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San Joaquin Valley Section

Educational Employees Credit Union

TABLE OF CONTENTS

3 Minute Thesis

Abstracts

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Graduate

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Chemistry

Navigating Pre-Service Elementary Teachers' Lack of Experience with Science Practices

Children possess innate curiosity for the natural world around them and ask scientific questions that go beyond disciplinary explanations. However, many elementary teachers struggle to support children's understanding of scientific phenomena. Such struggles arise from pre-service elementary teachers (PSETs) lack of opportunities to engage in authentic science practices aligned with children's curiosities. In this study, we seek to understand how an integrated Physical Science guided-inquiry laboratory curriculum supports PSETs' chemistry, physics, and integrated scientific explanations. Further, we explore how instructional approaches implemented by two university laboratory instructors impact PSETs' creative learning experiences during guided-inquiry instruction. Study participants (n=121) include underrepresented populations in Science, Technology, Engineering, and Mathematics fields consisting of 90% female students (n=109) with a varied representation of diverse ethnic groups including 67% Hispanics (n=81), 20% Caucasian (n=24), 7% Asian (n=8), 2% African American (n=3) and 2% other (n=2) and 2% decline to state (n=3). This study uses the Knowledge Integration (KI) framework to understand how guided-inquiry supports PSETs' scientific explanations. Furthermore, the Social Cognitive Learning theory is used to examine how social interactions during guided-inquiry instruction influence students' self-efficacy to engage in creative learning tasks. Statistical analysis of pre/post assessments indicate significant gains in PSETs' explanations of chemistry, physics, and integrated scientific phenomena. Further analysis reveals an instructor effect in which students taught by the chemistry laboratory instructor display greater KI gains in comparison to those students taught by the physics laboratory instructor. Preliminary analysis of video observations suggest that university laboratory instructors communicate powerful messages that are reflected in students' engagement in creative learning tasks. Findings from this study will highlight critical implications for teacher education programs to consider in supporting PSETs' future teaching practices in light of the Next Generation Science Standards (NGSS).

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Kinesiology

Evaluation of Mental Health Resources for an Intercollegiate Athletics Program

According to the 2008 and 2012 National College Health Assessment Annual surveys, 31% of male and 48% of female National Collegiate Athletic Association (NCAA) student-athletes reported anxiety or depressive symptoms (Hailine, Kroshus, & Wilfred, 2014). While it is widely understood student-athletes experience mental health struggles and that recommendations for student-athletes exist (NCAA, 2019 “Mental Health Best Practices” section), mental health programming specific to intercollegiate student-athletes has yet to be evaluated in practice. Therefore, the purpose of this study is to assess the mental health provisions for student-athletes at a NCAA Division I university. Student-athletes’ awareness of what is available to them, the accessibility of the services available, and the utilization of the mental health services by student-athletes will be investigated. Participants included student-athletes from a variety of sports who are returning to their Division I NCAA university located in the southwest region of the United States. Participants completed a demographic questionnaire and a mental health provision survey. The mental health provision survey is comprised of multiple choice, Likert-scale and open response items delivered via Qualtrics online survey software. Four hypotheses are made for this study. First, student-athletes are aware of the mental health programming and resources available from the athletics department. Second, student-athletes are using the services available to them. Third, participants will report that the mental health programming had a significant impact at destigmatizing mental health and illness concerns. Fourth, participants will report the athletics department programming has had a positive effect. Data analysis included descriptive statistics and an analysis of variance comparison of key demographic variables (e.g., gender). The results of this study will further the knowledge in de-stigmatization and effectiveness of the student-athlete mental health program.

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Kinesiology

Mental Toughness and Attribution of Perceived Failure in Collegiate Athletes

Mental toughness and attribution are contributing factors to an athlete's mindset about performance and the performance itself (Cowden, 2016; Rascle et al., 2008). While there is an abundance of individual research on mental toughness and attribution in the sports setting, there is limited research exploring the relationship between these two constructs (Cowden, 2017; Rees et al., 2005). Therefore, the purpose of this study was to examine the relationship between mental toughness and attribution of perceived failed outcomes of collegiate athletes. Eighty-one NCAA (American) and USport (Canadian) student-athletes participated in an online survey. The survey included the Sport Mental Toughness Questionnaire (SMTQ; Sheard et al., 2009), the short form version of the Sport Attributional Style Scale (SASS; Hanrahan & Grove, 1990), and a demographic questionnaire. SMTQ is used to assess overall mental toughness along three subscales: confidence, constancy, and control. SASS is used to measure attribution along five dimensions: internality, stability, globality, controllability, and intentionality. Two hypotheses were addressed. First, it was hypothesized that there would be a statistically significant difference between gender, academic year, and type of sport played (team vs. individual) on mental toughness scores and the attribution of failure dimensions. Second, it was hypothesized that there would be at least one statistically significant correlation between overall mental toughness and the components of mental toughness with the attribution of failure dimensions. Data analysis included a series of t-tests, one-way ANOVAs, and a Pearson's bivariate correlation. Results revealed a low positive correlation between mental toughness and several attribution of failure dimensions. However, there were no significant differences between gender, academic year, and type of sport played on mental toughness scores and the attribution of failure dimensions. Overall, this study suggests that there is some association between athletes' mental toughness and how they attribute failed outcomes.

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Graduate

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Department of Social Work Education

Stress and Coping among Parents Raising a Child with an Autism Spectrum Disorders (ASD)

Children with Autism Spectrum Disorder (ASD) lack social, emotional, and communication skills which can last throughout their life (Centers for Disease Control and Prevention, 2020). There is limited research that pertains to the influence that children with ASD have on the family functioning. This qualitative phenomenological study used a semi-structured interview that examined the psychological well-being and coping in 10 parents of children with ASD under the age of 18. Two central questions guided this study: What type of stressors are linked to parents who are raising a child diagnosed with autism spectrum disorder? What coping mechanism(s) if any are parents utilizing when raising a child with ASD? These questions focused on the daily challenges faced by parents of children diagnosed with ASD and looked at the different coping skills the parents used. This researcher asked ten open-ended questions. The use of scribing and audio-recording was used to collect data and was transcribed into written form and then analyzed using thematic analysis. The research is in advanced stages of completion. The data gathered so far shows parents with different stresses and coping skills to relieve the challenges when raising a child with ASD. Findings of this study may contribute to the existing literature and emphasizes the need to inform social workers and other professionals to implement or improve support programs and appropriate services to families who have a child with an autism diagnosis. The stigma observed in the community toward families and persons with disability must also be focused when advocating for those in the ASD community.

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Graduate

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Plant Science

EM38 Soil Surveys And The 1-D Hydrus Transport Model For Characterizing Salinity Patterns In Forage Fields Irrigated With Saline Water In The WSJV

Saline irrigation continues to be an effective practice when considering that California's quality irrigation water is in decline. Alternative sources of irrigation, such as from agricultural drainage, well waters, and commercial waste, are typically high in salinity. When irrigating with saline waters, you run the risk of soil salinization, especially the rootzone. With no proper drainage, periodic leaching is required when irrigated with this type of water to effectively flush out accumulated salts past the rootzone. Since the relationship between applied water salinity, leaching fraction, and soil salinity is so complex, computer models can simulate these complex interactions and estimate soil salinity. The calibration of these types of models requires data representative of field specific conditions. The project aims to calibrate the Hydrus model and run simulations of 1-Dimensional movement of water and solutes based on the collection of field-specific data collected at the San Joaquin River Improvement Project (SJRIP) reuse facility. 2 fields were selected at the SJRIP facility for the project, one with no drainage system and the other with a sub-surface drainage system made of perforated plastic tubing. The crop involved in the project, Jose Tall Wheat Grass, has been grown successfully at the SJRIP with saline drainage water. This salt-tolerant forage produces high biomasses, and makes an excellent candidate for this project. The fields will be surveyed using an electromagnetic induction sensor (EM-38) to give the spatial variability of salinity (ECa) and the assimilation of large field-specific data sets of applied water salinity, soil salinity, and yield data will also be conducted. With the EM-38 soil surveys and the calibration of the Hydrus computer model, the research will run solute transport simulations to characterize saline irrigation with the goal of yield sustainability and development of decision-support tools valuable to farmers and water-stakeholders.

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Public Health

Examining Differences In Influenza Vaccine Uptake Between Hispanic And Non-Hispanic Adults In California

Influenza vaccine uptake is a preventative measure that aims to reduce the incidence of illness and prevent a possible epidemic. Although research has determined that influenza is a serious health concern, there are still barriers to influenza vaccine uptake. Ethnicity among the California population, especially Hispanic and non-Hispanic adults, plays an integral role in one of the most diverse states in the nation. There is little information available regarding influenza vaccine uptake and the factors that affect vaccine utilization, behavior, and perception. Through a secondary data analysis from the 2015-2016 California Health Interview Survey administered through the University of California, Los Angeles Center for Health Policy Research, this study examined influenza vaccine uptake between Hispanic and non-Hispanic adults living in California and the factors that might affect vaccine utilization.

Gender, educational attainment, health literacy, and income level were determined to not be factors in influenza vaccine uptake between Hispanic and non-Hispanic adults in California. Statistically significant differences in vaccine uptake were found by the variables of ethnicity and English proficiency. From running a binary logistic regression, it was predicted that Hispanic adults were two times more likely to be vaccinated than non-Hispanics and those who spoke English very well or well were also twice as like to be vaccinated.

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Undergraduate

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Chicano and Latin American Studies

Ethnoplaticas: Conversations with Chicana Women About Colorism

This thesis will examine colorism from a Chicana feminist lens, it will examine and engage with sources that approach issues regarding colorism from perspectives that focus on self-worth, mental health, anti-Blackness, and anti-Indigeneity rooted within Mexican and Mexican-American culture. Colorism is a complex issue that stems from colonial violence and is maintained in the modern day through daily life, such as conversations, media consumed, and family dynamics. This paper will utilize an interdisciplinary approach that incorporates theories from Chicanx studies, History, and Sociology to understand the effects an individual may experience when they receive comments about their physical appearance.

This thesis utilizes the Chicana Feminist Epistemology as a framework for evaluating and understanding personal experiences. This framework also takes an intersectional approach to examining lived experiences, how does ones class, gender, language spoken, and ethnic status affect their treatments and experiences.

Participants for this study were adult women who were of Mexican descent. They are students at California State University, Fresno. The interviews will be conducted through teleconference meetings during February that will be recorded and transcribed. These interviewees were aware of the potential risk of sharing their experiences and will be compensated with mental health services and resources to minimize potential mental harm.

As this study still in the research stages, the data from the interviews that will be conducted in late February that will understand the relationship with experiences about physical appearances and self-perceptions or how an individual may self-identify. The implications of this study is to utilize an academic framework to validate the experiences of Mexican-American women. This study may be applied to understand the harm Mexican communities may perpetuate, and how to unlearn behaviors that are deeply rooted in colonial violence.

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Accountancy

Robo-Auditor, A Robotic Process Automation (RPA) Teaching Case in Auditing.

The technological environment of the accounting industry is rapidly evolving to new frontiers. Robotic Process Automation (RPA) is regarded as one of the most relevant tech innovations in the industry, which streamlines workflows and liberates professionals to focus on higher-level cognitive tasks. RPA, however, is often not included in accounting curricula, creating a skill gap for graduating students entering the workforce. This study provides a teaching case that can be implemented in Accounting Information System (AIS) Courses to introduce relevant RPA skills within an audit engagement.

Multiple RPA professionals were interviewed to determine the RPA skill levels students should have using semi-structured virtual interviews. The results of this feedback were used to design the learning objectives of the RPA case, prioritizing tasks rated highly across the board based on a five-point likert scale: filling in forms (4.8), extracting data from documents (5.0), and following decision rules (5.0). The teaching effectiveness of this case will be assessed at an AACSB accredited institution this semester.

This RPA case builds on a Caseware IDEA™ auditing case implemented at an AIS course. Students are tasked with programming “Robo-Auditor” to run RPA scripts that automate analyses previously conducted during a fictitious audit engagement. With additional fictitious data, students are able to automate monthly routine tasks typically conducted by internal auditors, integrating the recommended RPA skills in the span of two weeks. It includes YouTube videos to facilitate asynchronous learning.

This case provides accounting educators with the ability to integrate RPA in their AIS courses to better prepare our students with skills that meet the technology demands of the marketplace. This case encourages students to embark on a journey of self-learning of evolving accounting technology.

