate the activities to increase these six-strategies for effective learning and studying to changes in study strategies and mental health.

Poster #501

Fact or Fiction—Systematic Investigation on the Use of AI (or External Aids) for Online Homework

Hadi Arman

There has been great advancement in generative AI (such as ChatGPT) over the last few years. This has resulted in a claim that the use of AI is prevalent in online homework. This claim is mainly backed by anecdotal evidence and not actual data. One online homework platform, ALEKS, uses an assessment to evaluate student's initial proficiency in chemistry topics. The idea behind this is to allow students with more prior knowledge, to only be given topics they require increased understanding. It is not proctor and assumes a good faith effort is given. This initial assessment has sparked quite a debate as to whether students are using external aids to take advantage of the system. Our one-year study of General Chemistry I students' online homework data was analyzed using K-cluster means and other statistical analysis to categorize similar data. A longitudinal study was conducted on these clusters to compare their assessment scores over the semesters. Initial results suggest that there is a small group of students who may use AI or external aids on their homework. However, the longitudinal study showed that these students have no greater advantage in succeeding in the course compared to the rest of the students.

STEM Education and Workforce Development

Poster #502

Uncovering the Hyperexcitability Mechanism in ARX Brain Orgaonids

Sara Mirsadeghi, Sophia Carlson, Michele Giugliano, Jenny Hsieh

Mutations in the ARX gene are associated with epilepsy and neurodevelopmental disorders, often leading to disrupted neural development and network dysfunction. Brain organoids, derived from human stem cells, offer a unique model to study these mechanisms in a three-dimensional, physiologically relevant context. In this study, we used 3D multi-electrode array (3D-MEA) technology to assess neuronal activity in fused brain organoids composed of cortical (CO) and ganglionic eminence (GEO) regions. Organoids were generated from ARXPA2 mutant and isogenic control lines and were either matched-fused (CO and GEO from the same genotype) or mixed-fused (ARXPA2 fused withiCrt). This design allowed us to assess whether the electrophysiological phenotype is cell-autonomous. ARXPA2 matched-fused organoids exhibited hallmark features of epileptiform activity, including increased burst rate, prolonged burst duration, and abnormal synchronization, reflecting a hyperexcitable network state. Notably, mixed-fused organoids with ARXPA2 COs recapitulated the hyperactive phenotype, while those with ARXPA2 GEOs showed reduced activity, suggesting impaired interneuron integration or synaptic connectivity.

Poster #503

Phasic Dopamine Signaling as a Neural Marker for Motivational Persistence and Behavioral Cessation

Trinity Holenn Schiette, Matt Wanat, Cecilia Martinez

Generalized deficits in motivation-the inability to initiate or sustain effort for rewards—are core symptoms associated with numerous mental health disorders. Identifying the neural signals that dictate these motivational breaking points is essential for developing targeted therapeutic interventions. This study, part of a larger graduate research project investigating the neurobiology of reward seeking, utilizes in vivo fiber photometry to observe real time dopamine dynamics in the Nucleus Accumbens.During this undergraduate research experience, I executed behavioral protocols using a Concurrent Progressive Ratio task to map the threshold of drive. By utilizing genetically encoded GRABDA biosensors, we isolated high fidelity neural transients that correlate with behavioral output. Our preliminary findings identified a distinct breaking point at 161 presses, where a significant attenuation in dopamine signaling immediately preceded the cessation of effort. These data suggest that phasic dopamine acts as a critical neural marker for persistence. By identifying the signals that separate maximizers from those with motivational deficits, this research contributes to a broader effort to understand the biological foundations of resilience and drive.

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College of Sciences Associate Dean for Research

Elizabeth Sooby received her Ph.D. in Physics from Texas A&M University. She also is an Associate Professor of Physics and the Project Director for the Consortium on Nuclear Security Technologies. Her research expertise is in high temperature materials synthesis and thermal analysis for nuclear energy applications, specifically advanced fuel fabrication and characterization.

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Leslie Neely received her Ph.D. in Educational Psychology from Texas A&M University. She also is a Professor of Educational Psychology, a Director of the Child and Adolescent Policy Research Institute, and an Associate Director of the Brain Health Consortium. Her research centers on progressing the treatment of severe behavior for persons with autism and developmental disabilities with the science of applied behavior analysis.

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Zachary Tonzetich received his Ph.D. Inorganic Chemistry from the Massachusetts Institute of Technology. Research in his laboratory seeks to answer questions in catalysis, sustainability, and biology through the common theme of synthetic inorganic and organometallic chemistry.

Student Programming Chair

Hector Aguilar, Ph.D.

College of Sciences Associate Dean for Undergraduate Studies

Hector Aguilar received his Ph.D. in Chemistry from the University of Texas at San Antonio. He is also Professor of Instruction and Distinguished Teaching Professor of Chemistry. His areas of teaching expertise include chemical biology, medicinal chemistry, and organic chemistry.

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