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Undergraduate

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Political Science

Giving Voters Choices: An Examination of Vote Mode Choice in California

In 2018, California implemented a series of voting reforms under the new Voters Choice Act (VCA) that, taken together, created a major overhaul to the voting system. Participation in VCA is not required by law, rather counties are allowed to opt in to the program. In 2018, five counties: Madera, Napa, Nevada, Sacramento and San Mateo signed up for the program and implemented the changes for the 2018 primary and general elections. In 2020, the number increased to 15 counties and included over fifty percent of registered voters in the state. The opt-in nature of the policy creates a natural experiment to examine the effects of the adoption of VCA on turnout and vote mode. The goal of this study is to better understand who is voting, when, and how in the revamped California election environment. The paper utilizes voter data on turnout and mode of voting in the 2018 and 2020 elections. The paper also uses GIS to estimate voter distance to the nearest vote center. This allows us to determine whether distance to a voting location or ballot dropbox had an effect on who voted in-person versus who voted by mail. Preliminary results show that when given options such as vote by mail and vote centers with early voting hours, voters overwhelmingly choose to vote by mail. Results also suggest that when voters change their behavior in a reform environment, the majority move from in-person voting to vote by mail rather than vice versa.

Oral Presentations

Abstracts

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Central Valley Health Policy Institute

Changing land use policies through a racial equity lens: Lessons learned from zoning plans in South Fresno

This study investigates how communities identify and prioritize land use plans and policies meant to correct harms that are a result of discriminatory policies, including land use and community disinvestment, in Fresno, California. This is especially important because of the connection between Fresno being home to the most pollution burdened census tract in the State and historical and current land use policies. Using the Southwest Specific Plan, a formalized planning document for a Fresno community impacted by discriminatory disinvestment and zoning, including redlining, and the Transformative Climate Community program plan, which is part of a state initiative aiming to streamline the State's cap-and-trade fund to those communities most impacted by the pollution. Using interviews with key stakeholders and secondary data, this paper discusses how we analyzed ongoing policies aimed at repairing the harm of discriminatory land use policies and the challenges the Southwest Fresno community has faced to ensure that community priorities are addressed. Community power, authentic community engagement, and relationship building among residents, advocates, and decision-makers were needed to ensure the successful completion of these two plans. This study demonstrates that key stakeholders can work together to advance land use policies that have a focus on environmental justice, which is rooted in racial equity. These plans can potentially improve health outcomes and be successful when residents and community-based organizations can be viewed as experts and part of decision-making processes.

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Psychology

The Role of "Unusual Experiences" in Paranormal Beliefs

a. INTRODUCTION. The Central California Forensic Cognitive Database (CCFCD), a collaborative research effort of the California State University-Fresno, Walden University, and the Sierra Education and Research Institute (SERI), addresses cognitive and related anomalies involved in forensically-relevant behavior.

We have found that cognitive disorganization, and belief in “unusual experiences” in a dissociative context (in which the world appears vaguely “unreal” to the respondent), contribute to antisocial behavior. In our published research, a similar pattern of characteristics contributed to paranormal belief systems, such as those of the Heaven’s Gate mass suicide of 1997. This study is intended to advance our understanding of these issues in the paranormal realm.

b. METHOD. We analyzed protocols from 143 CCFCD volunteers, who completed the Carlson Psychological Survey antisocial behavior inventory (CPS), the Dissociative Experiences Scale (DES-II), and the Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE), standard instruments which, respectively, measure antisocial tendencies, dissociative tendencies, and atypical cognition. Using linear regression techniques, we examined the influence of these factors on atypical/paranormal beliefs (Bigfoot, UFO’s and ghosts) via independent Likert scales.

c. RESULTS. The only measure which significantly predicted these “paranormal,” atypical beliefs was the “unusual experiences” (UE) subscale of the O-LIFE. However, the UE subscale itself was shown to be driven statistically and significantly by dissociative tendencies, and by thought disturbance as measured by the CPS.

d. CONCLUSION. These results indicate the importance of specific types of cognitive distortion in atypical beliefs. Also, these findings illustrate the importance of intermediate effects in complex psychological systems; cognitive disorganization and dissociative processes do in

fact influence atypical beliefs, but, in this research context, only through the medium of belief in unusual experiences. Researchers and research students should recognize that complex cognitive phenomena may only manifest themselves significantly through intervening meditative variables, as we see in the present research.

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PPP vs OPUS

Post Processed Static (PPS) and Precise Point Positioning (PPP) techniques are not new; however, they have been refined over the decades. As such, today these techniques are offered online via GPS (Global Positioning System) data processing services. In this study, one Post Processed Static (OPUS) and one Precise Point Positioning (CSRS-PPP) technique is used to process 24 h GPS data for a CORS (Continuously Operating Reference Stations) station (P565) duration of year 2016. By analyzing the results sent by these two online services, subsidence is determined for the location of CORS station, P565, as 3-4 cm for the entire year of 2016. In addition, precision of these two techniques is determined as ~2 cm. Accuracy of PPS and PPP results is 0.46 cm and 1.21 cm, respectively. Additionally, these two techniques are compared and variations between them is determined as 2.5 cm.

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Public Health

Preparing the Next Generation of Environmental Health Workforce through Faculty Internship Programs: Existing Challenges and Opportunities for Improvement

The critical role of environmental public health profession in protecting the public health is widely recognized and often emphasized to gain interest of students in pursuing studies and careers in environmental health. Faculty serving in environmental public health academic programs play a key role in educating the future workforce and can serve to bridge the gap between academic training to profession readiness. The objectives of this research were to examine the professional certification program for registered environmental health specialist (REHS) in California, focusing on internship requirements, benefits, and challenges for faculty serving in academia. Research methods included review of 2019-2020 National Environmental Health Science and Protection Accreditation Council (EHAC) undergraduate education program outcome assessment report, review of a recent national survey of the tribal, local, and territorial (STLT) environmental health workforce, and case review of a faculty internship experience. Research results revealed that majority of the graduates from EHAC accredited institutions gained employment in environmental health fields, outside governmental and state institutions. Meanwhile, a national survey of the environmental health workforce in the United States indicated that 26% of the environmental health workforce in governmental and state institutions will retire within 5 years and the current workforce, facing future shortages, can benefit from increase in diversity and leadership skills development. Faculty internships can greatly benefit students as future workforce by improved teaching methods through integration of hands-on learning activities and professional experiences in the classroom; benefits to faculty vary depending on faculty's prior professional experience level. Availability of resources and support from academic institutions and governmental agencies involved with professional certification and training of faculty interns are essential elements of success for faculty internship/REHS certification achievement programs. Additional challenges and opportunities for improvement exist in areas of internship planning, communications and professional interactions. In conclusion, findings of this research indicate that benefits of faculty internships to students and professors cannot be fully realized without careful planning and effective collaborations between health departments and academic institutions.

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Graduate

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Biology

Origins of Amaranthus tuberculatus (Waterhemp) in Central Valley Agroecosystems: A Population Genetics Approach Using Genotyping-By-Sequencing

Native to wetland environments of the Mississippi valley, Amaranthus tuberculatus (waterhemp) began invading agricultural cropping systems in the 1950's and has since become a widely troublesome weed throughout the Midwestern United States. This species of Amaranthus is not reported to be a common weed in the agriculturally intensive Central Valley of California; however, in the last decade waterhemp has been increasingly observed invading agroecosystems within Merced County. The aim of this study is to (1) document and map the distribution of these recent waterhemp infestations in the Central Valley, (2) genetically characterize and determine the geographic origin of the source(s) of this invasion, and (3) evaluate likely evolutionary route(s) that may have facilitated this invasion. Between 2019-2020, we conducted multiple surveys to identify the extent of the distribution of waterhemp within the Central Valley; 7 populations of waterhemp were identified invading various agricultural fields (almond, corn, hay, rice) in Merced County between Highways 140 & 152. At each location, we collected leaf samples (20 individuals/population) and subsequently isolated DNA from each individual. These DNA samples have undergone library preparation and are currently awaiting sequencing using the method of genotyping-by-sequencing on the Illumina HiSeq4000 next generation sequencing platform. Once available, this data will be used to assess allelic variation within Merced populations, and be compared to a broad survey of potential Midwestern source populations for source identification using both model- and non-model-based clustering methods. Evolutionary routes of this invasion will be evaluated through demographic modeling using the method of approximate Bayesian computation. In accomplishing these aims, we hope to shed some light on the relative importance of preadaptation and evolutionary change in overcoming selection pressures in agroecosystem invasions, as well as the role and importance of multiple introductions.

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Electrical and Computer Engineering

Applying Network Intrusion Detection in Cloud and Fog computing for Internet of Things(IoT) Systems.

The emergence of cloud computing has made it easier for complex computations in the cloud. Some of the fundamental constraints of cellular devices such as battery life and hardware with low computational power can be tackled by performing complex operations in the cloud. Despite such advantages, cloud computing possesses computational overhead and security vulnerabilities. Fog computing has set standards in networking and overcome complexities that are present in cloud computing but they, too, are prone to various cyber-attacks due to their inherently distributed architecture.

To identify and mitigate network attacks, there is a need for multiple layers of detection and prevention mechanisms. This paper focuses on the implementations of Intrusion Detection Systems (IDS) that incorporate adaptive learning. The results are measured in terms of the accuracy of the methods and the efficiency of the methods in detecting the malicious behavior category. Some models achieve a 99% accuracy but lag in the correctness of detecting patterns while other methods show efficient results in terms of correctness and accuracy but at the expense of significant computation and cost overhead. We also propose a taxonomy to characterize these methods and identify the research gap by analysing the research trends.

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Graduate

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Physics

Fake Rate Backgrounds in the Search for Dark Photons via ZH Decay at ATLAS

Many beyond the Standard Model (SM) theories predict the existence of a dark matter particle called a “dark” photon, which can couple to the SM Higgs boson. In particular, the ZH decay of a Z and Higgs boson into a lepton pair, SM photon, and dark photon is a clean signature to search for in the ATLAS detectors. However, the decay of a WZ boson pair mimics this dark photon signature when electrons are misidentified as photons. This misidentification, known as fake rates (FR), may cause an overestimation in the ZH dark photon signal strength. Here, we discuss the steps needed in order to take this fake rate into account and apply the FR as a background signal.

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Graduate

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Higher Education Administration and Leadership

Serving Student Parents in Higher Education: An Exploration of Policy and Practice

Student parents make up 22% of all undergraduate students in the United States (Cruse et al., 2019). While many institutions in higher education prioritize diversity, equity, and inclusion on their campuses, students who are parenting while pursuing post-secondary education are often overlooked. For instance, as the largest four-year public system in the United States, the California State University (CSU) system has yet to implement any system-wide initiatives to address student parents. The purpose of this case study is to explore the specific policies, practices, and programs designed to support parenting students at a single CSU and how student parents experience these support systems. In this qualitative study, data were collected through online questionnaires, semi-structured interviews with four institutional agents, focus groups with nine student parents, and content analysis of campus websites, course syllabi, internal program data, and digital photographs of campus infrastructure. Preliminary findings highlight the impact of family-friendly policies and practices on parenting students. While several participants anticipated that attending college while raising children of their own would be challenging, findings suggest they felt most supported by understanding faculty and staff, accessible on-campus childcare, the distribution of food and diapers, and welcoming campus infrastructure.

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Graduate

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Counseling

Examining Parental Involvement in Rural Areas

This study examines school Counselors' perceptions of parental involvement in rural areas. The study uses a qualitative approach and School Counselors in the K-12 setting are interviewed using a semi-structured protocol. A thematic analysis conducted by the research team revealed several overarching themes and sub themes. The study has implications for practice, research and policy pertaining to understanding the school counselors' role in improving parental involvement in rural areas.

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Graduate

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Mathematics

Minimal Generating Sets of Oriented Reidemeister-Type Moves for Spatial Trivalent Knot Diagrams

A major goal of the field of knot theory is to be able to differentiate between two knots. It is well known that two oriented knot diagrams represent the same knot if and only if they can be related by a finite sequence of oriented Reidemeister moves. However it has only recently been shown by Polyak that all oriented versions of the Reidemeister moves can be generated by just a specific four oriented Reidemeister moves. In addition to this, Polyak proved that such a generating set cannot exist with fewer than four moves. We expand upon Polyak's work to find all minimal generating sets of oriented Reidemeister moves for oriented knot diagrams. Then we extend the notion of a minimal generating set of Reidemeister-type moves to generate all moves required to relate spatial trivalent graph diagrams.

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Graduate

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Civil & Geomatics Engineering

Evaluating the Application of Mixed Reality in Construction Education and Inspection using Immersive Media

There are different kinds of media that can be used for different purposes in construction and engineering disciplines. However, some sorts of software needed to develop and analyze them to get the result. Field trips to the actual construction sites enable Architecture, Engineering, and Construction Management (AEC) students to interpret abstract courses accurately. However, these conventional field tours confront many difficulties and challenges such as safety, accessibility, weather, logistics, and class size. Besides, some parts of the virtual inspection can be done using different media such as 2D photos. In this research, the application of media has been tested in virtual field inspection. Some software such as ImageJ was applied to inspect the different details of the construction site such as rebar cages. Field inspection is one of the education areas that students can learn to use that in their future career. The leading approach that inspectors typically use to inspect all civil infrastructure systems is called visual inspection. AEC students can comprehend the structural details and visual inspection process properly through the VFT multiple times wherever they are located. This paper creates a VFT prototype of the local site from the beginning step of the construction tasks to show how the field inspection can be done during the construction activities. Immersive media such as 3D building information models, video recording, and 360-degree photos of field activities has been captured to produce a VFT educating AEC students in visual inspection procedures. Furthermore, these media are placed in an online platform to enable students to navigate and discover the progress of the project. In this platform, students experience a self-guided tour with low-cost VR headsets.

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Graduate

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Finance and Business Law

How Marine Scientists, Fishers, and Fisheries Managers Can Effectively Collaborate to Manage United States Fisheries Sustainably in the Face of Climate Change

This study investigated ways that scientists, managers, and fishers in the United States fisheries management system can better work together to manage fisheries sustainably in the face of climate change. It involves a case study on nine fisheries management stakeholders who participated in individual interviews in which they described their positive and negative professional experiences with communication, trust, collaboration, and common goals in fisheries management. Qualitative content analysis was used to code and categorize data from the interviews to ultimately identify themes and make recommendations. The major findings were that 88% of the subjects have witnessed or experienced mistrust and poor communication between fisheries management actors; 77% have experienced common and uncommon goals, as well as aspects of knowledge sharing; and 55% have experienced trust and good communication between the actors. The major recommendations were to (1) allow fishers to become more involved in the research process, (2) assemble fishers more formally, (3) create more connections between fisheries management stakeholders, (4) request that scientists put more effort into bridging the divide between fishers and scientists, (5) develop more tools to incorporate fishers' knowledge into scientific information, and (6) bring more human dimensions data into fisheries-related studies.

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Graduate

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Mathematics

The Topological Symmetry Group of C_{13}

Spatial graph theory is the study of graphs embedded in $\mathbb{R}^3$. The K_7 family is the set of all graphs obtained by a finite sequence of $\Delta-Y$ and $Y \Delta$ moves performed on K_7. This family is of special interest to knot theorists since its elements are the only intrinsically knotted graphs with 21 edges. One of the graphs in this family is C_{13}, which is obtained by performing a $Y-\Delta$ move on the Heawood graph. We study the embeddings of C_{13} and determine which automorphism groups of C_{13} can be induced by groups of homeomorphism of $\mathbb{R}^3$.

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Graduate

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Criminology

Child Pornography Risk Assessment

The Child Pornography Offender Risk Tool (CPORT) is a risk assessment tool designed to estimate sexual recidivism for men convicted of child sexual exploitation material offenses. The aims of this study were twofold: 1) examine the psychometric properties of CPORT in relation to other risk assessment tools, and 2) explore the use of clinical data, including a polygraph examination, in improving the accuracy of the assessment results. We examined preexisting data from a sample of 208 parolees who were required to attend a treatment program designed for sexual offenders. The data was collected as a part of a larger project on program evaluation. Preliminary findings suggest that the majority of men had low scores on the CPORT, which was consistent with the results from other risk assessment tools (Risk Matrix 2000, Level of Service/Case Management Inventory). We also found that the use of clinical data increased the total score, which is a proxy for a higher risk to re-offend. CPORT could complement the risk assessment process by capturing something additional about risk in relation to other instruments.

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Graduate

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Civil Engineering

Comparison between normal weight and rotary-kiln produced expanded aggregates.

The project investigates the design of structural lightweight concrete using rotary-kiln produced expanded aggregates, like expanded shale, clay and slate. Expanded clay, shale and slate are the main materials to produce structural lightweight concrete. The current design code approach does not distinguish between different types of structural lightweight aggregates. This project utilizes a 9-story structure per ACI 318 to investigate design procedures for structural lightweight concrete as opposed to conventional normal weight concrete. The result includes an evaluation of current strength values and assesses the benefits of using lightweight concrete to identify opportunities of change in the current building regulations.

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Mechanical Engineering

Thermal transport across the interface of liquid n-dodecane and its own vapor: A molecular dynamics study.

Thermal analysis of fuel nano-droplets has presented errors in estimating evaporation times due to thermal resistance at the interface. Solutions to this issue have been attempted using relations derived from the kinetic theory of gases (KTG) but have failed to be validated due to two major complications. First, evaluation of these relations requires knowledge of interfacial properties challenging to obtain through experiment. And second, quantifying the amount of heat transferred through a liquid-gas interface has been difficult due to the simultaneous occurrence of evaporation and interfacial heat conduction. In this study, these two issues were resolved using Molecular Dynamics (MD) simulations. The use of MD simulations allowed us to measure with high fidelity the necessary properties needed to validate evaporation and condensation rates predicted by the KTG relations and estimate the individual contributions of heat transferred through the interface by evaporation or heat conduction. These simulations modeled the thermal transport across the liquid-gas interface of model n-dodecane (C12H26) under evaporation and heat conduction separately. The obtained results offered a great understanding between the predicted KTG and the simulated evaporation rates. Meanwhile, the interfacial heat conduction simulation found both KTG prediction and simulated results to agree with each other. These results also suggest the relations are valid not just for monoatomic fluid interfaces but also for more complex chain molecules such as C12H26. The validation of these relations will offer further development in the modeling of heating and evaporation of fuel nano-droplets. Future work to be conducted includes the study of heat transfer through a C12H26 liquid-vapor interface in the presence of nitrogen gas, to mimic engine-like conditions, and to study the transfer of heat through the curved interface of a nano-droplet.

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Mathematics

Quandle Coloring Quivers of T(p,2) Torus knots

Mathematical knots are knotted circles in three-dimensional space and knot diagrams are projections of these knots in two-dimensional space. Knot theory focuses on distinguishing knots, and the Reidemeister moves are a common tool used on their projections. Quandles provide an algebraic perspective of this goal, as they are sets used to label the strands of knot diagrams, with operations defined by axioms analogous to the Reidemeister moves. As a gateway to where topology meets algebra, I will present my ongoing research of dihedral quandles, and their use in studying applications of quandles such as quandle colorings and the quandle counting invariant. This will also cover my recent findings and proof methods for classifications of torus knots using quandle coloring quivers, which further rely on basic combinatorial concepts.

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Chemistry

Using Modern Computational Chemistry Methods to Find Chemical and Geometric Similarities Between β-N-Methylamino-L-Alanine and Glutamate

β-N-methylamino-L-alanine (BMAA) is a non-proteogenic amino acid which is associated with the onset and progression of Amyotrophic Lateral Sclerosis/Parkinsonism Dementia complex (ALS/PDC). BMAA is also implicated in the onset and progression of other neurodegenerative diseases and previous studies have shown its presence in the brain tissues of Alzheimer's and ALS patients. Despite these strong connections between BMAA and neurodegenerative disease, its exact role is still not clearly understood. Many in vitro studies have shown the detrimental effects of BMAA on neurons and it's also been discovered that the presence of bicarbonate ions is essential for this neurotoxic activity of BMAA. Further studies found that this leads to the formation of primary and secondary carbamate adducts of BMAA where CO2 molecules produced by bicarbonate react with the α- or β-amine groups of BMAA. The β-carbamate product, in particular, bears strong resemblance to glutamate since both molecules contain α- and β-carboxylic acid groups. Because of these findings, it's theorized that the mechanism of BMAA neurotoxicity involves cell death caused by excitotoxicity through the overactivation of excitatory glutamate receptors. Here, we present a detailed comparison between the structures and chemical capabilities of BMAA and glutamate using different computational chemistry software to run simulations. The goal of this project was to demonstrate that if excitotoxicity is a mechanism for a deleterious path, then BMAA must be very similar to glutamate in terms of geometric structure and binding capabilities. The preliminary results already show that the molecular geometries of β-carbamate BMAA and glutamate are extremely similar and suggest that binding capabilities will also be similar. Continuing to find similarities through these comparisons should reaffirm the theory that BMAA contributes to neurodegeneration through the overactivation of excitatory glutamate receptors and may bring us closer to understanding the precise mechanisms through which this all occurs.

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Plant Science

Examining genetic and environmental interactions of 63 fava bean germplasm lines for suitability in the Southern San Joaquin Valley

Fava bean, an annual winter legume, has the potential to enhance soil fertility due to its ability to biologically fix atmospheric nitrogen in the root nodules. It can be used as a winter cover crop before planting the main summer crop in many areas of the US. This experiment is aimed to evaluate agronomic and phenotypic traits of 63 genotypes of fava bean grown in the Southern San Joaquin Valley, and quantify their ability to fix atmospheric nitrogen.

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Social Work

Social Workers Perspectives on Barriers to Services for Undocumented Immigrant Families within Child Welfare Services.

Children in undocumented immigrant families have historically been considered at risk for abuse or neglect due to the challenges experienced by their parents during the immigration process. Child Welfare Services (CWS) is responsible for the protection of children's safety and well-being and the stability of their families, regardless of immigration or undocumented status. Undocumented immigrant families are expected to participate, and complete court ordered services in an effort to reunify with their children. Social workers within CWS have observed barriers to such services to include fear of law enforcement or deportation, language barriers, and lack of readily available resources. A narrative qualitative study was conducted using six social workers from Tulare County CWS to better understand the experiences and barriers that undocumented families may face, through the use of an interview guide. Participants were recruited via purposive sampling and convenience sampling. Interviews were completed via zoom and in person and were recorded for further transcription. Findings suggest that Tulare County CWS social workers have a moderate understanding of the barriers that undocumented immigrant families may face when encountering court ordered services. The majority of the respondents also reported a lack of knowledge on how to handle an undocumented immigrant family case as immigration liaisons usually help but do not share their knowledge. However, most participants reported they did not have enough training or support from their county to handle cases with undocumented immigrant families when it comes to appropriate resources and case management.

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Mathematics

Investigating Zero Packing Implementation in the Gerchberg Saxton Algorithm

In the past, algorithms have attempted to solve the phase retrieval problem using linear approximations. While initially successful, the validity of the solution was limited to a small interval, leading to amplitude and phase variations. The Gerchberg Saxton Algorithm (GS Algorithm) created an efficient way to solve the phase retrieval problem by measuring the intensities between the image and diffraction planes. Compared to past algorithms, the GS Algorithm utilizes the reconstruction method which allows for the expansion of validity intervals and more efficient computing. While the GS Algorithm has proved to be successful in solving the phase retrieval problem, it contains some setbacks, such as a low recovery rate of the phases and stagnated iterations, causing excessive computation time. To improve the success rate of the algorithm, we propose the implementation of Zero Packing. Through Zero Packing, we predict the convergence rate of the algorithm will increase and minimally effect the computation time required to run the algorithm. Interestingly, our preliminary results suggest that the improvement of the algorithm's convergence rate is directly correlated to the number of zeros packed within the original function. Overall, these modifications to the GS Algorithm can be beneficial in applications such as X-ray crystallography, electron microscopy, and a multitude of image and signaling problems.

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Mathematics

Braids: The Group Structure

I will discuss the connections between braids and mathematics. I will prove that the set of braids on any number of strands with a given set of relations defines a group and use this fact to answer the question “are these two braids the same?” We work with braids, which are three dimensional, by looking at its two dimensional projection. We then associate a word to each projection of a braid and see that two braids are equivalent if the words associated to their projections are equal. We will define an algorithm that takes in two words and tells us whether these two braids are the same. I hope to give an intuition that any knot is equal to the closure of some braid, which allows us to answer the question whether two knots are equivalent. Then, it is practical to exploit the group structure of the braids in order to answer the same question for knots.

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Graduate

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Mathematics

The Characteristic Polynomial of a Spread

A spread of a vector space V where V is a four dimensional vector space over a finite field with q elements is a collection of 2-dimensional subspaces of V that partition all the non-zero vectors of V . Spreads are important since they can be considered as ‘geometric bases’ for affine planes of a certain kind (translation planes). In this talk, we will introduce the concept of the characteristic polynomial of a spread in V and then see what the degree of this polynomial is for a variety of spreads of V for small values of q. We will focus specially on the so-called regular spread and spreads obtained by doing certain line-replacements in a regular spread.

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Physics

X-ray Fluorescence to detect Lead in bone

Lead (Pb) is a well-known neurotoxin. Mitigation measures of Pb exposure implemented over the past few decades resulted in significant decreases of Pb levels in the general population. However, clinical studies conducted over the past two decades showed that neurodevelopmental problems in children were associated with low levels of exposure (blood Pb levels < 5 μg/dL), findings that raised new concerns. Blood Pb concentrations measured by mass spectrometry methods can assess levels of recent Pb exposures. Cumulative long-term Pb exposure, however, is better assessed by in vivo x-ray fluorescence (XRF) bone Pb concentration measurements. Hence, bone Pb measurements can add important information to blood data. L-shell x-ray fluorescence (LXRF) bone Pb measurement method using x-ray tube and silicon x-ray detector assembly is a practical alternative to the established K-shell XRF system consisting of a Cd-109 radioactive source and a germanium gamma-ray detector. Unfortunately, past bone Pb LXRF studies did not yield accurate results. Over the past three years, a novel bone Pb measurement based on an optimal grazing-incidence position method and a calibration using the strontium (Sr) Kβ/Kα ratio, was developed in our XRF lab. Experimental in vivo conditions were simulated by plaster-of-Paris (poP) Pb-doped bone phantoms with overlying polyoxymethylene (POM) and resin soft tissue phantoms. The poP Sr concentration of 1 mg/g was an order of magnitude larger than that of the human bone. Therefore, Sr Kβ/Kα measurements performed on a lamb bone sample with Sr levels closer to those of human bone, will demonstrate in vivo applicability of the calibration method. POM and resin soft tissue phantoms in the 0.5 to 2 mm thickness range will mimic skin and adipose tissues, respectively. Although lamb bone Pb concentration could be below the detection limits (2.8 μg/g for bare poP bone phantom), experimental data will provide the required acquisition time increase and implications on Pb detectability and radiation dose.

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Chemistry

Spatio-Temporal Metabolomics of Imazalil treatment in Fukumoto Navels and Clementine Mandarin Oranges

The citrus industry is a major economic contributor to agriculture globally, especially in the central valley. Every year, millions of citrus products are wasted due to post-harvest conditions such as fungal infections, latent physiological disorders that occur in storage, or even over a mature product that stays in cold storage due to market conditions. Further, a shortage of labor for harvesters is putting pressure on harvest teams to harvest the products as fast as possible, leading to considerable amounts of tissue damage that contribute to fungal infections. To minimize fungal infection loss, packhouses utilize aqueous applications to cure infections that occur during harvest. Penicillium digitatum and Penicillium italicum are the most prominent fungal pathogens of citrus fruit, which are commonly treated with imazalil sulfate due to its efficacy for controlling these pathogens, low cost, and ease of handling. Although imazalil sulfate is the most commonly used fungicide in an aqueous application, little is known on how it alters the tissues in the citrus fruit physiology.

Metabolomics is the study of the metabolic profile of a targeted biological tissue under specific criteria or experimental conditions. It allows one to identify metabolites that can serve as potential biomarkers for certain conditions or identify groups of metabolites that can help identify specific metabolic pathways associated with these conditions. In this study, NMR spectroscopy is utilized to identify and quantify metabolites based on the chemical shifts unique to each metabolite. Experimental conditions include isolating the juice, the albedo and flavedo tissues of both Navel and Clementine raw fruit initially at harvest, raw fruit stored for ten days at 40o F, and raw fruit treated with imazalil sulfate and stored for ten days at 40o F. Several notable changes in the levels of the metabolites due to imazalil sulfate treatment both the spatial (albedo, flavedo or juice) and temporal levels (days and storage) were found. A detailed description of these changes and their relevant implications on the metabolic pathways will be presented. These findings provide insight into how imazalil treatment alters fruit quality and identifies specific metabolites altered due to imazalil treatment and storage which can potentially serve as indices for such conditions.

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Biology

The Transduction of Climate Change in Rocky Intertidal Crabs P. cinctipes and P. manimaculus Through Increased Density and Competition.

Global change is known to affect species distribution. Understanding the resulting physiological responses of organisms is critical for predicting community composition changes that may occur under current and future conditions. The porcelain crab, Petrolisthes cinctipes, resides in the upper to mid intertidal zone and is expected to respond to rising temperatures by shifting its distribution lower in the cooler intertidal zone, where they will experience higher densities. They will also interact more often with their congener, Petrolisthes manimaculus. In this study, I addressed how increased temperature, increased density, and species interactions (inter- and intra-) might impact reproductive physiology in P. manimaculus and P. cinctipes. This was indexed by circulating levels of the yolk protein vitellogenin (Vg). Female crabs were exposed to high-density (1000 crabs/m 2) and low-density (333 crabs/m 2) treatments with and without the presence of its congeneric species for 7 days. I found that interspecies interactions in high density during emersion caused a downregulation of vitellogenesis in P. cinctipes and P. manimaculus. Together with data from a collaborating study measuring injury and HSP70 expression, these data suggest climate change transduction in the rocky intertidal.

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Graduate

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Department of Mathematics

Using Q-Learning to Stop the Space Invaders

With increase of data and data availability, machine learning has become a popular predicative tool. There are multiple methods for training, with supervised and unsupervised being the most common approaches. We use reinforcement learning to train an AI in developing a strategy that most improves the score in the video game “Space Invaders”. Reinforcement learning is a process of trying new strategies while also using previously gathered experiences to make decisions, making it a method of training very similar to the way we learn ourselves. We implement experience replay and Q-learning – a process where actions and situations pairs are assigned values called Q-values with the goal of maximizing the Q-value reward – along with deep neural networks to create deep Q-networks for the training of the AI. With the deep Q-network, there is a noticeable increase in performance in terms of score over the multiple play throughs taken by the AI.

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Graduate

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Geomatics Engineering

A Comparative Analysis of Software Used to Process Drone Imagery

The accessibility and relative ease of use of drones has had a great impact in various industries, such as real estate, agriculture, environmental monitoring, mining. Similarly, the mapping industry has been revolutionized by the introduction of drones as an alternate platform for image capture. Imagery collected by drones can produce 3D models, and from them a wide variety of mapping products can be derived. In contrast with classic mapping techniques, many drone processing software are characterized by high automation and ease of use. High automation and ease of use make drones greatly appealing to a wide range of users, but they often lead users to undermine drones' capabilities and limitations in 3D modelling. Using classic mapping techniques as a comparative reference, the results obtained from processing drone imagery can lead to an objective analysis. This study focuses on analyzing drone processing methods by conducting a critical literature review of 36 accuracy results from 10 published articles. The results are analyzed based on many of the technical factors that influence 3D modelling, such as the imagery acquisition platform, the flying height, the camera type, among others. The analysis of the 36 accuracy results show that classic mapping techniques yield more accurate results by a factor of two. Additionally, an independent experiment carried out for this study confirmed the conclusion derived from the literature review. Despite the difference in relative accuracy obtained from both techniques, the absolute accuracy resulting from drone imagery qualifies it for most applications in the mapping industry.

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Physics

Random Phase Approximation for Cold Atomic Gases

The general purpose of statistical physics is to explain how the collective,macroscopic properties of systems in nature arise from the microscopic interactions of their constituent atoms and molecules. Accounting for all interactions in a classical system is quite challenging. In a quantum system, we have the added difficulty that the particles behave in fundamentally different ways from classical objects. In the quantum realm our everyday intuitions about how an object should behave provide us with little guidance. Despite these problems, theorists and computational physicists have risen to the challenge of quantum many-body physics and developed many ingenious theoretical and simulation-based techniques to address them. One approach is Random Phase Approximation (RPA), a powerful theoretical formalism that has been successfully applied to study superconductors, cold atomic gases, and other exotic quantum systems. In this talk, we provide an intuitive overview of RPA applied to cold atomic gases and give our preliminary results for the collective density fluctuations of the system, calculated using RPA. Intriguingly, by solving for the properties of cold atoms, we may also uncover information about the properties of seemingly disparate systems, such as superconductors and neutron stars. By exploiting this fact we may be able to partially solve multiple problems in quantum many-body physics at once.

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Computer Science

Academic Analytics using a Novel Advanced Predictive Framework

Page views, historical data and click stream data logged on learning management system websites come up with concrete information about students' approaches towards the course. Such information can help in delivering descriptive feedback that can contribute to students' progress and predicted performance. Our main objective behind this research is to develop a model which provides valuable intuitions such as suggestions beyond grades. Auto Regressive Integrated Moving Average and Simple exponential smoothing models have predicted grades with a low mean absolute error of 0.305. Hybrid recommender Model is chosen for course recommendation and students with similar choices are clustered. Rule mining is applied to these clusters to derive association rules. We also used cosine similarity to extract skill set from jobs and match with the courses available. In this research, we mine data from e-learning sites to deliver weekly feedback, grade predictions, course and job recommendations. Weekly predictions are evaluated by comparing effectiveness of uni-variate versus multivariate time series models. We intend to provide students with the behavioral patterns throughout the course every week. We extracted and prepared data from number of clicks recorded and type of modules accessed. Natural language processing is used to provide weightage for the modules. This information can help instructors and learners identify the risk and improve in initial weeks of change detection. We also presented a course recommender and job recommender algorithm that helps students in choosing elective courses that match their career goals. We used a hybrid approach that uses both collaborative filtering to cluster similar users and content-based filtering for generating association rules. The effectiveness of these rules is measured by the parameters using confidence. This model can be integrated within the learning management systems like Canvas.

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Viticulture and Enology

The Effect of Deficit Irrigation and Mechanical Leaf Removal on Cabernet Sauvignon/Ruby Cabernet Berry Quality

The San Joaquin Valley (SJV, crush district 11, 12, 13, and 14) contains 40% of the wine grape acreage and crushes 70% of California wine grapes. However, the average price per ton of wine grapes in the southern SJV ranges from $200 to $500, which is much lower than other wine regions. The goal of this research is to determine how mechanical leafing and deficit irrigation affect yield and berry composition of Cabernet Sauvignon and Ruby Cabernet.

Cabernet Sauvignon berries were harvested at commercial vineyards from Madera, and Ruby Cabernet berries were harvested from a Fresno vineyard. In Madera vineyard, the experiment was a two (deficit irrigation) × three (leaf removal) factorial trial with a split block design and five replicated blocks. The two levels of water deficit were 80% ETc through the growing season and 50% ETc from berry set to veraison and 80% ETc after veraison. The three timings of mechanical leafing were bloom, berry set, and no leafing. In Fresno vineyard, deficit irrigation was kept at 80% ETc from berry set to veraison and decreased to 60% ETc from verasion to harvest. Four timings of mechanical leafing included: bloom, berry set, veraison, and no leafing.

In a Madera vineyard, the results showed that deficit irrigation significantly decreased yield through cluster number and berry size. But it reduced IBMP and increased berry anthocyanins and phenolic compounds. Leafing didn't change yield components, but improved berry anthocyanins and increased IBMP when conducted at bloom. In a Fresno vineyard, leafing at berry set and veraison reduced cluster weight through decreased berry number/cluster. Leafing at bloom and berry set improved berry anthocyanins and total phenolic compounds, but leafing at veraison did not have effect on these parameters.

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Graduate

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Biology

A Phylogeny of the Genus Helianthella

This project aims to establish a phylogeny of the genus Helianthella (little sunflowers) and place it within its taxonomic subtribe in the family Asteraceae. Helianthella are wildflowers with perennial taproots and annual flowers with basal rosettes of leaves. They are distributed along the mountains of western North America, from southern Canada to northern Mexico, with some highly geographically restricted species in California and Mexico. This genus has gone understudied for many decades, with its last major taxonomic treatment being a monograph in 1952. Since then it has received a few scattered additional species descriptions and seen occasional use as an outgroup in other studies, but the relationships among the 10-11 species within Helianthella, and the relationship of the genus to the four other genera in the taxonomic subtribe Enceliinae, are unknown. The genetic and technological tools and methods available today were not yet invented when last this genus was directly studied, so applying them now could provide a wealth of new information about the spread and diversification of these species. A combination of genetic and morphological methods will be used to resolve a phylogeny of Helianthella and infer the evolutionary and biogeographical history of the genus. Preserved herbarium specimens and new field collections will be examined morphologically and sampled for genetic sequencing, and the gathered data will be run through multiple phylogeny-building programs. Thus far we have received loans of specimens from four herbaria, which combined with our field collections means we have samples for every species in Helianthella and every closely related genus. We have extracted clean, high-quality DNA from at least one specimen per species, and are in the process of refining our PCR methods to accurately amplify four variable gene regions. The resulting phylogenies will give insights into the diversification of montane plants and their movement patterns.

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Graduate

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Mathematics

Hyperplane Arrangements over Finite Fields

Hyperplane arrangements are commonly studied in vector spaces over the real and complex numbers. As expected, a generalization of hyperplane arrangements to vector spaces over finite fields will have a very different flavor, as many concepts, such as the number of bounded and unbounded regions created by the hyperplane arrangement, cannot be generalized to spaces of the finite type. However, studying hyperplane arrangements in a finite world opens the doors to combinatorial methods usually used in the study of finite projective spaces. This paper will be on work done about blocking sets of the complement of a hyperplane arrangement in a vector space over a finite field of order q that generalize the work of Settepanella.

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Mathematics

Black-Scholes-Merton Model

The Black-Scholes-Merton Model is a standard options pricing model that is a product of stochastic calculus, probability theory, and finance. The accuracy of the model is dependent on the assumptions made and the inputs of the model itself. In this talk, we will briefly discuss the mathematics behind the model, trading strategies involving the model, and how to improve the assumptions and inputs required for the Black-Scholes-Merton Model.

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Graduate

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Biology

Antimycin A Leads to the Upregulation of Myo10 and Tunneling Nanotube Formation

Tunneling nanotubes (TNTs) are actin-containing cellular protrusions involved in a myriad of cellular functions. Myo10 is a key regulator of TNT development. We designed an experiment to test the effects of endogenous reactive oxygen species (ROS) production on Myo10-dependent TNT formation. To establish the relationship between Myo10 dependent TNT formation and increased endogenous ROS production, HeLa cells were treated with antimycin a (AMA), a secondary metabolite of Streptomyces. AMA has been linked to electron transport chain (ETC) inhibition via the disruption of complex III. Resulting disruption leads to increased ROS production. To determine the effects of this drug on the expression pattern of Myo10, cells were treated with 50uM AMA for 24, 48, and 72 hours. Following treatment with AMA, Myo10 expression patterns were established through western blotting. To determine a correlative relationship between Myo10 expression and TNT formation during AMA treatment, TNTs were quantified via fluorescence microscopy. Lastly, fluorescence microscopy was used to determine the effect of AMA on the localization of mitochondria within the cell. Our preliminary results indicates that after 24 hours of AMA treatment, cells exhibit elevated levels of Myo10 and TNTs. Moreover, after 48 and 72 hours, Myo10 expression returns back to the control levels. Lastly, the localization of mitochondria does not change compared to the untreated cells after 24, 48, or 72 hours of AMA treatment. These results suggest that during the early stages of AMA-induced oxidative stress, Myo10 dependent TNT formation increases, while mitochondrial localization remains unaffected. By identifying a correlative connection between Myo10-dependent TNT formation and oxidative stress, novel therapies could be developed to slow the proliferation of diseases, such as cancer.

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Chemistry

3-Carbamoyled-5,7,20-trimethylsilybins: Synthesis and antiproliferative evaluation

Prostate Cancer is the most commonly diagnosed cancer in American men, and 1 in 8 US men will be diagnosed with prostate cancer during their lifetime. Castration-Resistance Prostate Cancer (CRPC) is an advanced and lethal version, and current treatments for CRPC can only prolong patients' limited survival life. More effective treatment for CRPC is therefore urgently needed. Androgen receptor (AR) continues to serve as a critical drug target for CRPC as verified by the fact that the second generation AR antagonists have been approved by FDA for patients with CRPC. Silibinin has been demonstrated to have potency in treating CRPC by targeting AR transcriptional axis. However, its moderate antiproliferative potency, poor oral bioavailability and low selectivity towards AR-positive prostate cancer cell line need to be improved. This study aims to manipulate the chemical structure of Silibinin in hope to improve its potency, oral bioavailability and selectivity towards AR-positive PC cell lines. To this end, 3-carbamolyed-5,7,20-trimethylsilibinins were designed and synthesized by introducing three different carbamoyl groups into 3-OH group of 5,7,20-trimethylsilibinins, and their antiproliferative potency and selectivity towards either AR-positive (LNCaP) or AR-negative (DU-145 & PC-3) PC cell lines were tested with WST-1 bioassay. During the synthesis process, we found out for the first time that the desired carbamoyl groups can be selectively appended to 3-OH of 5,7,20-trimethylsilibinins by reacting with carbamoyl chloride mediated by triethylamine and 4-dimethylaminopyridine. This reaction has been repeated over forty times and verified by two authors. At this point, six carbamoyled derivatives have been successfully synthesized, and their chemical structures have been characterized by 1D-NMR, 2D-NMR, and High-Resolution Mass (HRMS) Data. Our WST-1 bioassay data indicated that four carbamoyled derivatives can selectively suppress AR positive LNCaP prostate cancer cell proliferation with IC50 values less than 1μM. The data suggest that 3-carbamoyled-5,7,20-trimethylsilibinins may affect AR-induced transcriptional activities.

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Graduate

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Chemistry and Biochemistry

Structure of Enterohemorrhagic Escherichia coli O157:H7 Intimin Virulence Factor Bound to Nanobodies

Enterohemorrhagic E. coli O157:H7 (EHEC) presents a significant risk to human health. EHEC resides in the intestinal tract of cattle but can be transmitted to humans when contaminated food is ingested. Once EHEC colonizes the human intestinal tract, it secretes Shiga-like toxins causing serious illnesses. Antibiotics are not recommended for treatment of EHEC as they can induce enterotoxin release, increasing the risk of HUS. There is currently no effective treatment or vaccine against EHEC. EHEC pathogenicity involves intimin, which mediates bacterial colonization of the GI tract. Blocking the interaction of intimin with its cogent receptor, Tir, could neutralize EHEC pathogenesis. One novel solution for treating EHEC infection comes from antibodies known as nanobodies or VHHs, which are the antigen binding domain of heavy chain antibodies produced by the Camelid family. Intimin specific nanobodies were generated by immunizing a llama followed by phage display and selection for high specificity and affinity for intimin binding nanobodies. We hypothesize that these nanobodies (VHH1-VHH5) could specifically bind the Tir-binding domain of intimin neutralizing EHEC infection. The goal of this project is to determine the nanobodies-intimin complex crystal structures and examine the physical interaction occurring between key residues of the two proteins. Understanding such interaction could form the bases for identifying and developing novel therapeutics for treating EHEC pathogenesis. The nanobodies-intimin have been purified and co-purified using size exclusion chromatography. Crystals complexes were harvested, sent out for x-ray data collection, diffraction measurements of VHH2-intimin and VHH3-intimin complexes were collected and processed in space groups P1 and P212121 with the resolution of 2.1 and 1.8 Å, respectively. Initial analysis of the structures shows that CDR3 and a non-CDR loop interact with intimin via polar interaction. Next, we are planning to preform inhibition assays using mammalian cells to evaluate the potency of the nanobodies against the bacteria.

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Graduate

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Mathematics

On Binomial Combinations of Chebyshev Polynomials

The sequence of Chebyshev polynomials of the second kind {Um(z)} is a well-known sequence of orthogonal polynomials whose zeros lie on the interval (−1, 1) and are dense there as m → ∞. For 0 < α < 1, we discuss the zeros of the sequence of polynomials {Pm(z)}generated by the reciprocal of (1 − t)^α(1 − 2zt + t^2) expanded as a power series in t. This sequence can equivalently be obtained from a linear combination of Chebyshev polynomials whose coefficients have a binomial form. We prove that the number of zeros of Pm(z) outside the interval (−1, 1) is bounded by a constant independent of m.

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Undergraduate

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Information Systems and Decision Sciences

Relationship Between Endorsements and Polling Averages for the 2019 Democratic Primary

The purpose of this study is to examine the relationship between endorsements and standings in polling averages for the major players in the 2019 Democratic Primary. The relationship differs for each candidate, but overall, endorsements Granger cause movement in the polls.

Endorsement data and polling data are both pulled from FiveThirtyEight, a firm that analyzes political and sports data and models electoral races and sports championships.

The data were reduced to their respective relevant columns and limited to just the major players. I determined that the eventual winner, then-former Vice President Joe Biden, was relevant, along with then-Mayor Pete Buttigeg, then-Senator Kamala Harris, Senator Amy Klobuchar, Senator Bernie Sanders, and Senator Elizabeth Warren. From there, the data was aggregated on a weekly basis and joined on week numbers.

The data yielded unexpected insights into the relationship between endorsement points and polling averages. There were eight major findings that were statistically significant at a maximum significance level of 0.10, accounting for a two-week lag:

Biden: Cumulative endorsement points Granger caused change in the polls.

Biden: Individual endorsement points Granger caused change in the polls.

Buttigieg: Change in the polls Granger caused change in cumulative endorsement points.

Harris: Cumulative endorsement points Granger caused change in the polls.

Harris: Change in the polls Granger caused changes in cumulative endorsement points.

Klobuchar: Cumulative endorsement points Granger caused change in the polls.

Klobuchar: Individual endorsement points Granger caused change in the polls.

For all candidates in aggregate, cumulative endorsement points Granger caused percentage change in the polls.

Endorsements and polling averages affected each other in different ways depending on the candidate. Perhaps most importantly, cumulative endorsement points had a statistically significant Granger effect on polling averages for the overall data. For the individual candidates, the relationship between the two variables took on other forms.

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Chemistry

Two for One: Metformin for the Treatment of Prostate Cancer and Diabetes Mellitus

Prostate cancer (PC) and type 2 diabetes mellitus (T2DM) are two of the most common illnesses that affect the aging male population in America. Previous retrospective epidemiological studies highlight an inverse relationship between these two chronic diseases. Metformin, an FDA-approved oral anti-diabetic drug, is suspected to play a large role in the observed decrease in PC incidence and mortality in patients with T2DM. This inexpensive and effective treatment is known to give its therapeutic effect partly by acting on adenosine monophosphate-activated protein kinase (AMPK), a highly conserved metabolic-sensing enzyme in mammalian cells. Having been in clinical use for over 50 years with an excellent safety profile, metformin is of interest to further evaluate its potential as an anti-prostate cancer agent. Preclinical studies have already indicated its anti-proliferative properties in three PC cells: DU145, LNCaP, and PC3. The activation of AMPK and its subsequent effect on downstream signaling pathways appears to be the main mechanism by which metformin is able to simultaneously promote glycemic homeostasis and inhibit cancer growth, although it is not yet completely understood. This meta-analysis summarizes the present literature regarding the effects of metformin on PC, highlighting incidence, mechanism, and studies. On-going investigation suggests that metformin—and possibly, other AMPK activators—may be a promising monotherapy or adjunct therapy for the management of PC.

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Political Science

One Man, No Vote: The Legacy of Felon Disenfranchisement

Over the past half century the population of those incarcerated in the United States has increased to 2.2 million. The state laws that govern whether felons can vote are not uniform, which leads to an unequal participation and unfair disparity in elections based on where an individual resides. Due to variant felon disenfranchising policies across the country, an estimated 6.1 million Americans are unable to cast ballots, which is 3% of the voting population. This project will have two phases, the first is to use national surveys that include ex-felons, along with national and county level election returns to examine the political behavior and participation of ex-felons. This will help answer if re-enfranchisement leads to increased county-level turnout, both in elections and other political activities. These empirical results will be followed by a second phase, involving a case study of New York City, which will focus on voter turnout after Governor Cuomo's 2018 executive order. This study can provide a greater understanding of how the political participation of ex-felons, or lack thereof, can inform future election and voter policy at the county, state, and federal levels.

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Political Science

Pay to Play: Gender and Partisan Differences in Net Worth Between Congressional Candidates and Incumbents

One concern prospective congressional candidates have about running for office is the cost. Women congressional candidates do just as well as men when it comes to fundraising (Uhlaner 1986; Burrell 1994), yet women in different political parties face different fundraising landscapes (Crespin and Dietz 2010). Women are also more likely to be challengers than men (Burrell 2008), and challengers often have difficulty fundraising money at levels comparable to incumbents, which possibly puts them at an electoral disadvantage. Often, candidates must sacrifice jobs and family obligations to run a campaign, which can affect a candidate's personal finances. Women who have a higher personal net worth may offset the risks incurred by running for Congress. The literature on candidate emergence and campaign finance, however, has not yet fully addressed this possibility. This paper seeks to do so by assessing whether female congressional candidates have a higher personal net worth than male candidates who run for Congress. This paper will also examine whether Republican women who run for Congress have a higher net worth than Democrat women. An argument is put forth that women will have a higher net worth than men at the time they run for Congress, and that Republican women will be worth more than Democrat women.

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Psychology

Thoughts and Realities: Gay Latino Men Who Grew Up in the Central Coast and Central Valley Regions of California

While scholars in the past have made strides to address the experiences of gay Latino men who have migrated to or have been born within the United States, there is a dearth of literature to encompass the rapidly changing progression of the normalization of the LGBTQ+ community within the United States. Topics of these studies focus on migration, identity, family, and larger urban/metropolitan areas. Overall, this study will attempt to examine, through an ethnographic approach, the literature, both traditional and contemporary ways of thought, and investigate the shift in cultural spaces for US born gay Latino men that comes from the normalization of the LGBTQ+ community as a whole. More specifically, in how gay Latino men navigate their traditional ethnic family unit and white dominated mainstream gay spaces when living or growing up within the Central Coast and Central Valley regions of California where resources are limited, namely gay spaces. In addition, the study will analyze the way in which these men present and think about their gender in regard to masculinity and femininity. The findings of this study are still ongoing, but hope to have implications to better understand and address the role location plays on the thoughts and realities of individuals form this community.

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Biology

Suddenly Online: Exploring Postsecondary Teaching, Attitudes, Technology, and Faculty Mental Well Being in Spring 2020

In early 2020, the road to improving student success through active learning became additionally complex. With the outbreak of the novel coronavirus, most higher education classrooms shifted to online learning, disrupting intended teaching practices. This unique context, in tandem with the importance of using active learning, led our research team to explore how postsecondary teaching practices for 226 instructors changed during the coronavirus pandemic. Participants described their originally planned classroom practices (before changes due to the COVD-19 pandemic) as well their modified practices (after changes due to the COVD-19 pandemic) using Postsecondary Instructional Practices Survey. We used cluster analysis of survey data and a theory-based model for teaching knowledge and skills to understand how teaching practices changed in Spring 2020. We also explored how teaching was impacted by attitudes about teaching (Approaches to Teaching Inventory), technological pedagogical content knowledge (Technological Pedagogical Content Knowledge for Twenty-First Century Skills; TPACK-21), and mental well-being (Warwick-Edinburgh Mental Wellbeing Scale). We found student-centered teaching practices significantly decreased in Spring 2020, while instructor-centered teaching remained unchanged. Although most participants reported less student-centered teaching, some with higher TPACK-21 scores had less dramatic drops in student-centered teaching. Lastly, most participants experienced lower-than-healthy levels of mental well-being. We hypothesize drops in active learning may correspond to participants with low mental well-being who were unable to transform their teaching in the modified context. If the population was struggling with anxiety or depression, they may have not wanted to socially engage in ways that active learning would require.

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Electrical and Computer Engineering

Seizure Detection using Deep Learning Neural Networks

Machine Learning has advanced dramatically in the past few years, and it's now being implemented in self-driving vehicles. With 150,000 people suffering from seizures annually, it is difficult to believe Machine Learning algorithms haven't been implemented to detect seizures. Thus began our research efforts, in search of a method to explore applying Machine Learning algorithms for seizure detection. Through our research, seizures were broken down to be an abnormal electrical impulse being emitted from the brain's neurons, and then seizure signals were compared and analyzed with non-seizure signals. During the analysis, the time-based signal was transformed to the respective frequency-based signal and it was noted that the seizure signals in the frequency domain tend to spike towards higher frequencies. These spikes were often greater than 200 Hz. It was also noted that the seizure signal amplitude was almost 10 times greater than the non-seizure signal's amplitude. To implement a Machine Learning algorithm that used these characteristics to determine seizures, a Deep Convolutional Neural Network (DCNN) algorithm will be used to train our seizure and non-seizure signals to come up with a model that would be used to automatically detect whether a person is experiencing a seizure and provide a warning message. The DCNN algorithm is one of the state-of-the-art Deep Learning algorithms that works similar to human perception, it learns through experience. For people, once the general concept is determined, the concept can then be applied in different scenarios and people can expect a certain outcome. We plan to develop and implement hardware experimentation to test our seizure detection scheme.

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Criminology

Mock Jurors' Perceptions of Cannabis Intoxicated Eyewitnesses

Imagine that the only evidence to solve a crime was a high eyewitness. Marijuana was named the most illicit used drug in the United States in 2015 (Bose et al., 2016) and its recreational use is now legal in 16 states (Disa, 2021). Thus, increasing the possibility of encountering a cannabis intoxicated eyewitness in the future. One of the leading factors in wrongful convictions is eyewitness misidentification (Innocence Project, n.d.), therefore, mock jurors were used to observe how intoxicated eyewitnesses affect mock juror verdicts. This study analyzed mock jurors' perceptions of cannabis intoxicated eyewitnesses, as opposed to drunk or sober eyewitnesses, of a fictitious crime. Some research had been done on mock jurors' perceptions of drunk eyewitnesses (Evans & Schreiber Compo, 2010; Ewanation & Maeder, 2018), however, no known research examined mock juror perceptions of cannabis intoxicated eyewitnesses. This study utilized a 3 (Eyewitness intoxication: high on marijuana, drunk on alcohol or sober) x 2 (When lineup identification was made: shortly after the crime v. one week later) x 2 (Expert testimony at trial: present v. not present) between participants design. Participants were randomly assigned to read one of 12 vignettes describing a criminal trial that varied information depending on membership to the three conditions. After reading the vignette, participants then completed a brief survey assessing participants' perceptions of the eyewitness' level of intoxication, the eyewitness' testimony, the defendant's guilt, when the line-up identification was made, and the expert's testimony. Preliminary findings indicate that intoxication does impact trial verdict.

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Chemistry

Natural Products for the potential treatment of Triple Negative Breast Cancer (TNBC)

Triple negative breast cancer (TNBC) is the most aggressive type of breast cancer due to its rapid growth and proliferation. TNBC is highly drug resistant and has a poor prognosis due to the lack of established receptors. Breast cancer is the second leading cancer death in women, one in four people diagnosed will die from TNBC. Natural products have long been proven to be good lead compounds for the treatment of various cancers. Numerous natural products including ilamycin E, strictin, salvianolic acid B, chetomin, jatamanvaltrate P, and lycochalcone A have been reported to have potential in treating TNBC based on the data reported in cell and animal models. Among these natural lead compounds, licochalcone A (LA) was chosen as our lead compound in this project because of its relatively greater potency and synthetic accessibility. A group of analogues of lycochalcone A have been designed by replacing the hydroxyphenyl in licochalcone with an 1-alkyl-1H-imidazol-2-yl in hope to improve its potency. This presentation will review those natural products with potential in treating TNBC and describe the proposal for design and synthesis of lycochalcone A analogues for the potential treatment of TNBC.

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Mechanical Engineering

Thermal Treatment for Tremors

The purpose of this research is to investigate the relationship between thermal therapy treatments and tremors and to apply these findings to an engineering device that could improve an individual's quality of life. Our research included compiling background information on tremors and their effects on the human body, such as researching different classifications of tremors and each tremor's origins in the nervous system. Once we established this basic understanding, we investigated the thermal therapy treatments used for all ailments and the science behind their success or failures, ranging from ice pack applications to water immersions of the limbs. We additionally researched the devices associated with thermal therapy treatments to gain an engineering perspective that could apply to our future design. From our research, we found that thermal therapy treatments have had success in temporarily treating tremor patients, affecting the nerves differently based on the temperature, application area, and duration of the treatment. Our research indicates that warm temperatures are often used for relaxing the muscles in the body while cold temperatures are used for numbing procedures and slowing the nerve response time. This produces different results in the application of the temperature among a variety of afflictions, even beyond tremors. We believe that there can be more specifically engineered devices to aid in these temperature applications. Many current thermal therapy treatments utilize special circuits or liquids in contact with a cold or warm source for their design. These methods demonstrate promising potential for additional alternative tremor treatments that can be engineered for portability and ease.

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Marketing

How do I look? Exploring the impact of TikTok on young consumers' appearance management

Appearance management refers to all the attention, decisions, and acts related to one's appearance. As a socialization agent, media plays an important role in people's appearance management. However, limited studies investigated the role of social media in affecting appearance management. This study aims to explore how social media, specifically TikTok, affects young consumers' appearance management since social media has become integral in their daily lives. A qualitative study with personal interviews was conducted. 12 participants with ages from 18 to 29 were recruited by word of mouth. The findings reveal that TikTok, which focuses heavily on visual media, is very popular among young consumers. They mainly use it for entertainment and information value. They especially enjoyed the artificial intelligence-powered algorithm, namely the "For You Page," which can accurately detect one's specific interests and feed content that caters to those. When it comes to appearance management, a majority of the participants stated that TikTok affected their fashion sense and choices of stores. They learned about fashion trends and got inspiration for different styles. They also gained information on where to shop and discovered unique entrepreneurial startups. Online boutiques have gained popularity because social media platforms have provided entrepreneurs with a powerful tool to showcase their creativity and engage with customers. Most importantly, the findings suggest that TikTok may have helped young consumers to increase self-esteem and become more confident with their body image. To conclude, TikTok plays an important role in young consumers' appearance management and body image because of its relatable, relevant, and unique content. The findings provide valuable insights for fashion companies and brand managers to better target young consumers using trending social media platforms.

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Undergraduate

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Department of Criminology

2,732 and Counting: A Study on Exonerees' Perspectives

The current study aimed to examine the difficulties that exonerees face after reintegrating back into their lives after they are found innocent and are released from prison. The researchers chose to concentrate on three main areas where exonerees would likely report difficulties with: the reintegration process back into society after being released, the presence of any psychological disorders because of their wrongful conviction, and their perceptions and beliefs about the criminal justice system overall. To examine this, the researchers developed an online survey that focused on learning and collecting data about exonerees' experiences after being proven innocent. After analyzing the data contained from the exonerees who filled out the survey, we found out that many exonerees reported facing difficulties reintegrating back into society because of commonly reported factors like not having their criminal records cleared, a lack of government resources and assistance available to them. Additionally, several reported a negative stigma from community members, law enforcement, and prospective employers. A majority of the exonerees indicated that they received absolutely no government assistance after their release. Regarding their psychological well-being, the data demonstrated that about 75% of the respondents reported they had some psychological difficulties, the most common being PTSD and depression. Lastly and not surprisingly, a majority of the respondents indicated that they didn't trust the criminal justice system and they do not believe the justice system is fair. They also claimed they were unlikely to call the police in situations they may need them. More research is needed to continue giving people a better understanding of exonerees' perspectives. Hopefully, with more research, state assistance can be facilitated for the areas of greatest concern for exonerees.

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Department of Mathematics

Financial Volatility Estimation through Data Mining Techniques

Volatility modeling has been one of the most active and extensive research areas in empirical finance and time series economics for both academics and practitioners. It plays a critical role in pricing derivatives, calculating measures of risk, and hedging. It has also sparked an enormous interest and a large number of models have been developed since the seminal works of autoregressive conditional heteroscedasticity (ARCH) by Engle (1982) and generalized autoregressive conditional heteroscedasticity (GARCH) by Bollerslev (1986). The aim of this current research is to examine the popular data mining techniques such as artificial neural networks (ANN), decision trees, and multivariate adaptive regression splines (MARS) to model the volatility. The results were compared to the existing ARCH/GARCH type of models. We have used the major foreign exchange rates EUR/USD, USD/JPY, GBP/USD, AUD/USD, USD/CHF, and USD/CAD, which are freely available from the Federal Reserve Bank of St. Louis. Some simulations were also implemented to complement the real-data. The real-data and simulation results indicated that the ANN, decision trees, and MARS performed at least as well as the classic ARCH/GARCH models.

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Undergraduate

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Sociology

The foodways of food insecure Farmworkers from the Central Valley

Food insecurity is studied nationally, but the Central Valley has produced minimal research on the topic as a whole despite high levels of food insecurity, particularly among farmworkers. I will investigate the food practices of food insecure farmworkers in the Central Valley of California. The purpose of this research is to understand the economic, cultural, and social food practices that may be occurring in the Central Valley among food insecure farmworkers. The research will be conducted through a qualitative approach. I will conduct semi-structured open-ended interviews. I have formatted the research interview questions into three themes which are social, economic, and cultural food practices. I am anticipating that this future study will provide more information on food insecurity and bring a sociological perspective on the social impacts it may cause to a unique community. This proposal will introduce the research topic, an academic review on food insecurity among farmworkers, the methodology, and the timeline of the project.

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Child and Family Science

The Role of Religion in the Ethnic Identity Development of Bicultural Emerging Adults

In recent decades, Hmong and Latinx individuals have immigrated into the Central Valley, contributing to the Central Valley's ethnically and culturally diverse population and to the number of bicultural individuals. Although there is research on ethnic identity in emerging adulthood, there is minimal research on underrepresented bicultural individuals' religious exploration in the process of acculturation. This study explores the role of religion in the ethnic identity development and acculturation processes of Hmong and Latin American emerging adults.

This study is part of a larger project on psychological experiences of biculturalism among Hmong and Latin Americans in the Central Valley. Participants included 50 self-identified bicultural emerging adults (24 Hmong American, 26 Latin American, Mage=22.14). Of all participants, 90% were born in the U.S., and 96% had at least one parent born outside of the U.S. This study focuses on data pertaining to the role of religion in bicultural emerging adults' ethnic identity development through the methods of participants creating an identity map, completing a questionnaire, and responding to semi-structured interview questions.

This study used thematic analysis to examine participants' religious affiliations, experiences, explorations, and beliefs. Results revealed that when bicultural individuals experience cultural conflict in the acculturation process, religion can be advantageous insofar as it provides a sense of community and a gateway of sorts into dominant American culture. On the other hand, religion can also provoke tension if it is experienced not as an active and purposeful choice by the individual, but rather is perceived as externally prescribed from either their heritage or adaptive culture. This study found that bicultural individuals may actively use religion as a portal into their desired ethnic identity development and acculturation processes outcome. Religion may offer a temporary or permanent acculturative tool into a dominant culture for bicultural individuals.

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Sociology

Self-Perception and Societal Mirrors: How the Homeless are Perceived by Those Who Worked with Them

The purpose of the study is to acquire an in-depth understanding of the social services providers' perceptions of the homeless community with whom they work. The research will explore the potential impact of the attitudes and behaviors of the social service providers on their clients (homeless members) as they attempt to transition out of homelessness. The study is designed to a) ascertain the providers' perception of the homeless, b) compare the social service providers' perception of the homeless population with whom they work, and the self-perception of the homeless as reported in the literature. Participants are selected based on prior or current experience working with the homeless community. Other qualifications include the following: 18 years of age or older; English-Speaking; professional involvement with the homeless; and access to virtual communication, via phone or zoom. The sampling size contains between ten to fifteen participants. The sampling settings include organizations, transitional housing, and homeless shelters. The data are collected in Fresno, California, from February 9th to March. To achieve an in-depth understanding of the staff's standpoint in working with the homeless population, this research uses a qualitative method, using semi-structured interviews with opened-questions. All interviews are conducted via zoom or email, and participants are sent a consent form before the meeting. Data will be transcribed and code into themes for analysis. The findings have not been published as research is still ongoing.

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Undergraduate

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Biology

Using active learning in the face of personal and institutional barriers: A qualitative study

Active learning reduces course failure rates and improves scores on conceptual tests much more than traditional lecture. However, most STEM professors in North America continue to exclusively lecture. This work has led institutions to seek to understand why faculty teach like they do and build meaningful professional support for faculty. This requires researchers to decide (a) how to encourage faculty to use more active learning and (b) how to best measure whether change efforts are impacting faculty teaching practice. The purpose of this research project is to understand the nature of observed and self-reported teaching practices and also unpack what attitudes, norms, or perceived barriers inform teaching practices. My research study uses a case-study approach to interview a convenience sample of 10 faculty members on their attitudes, norms, or perceived barriers to inform teaching practices. I will select faculty for an interview based on alignment between their enacted teaching practices (as measured by an observation protocol, COPUS; Smith et al., 2013) and intended teaching practices (as measured by a valid and reliable survey; PIPS; Walter et al. 2016). We took a convenience sample of faculty that were surveyed (n=74), observed (n=76 individuals; 214 class periods), or both (n=50). In our initial findings, we found that some instructors (n=12) were under-reporting lectures. I want to understand why they continued to lecture, even though they may place value on active learning. Additional findings will help us to understand the extent to which our survey and observation findings can be explained by (a) misalignment of faculty intent and teaching behavior or (b) potential misalignment of our survey and observational protocols. We expect the talk to interest a wide group of CCRS participants, including education researchers, faculty developers, and university administrators.

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Biology

Do perceptions meet reality?: A quantitative exploration of intent and teaching practices in post-secondary STEM classrooms

Advancements in Science, Technology, Engineering, and Mathematics (STEM) are required to address world problems and move society forward. However, STEM jobs generally require a 4-year degree in STEM and most STEM students do not complete their degree in the discipline. One of the main reasons students cite for leaving STEM are their experiences in the classroom. A recent meta-analysis documented that active learning reduces course failure rates and improves scores on conceptual tests much more than traditional lecture. Despite this, most STEM professors in North America continue to exclusively lecture.

This work has led institutions to seek to understand why faculty teach like they do and build meaningful professional support for faculty. This requires researchers to decide (a) how to encourage faculty to use more active learning and (b) how to best measure whether change efforts are impacting faculty teaching practice. The purpose of this research project is to understand the nature of observed and self-reported teaching practices. Our methods include surveying faculty using the Postsecondary Instructional Practices Survey (PIPS) and 3 observations of class sessions using the Classroom Observation Protocol for Undergraduate STEM (COPUS). We took a convenience sample of faculty that were surveyed (n=74), observed (n=76 individuals; 214 class periods), or both (n=50). In our initial findings, we found that some instructors (n=12) were under-reporting lecture, but that faculty could accurately self-report group work (r=.390, p=.025) and clicker questions (r=0.405, p=0.019). We will explore the extent to which our survey and observation findings can be explained by (a) misalignment of faculty intent and teaching behavior or (b) potential misalignment of our survey and observational protocols. We expect the talk to interest a wide group of CCRS participants, including education researchers, faculty developers, and university administrators.

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Law Enforcement's Use of Negative Interviewing Techniques

Very little research has examined police interviewing behaviors with cooperative witnesses, often finding that negative techniques outnumber positive ones. The current study seeks to add to this literature and our understanding of what police officers do - both the good and bad - during their interviews with witnesses. Through this study researchers have analyzed more than 80 videos of police and mock-witness interviews and have identified 15 negative techniques that these officers use, including interruptions, leading questions, and distractions. Similar to previous research, officers are using many negative techniques. However, we did find evidence of several research-based techniques being used. Negative techniques, such as asking legally harmful questions or about their personal history, making judgmental comments, treating the witness as a suspect, and negative verbal and nonverbal demeanor have been found to be used by some law enforcement agents. There were approximately 26 instances where police officers asked legally harmful questions or asked negative questions about their personal history. Most of the negative techniques were found in the negative verbal and nonverbal demeanor with over 250 instances.

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Biology

Exploring Values Affirmation on Student Success in Introductory STEM Courses

Our research explores the impact that a values affirmation (VA) writing task can have on students' exam scores and final course grade in undergraduate STEM courses. This research is intended to reduce the 'achievement gap' in undergraduate STEM: Only 40% of students who start as STEM majors complete a STEM degree, and this drops to 22% for underrepresented minority (URM) students. URM students may struggle in STEM partially due to perceived stereotype threats that can negatively impact their classroom performance. The VA could improve students' exam scores and final course grades because it is designed to reduce psychological threats.

For the VA intervention participants are split into demographically matched experimental and control groups, which write 2-3 paragraphs about 2-3 values selected from a list of 12 values. The experimental group writes about their most important values while the control group writes about their least important values. We gathered data from 111 undergraduate STEM students from a large-enrollment medium-research intensive university in the Western U.S. in Summer and Fall 2020 using VA and two surveys about conceptual knowledge and attitudes.

In our sample we saw no significant difference in course grade between the experimental and control groups ($p > 0.05$), however we did find that the experimental condition had significantly higher attitudes about biology in the real world than the control group ($p = 0.009$). Furthermore real world attitude scores were significantly correlated to course grade ($r= 0.358$, $p < 2.74E-4$).

Results of past VA studies have been mixed, but mostly show that VA can reduce the achievement gap. Through this study we can contribute to the ongoing discussion about the efficacy of VA. This research will be among the first to be conducted at scale at a majority-minority institution.

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Crimonology

What is Rapport? From the Viewpoint of Police Officers

Rapport built by police officers is imperative when interviewing because it assists with cooperation and the accuracy of the information relayed by witnesses. The purpose of this study was to analyze what officers think rapport is, what is does, when, how, and why to use rapport. From the 131 officers interviewed, the results of this study showed that officers are likely to build rapport when trying to comfort a witness and build a positive relationship with them. Rapport was typically used at the beginning of the interview. There are many implications of this research and future research that is yet to be conducted in this area.

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Undergraduate

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Physics

Conductivity in Simulated Crystalline Solids

The ability to study quantum systems and to predict their behavior starting from the basic equations of quantum mechanics is a major challenge with very broad applications, from condensed matter physics, to atomic physics and quantum information just to mention a few. In this context, computer simulations provide a very valuable insight whenever analytical approaches are doomed to fail due to the strong inter-particle correlations. The objective of our computational experiment is to design and perform a Monte Carlo study of a collection of fermions moving in a lattice, modeling the behavior of electrons in a crystalline solid or even a collection of qubits. In particular, we would like to design a computational probe that is able to distinguish between insulators and conductors just relying on the ground state physics, without the need of computing complicated response functions. We will present results in simple geometries, and in particular in one dimension, we will discuss broad applications of the techniques and we will comment about potential future steps to make the study more realistic, for direct applications in real materials and superconductors.

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Undergraduate

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Biology

Targeted Gene Sequencing and Mutational Analysis of Aggressive Tumor Types of Thyroid Cancer

Thyroid cancer is the most common endocrine malignancy in the United States with over 52,000 new cases diagnosed annually and over 2,100 deaths. Approximately 72% of those diagnosed are women. Regionally, we see a higher incidence of thyroid malignancy in the Central Valley compared to other parts of California. The second most common type of well-differentiated thyroid cancer is the follicular variant of papillary thyroid cancer (FVPTC). A critical issue in the pathology field involves refining which lesions of FVPTC are benign and which lesions have the potential to become malignant and metastasize. Early detection of potentially malignant FVPTC can be predictive for aggressiveness and inform clinical treatment. Mutations in exons of the oncogene, NRAS, are associated with many malignancies--including thyroid malignancies. NRAS is an oncogene that affects various cancer-driving growth processes when mutated. Our goal is to use targeted gene sequencing to identify patterns of mutations within the NRAS oncogene among 20 archival FVPTC tumor tissue specimens. These 20 paraffin-embedded tissue slides obtained in collaboration with local clinicians, were prepared using laser capture microdissection (LCM) techniques. Precise LCM cuts of about 1500-2000 micrometers were made to separate tumor tissue from adjacent normal thyroid control tissue. From this micro-dissected material, DNA was extracted for PCR and targeted sequencing and mutational analyses of the NRAS oncogene. We have designed primers and are optimizing PCR protocols for sample testing. Our hope is that we will be able to identify mutation patterns in the NRAS oncogene that will help in the early detection of FVPTC for improved predictive clinical utility.

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Undergraduate

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Electrical and Computer Engineering

A Comparative Analysis of the Effects of Dataset Normalization on Deep Neural Network Security Training

The importance of cybersecurity has grown exponentially in the increasingly digital world. Due to this growth, there has been an expansion of newly-evolved cyber attacks. These novel attacks pose a significant threat to digital systems and require an adaptive solution. Machine learning-based intrusion detection systems (IDS) attempt to mitigate this threat by extracting features of each incoming message to classify it as normal or abnormal data. To avoid the bias of disparate attributes with varying scales, the dataset must be normalized. Applying normalization on different datasets, however, produces distinct results; this affects how the neural network processes data. There is a gap in research as to which technique most effectively normalizes two widely-accepted IDS benchmark datasets, NSL-KDD and CIDDS. In this study, a simple Deep Neural Network-based IDS was designed to identify the impacts of data normalization and dataset selection on the performance of the model. The model was trained and tested on NSL-KDD and CIDDS using Z-Score, Min-Max, and no normalization; the performance was recorded and compared. The prediction accuracies for Z-Score and Min-Max on NSL-KDD were 72.45% and 70.74%, and the false negative rates (FNR) were 47.48% and 51.01%, respectively. For CIDDS, Z-Score and Min-Max produced corresponding accuracies of 98.33% and 97.79%, and FNRs of 1.7% and 2.27%. The results identify Z-Score normalization as the optimal technique with respective improvements in accuracy of 4.36% and 38.17% and in FNR of 3.48% and 180.51% for NSL-KDD and CIDDS. The model demonstrates better performance when using CIDDS compared to NSL-KDD, with an increase in accuracy of 30.31% and a decrease in FNR of 186.17%. The results demonstrate the significance of selecting an appropriate dataset and normalization technique for the training and testing of an effective IDS.

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Criminology

Mock Juror Perceptions of Eyewitness Confidence when Presented with Relevant Expert Testimony

While varying degrees of eyewitness confidence may seem convincing, it does not always indicate accuracy. Oftentimes when an individual displays a high degree of confidence, we trust and believe that what they are saying is true, or at least partially true. Although this attribution can be seamlessly made in everyday life, it should be cautioned in the courtroom. Within the current study, we investigated the decision-making of mock jurors in eyewitness cases where expert testimony is presented. Participants were randomly assigned to read one of twelve trial transcripts (adapted from Wise & Kehn, 2020). The transcripts described the testimony of a woman who witnessed a man walk into a liquor store and pull a gun out, ordering the clerk behind the register to give him all the money within the register and eventually fatally shooting the clerk. Across each of the transcripts, three variables were altered: (1) the eyewitness testimony differs in the amount of poise and conviction the eyewitness presents the testimony with (e.g. confident vs. unconfident eyewitness); (2) furthermore, the expert witness testimony surrounding the eyewitness science varies between modern and earlier findings regarding the empirical relationship between confidence and accuracy (e.g. expert old findings, expert new findings, vs. no expert); (3) in addition to these variables, the transcripts featured facts that presented either a strong or weak criminal case. It was hypothesized that participants in the confident and strong case conditions with no expert witness testimony were more likely to deliver a guilty verdict than participants in the non-confident eyewitness conditions and expert witness testimony was presented. Implications will be discussed.

Poster Presentations

Abstracts

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Doctoral

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Physical Therapy

Shoulder Rotator Strength Profile in Adolescent Female Volleyball Athletes

Introduction: Due to the musculoskeletal changes observed in shoulders of overhead athletes and the increased risk of injury in the adolescent female athlete population, the purpose of this study is to evaluate peak isometric glenohumeral external and internal rotation strength values and external-to-internal rotation strength ratio in the dominant and non-dominant shoulders of adolescent female volleyball players.

Methods: Fifteen asymptomatic adolescent female club volleyball players (age = 14.8 ± 1.01 years, height = 164.0 ± 5.21 cm, weight = 59.25 ± 14.39 kg) completed isometric strength testing. Shoulder internal and external rotation strength were measured with a handheld dynamometer with the participant positioned in supine and the arm at ninety-degrees of shoulder abduction and neutral rotation. SPSS software was used for descriptive and inferential statistics. Paired t-tests were conducted to examine bilateral differences in ER strength, IR strength, and ER-to-IR strength ratio ($\alpha = 0.05$). Cohen's d and post-hoc power were also calculated.

Results: All participants presented with internal rotation strength weakness and external-to-internal rotation strength ratios greater than the normal range. No significant difference between dominant and nondominant internal rotation strength ($p = 0.362$, $d = 0.20$, power = 7.7%) and external-to-internal rotation strength ratio ($p = 0.856$, $d = 0.05$, power = 4.1%) was observed. Although dominant arm external rotation strength was statistically greater than nondominant arm strength ($p = 0.011$), it was not clinically meaningful due to a low power (8.1%) and small effect size ($d = 0.20$).

Conclusion: The current study did not observe a clinically significant difference in glenohumeral rotational strength bilaterally. However, the raw values of internal rotation strength revealed significant weakness which contributed to abnormal strength ratio. The results demonstrate the need to consider each arm individually in adolescent athletes, rather than comparing bilaterally. Further research is needed to develop normative shoulder rotation strength values in the female adolescent volleyball population to then

apply a preventative training program addressing adaptations that have been associated with injury in older volleyball players.

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Physical Therapy

Subacute Physical Therapy Management After a Heart Failure Exacerbation: A Case Report

Introduction/Purpose: Heart failure (HF) is a diagnosis involving structural or functional abnormalities of the heart. About one fourth of patients with HF are discharged from hospitals to skilled nursing facilities (SNFs). Compared to those who return home after hospitalization, patients who are discharged to SNFs have higher rehospitalization rates and have 24.4% greater 1-year mortality rates (53.5% vs. 29.1%). According to the most recent Clinical Practice Guideline published by the American Physical Therapy Association for the management of individuals with HF, needs for future research include studies which clarify the appropriate interventions and exercise dosing for patients in subacute rehabilitation. The purpose of this case report is to discuss a physical therapy plan of care for a patient who presented to a SNF with significant debility and mobility deficits secondary to prolonged hospitalization for heart failure.

Case Description/Intervention: The patient was an 82-year-old female admitted to a SNF after 31 days of hospitalization due to exacerbation of heart failure. Her prior level of function was modified independence for all mobility tasks. The patient participated in skilled physical therapy intervention for 35-45 minutes, five times a week, for four weeks (20 sessions total). Primary interventions included therapeutic activities, resistance exercise, and gait training to improve mobility and functional deficits.

Outcomes: At discharge she required supervision level assistance for all mobility tasks except for bed mobility, for which she required modified independence.

Conclusion: This case report highlights the positive effects of aerobic exercise and progressive resistive exercises in improving functional independence in older adults during subacute rehabilitation. Expanding on the findings of this case report, future research of higher level of evidence is needed to adequately update the Clinical Practice Guidelines for the appropriate interventions and exercise dosing for patients recovering from a heart failure in subacute rehabilitation.

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Internal Medicine

Clinicopathological Features of Double Hit and Double Expressor Lymphomas in Hispanics Versus non Hispanics in Central California

Objective

Double-hit lymphoma (DHL) and double-expressor lymphoma (DEL) are subtypes of diffuse large B-cell lymphoma (DLBCL) with limited studies investigating if any variations within ethnic groups exist. Our objective is to determine whether differences in incidence and outcome between Hispanics and non-Hispanics in DHL and DEL exist.

Design

Retrospective, single-center study analyzing patients greater than 18 years old diagnosed with DHL or DEL between 2013-2017. Primary CNS lymphoma excluded.

Outcomes Measures:

Incidence, 2-year progression free survival (PFS), 2-year overall survival (OS) in Hispanics vs non-Hispanics

Results:

Among 168 patients with DLBCL, 24 patients met criteria (n=10 DHL, n=14 DEL). In DHL, median age 62.5 (range 55-76), germinal center (GC) origin in 7 (70%), stage IV disease in 9 (90%), high-intermediate/high international prognostic score (IPI) in 9 (90%), 5 were Hispanics (50%). 8 patients (80%) underwent intensive induction therapy (REPOCH, RICE, R HyperCVAD). 5 achieved complete remission (CR). Incidence was 11.2 per 100 new cases of DLBCL in Hispanics versus 4.2 in non-Hispanics with an odds ratio of 2.76 (p= 0.14). 2-year PFS 80% and 2-year OS 80% in Hispanics versus 40% and 40% (p=0.42) respectively in non-Hispanics.

In DEL, median age 70 (range 47-91), GC origin in 6 (42.9%), stage IV disease in 7 (50%), high-intermediate/high IPI in 10 (71.4%), 3 were Hispanics (31.4%). 6 patients (42.9%) received

REPOCH with 5 achieving CR. 6 patients received RCHOP, 2 of them only achieved CR. In Hispanics, the incidence was 6.6 versus 9.5 in non-Hispanics with odds ratio of 0.682 (p = 0.76). 2-year PFS was 67% and 2-year OS was 67% in Hispanics versus 45.4% and 54.5% (p=0.38) in non-Hispanics.

Conclusion

In our study population, there is a trend towards increased incidence rate of DHL in Hispanics compared to non-Hispanics. 2-year PFS and OS in Hispanics in both DHL and DEL subtypes were numerically higher but did not reach statistical significance due to small sample size. Further evaluation with larger sample size is warranted.

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Doctoral

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Physical Therapy

Physical Therapy Management for a Patient with Uncontrolled Diabetes Mellitus Type II s/p Necrotizing Fasciitis Surgical Debridement: A Case Report

Title: Physical Therapy Management for a Patient with Uncontrolled Diabetes Mellitus Type II s/p Necrotizing Fasciitis Surgical Debridement: A Case Report

Background and Purpose: Persons with Diabetes Mellitus Type II often experience delayed wound healing. The purpose of this case report is to describe novel, conservative treatment strategies for a female in the intensive care unit with multiple comorbidities and complicating factors.

Case Description: A 43-year-old female with subcutaneous emphysema overlying the thoracic spine and left chest wall was admitted to the emergency department for multiple complications including a soft tissue necrotizing fasciitis infection. Following surgical debridement and negative pressure wound therapy, the patient required moderate assistance with the use of a front-wheeled walker for all mobility and transfers at initial evaluation. Physical therapy interventions included bed mobility, gross strengthening, and gait training for eight treatments utilizing Function in Sitting Test and 10 Meter Walk Test as outcome measures.

Outcomes: After multiple setbacks of debridement, delayed tissue healing, and malnutrition, the patient gained independence with all bed mobility tasks and was able to ambulate greater than 500 feet utilizing a front-wheeled walker with contact-guard assistance. A Minimal Detectable Change was achieved in the Function of Sitting Test while a Substantial Meaningful Change was met in the 10 Meter Walk Test.

Discussion: Treatment strategies for patients with diabetes and malnutrition post-surgical intervention are not well defined. This case report describes a multi-factorial yet conservative approach of mobility training for the individualized care and treatment necessary for the reduction of complications. This case report may assist in promoting improvement in objectivity with clinical decision making in the intensive care acute setting.

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Communicative Sciences and Deaf Studies

Supporting Knowledge of Laryngeal Anatomy and Physiology Concepts through the Use of Virtual Reality

Applications for the use of virtual reality (VR) in the field of preservice education for future speech-language pathologists are emerging (Dudding et al., 2019). This study used a pretest-posttest control group design to explore the effectiveness of using virtual reality (VR) to teach laryngeal anatomy and physiology concepts to speech-language pathology students. Participants in the experimental group engaged with a 3D-model of the larynx using Oculus Go headsets. Data were collected regarding the participants' knowledge of laryngeal anatomy and physiology concepts, their confidence in these areas, and their perceptions associated with using the technology. Results of this study indicated positive effects associated with using this novel, immersive approach to instruction. The results indicated a statistically significant difference ($t(17.36)= -4.40$, $p< .001$) in overall knowledge of targeted laryngeal anatomy and physiology concepts between the experimental ($M= 9.50$, $SD= 6.61$) and control groups ($M= 1.08$, $SD= 2.66$). A statistically significant difference was also observed for participants' confidence in their anatomy skills post intervention ($t(25)= -4.09$, $p< .001$), with students in the experimental group ($M= .71$, $SD= .73$) reporting greater changes in confidence levels than those in the control group ($M= -.85$, $SD= 1.21$). While the descriptive statistics did indicate that the experimental group reported greater changes in their physiology confidence levels ($M= .79$, $SD= .70$) than noted in the control group ($M= .08$, $SD= 1.32$), this difference did not meet statistical significance ($t(25)= -1.76$, $p= .090$). The results of this study suggest that immersive VR experiences are an effective method for supporting laryngeal anatomy and physiology instruction.

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Faculty

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Physical Therapy

The Effects of Tai Chi on Fall Risk as Measured by Preferred and Maximum Gait Velocity: A Pilot Study

Introduction and Purpose: Gait velocity has been associated with life expectancy, general health, well-being, function, and fall risk in older adults. Falls are a significant concern for community-dwelling older adults in the U.S. due to their prevalence, mortality risk, and cost. Physiological changes that occur over time with aging lead to a decreased gait velocity. Studies have shown that gait velocity of 1.0 m/s or lower has been associated with a higher risk for falls and intervention is recommended to reduce risk. Tai Chi has been commonly studied for its effect on improving function and reducing the incidence of falls in older adults. The purpose of this study was to determine the effect of Tai Chi on fall risk as measured by preferred and maximum gait velocity.

Methods: Eight participants volunteered to participate in this study. Tai Chi was performed 50-minutes, 1 time per week for a duration of 12-weeks. The class was taught by a certified Tai Chi instructor and incorporated various movements to improve strength and balance. Gait velocity was measured by the 10-meter walk test prior to and following completion of the tai chi intervention. A practice walking trial was performed prior to 2 test trials. The test trials were combined to achieve the average gait velocity at preferred and maximum speeds.

Results: Five participants completed this pilot study. A paired t-test was used for within group repeated measures for preferred gait velocity ($p=0.057$) and maximum gait velocity ($p=0.008$).

Conclusions: Maximum gait velocity was significant however preferred gait speed was not. Sub-analysis using the fastest trial (vs. average) for preferred ($p=0.047$) and maximum ($p=0.016$) gait velocity were both significant, even with a small sample size. Further research with a larger sample size would be beneficial. Long-term follow up on falls or near-fall occurrences would strengthen findings.

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Graduate

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Biology

Antibacterial Activity of Medicinal Fungi against Antibiotic Resistant Bacteria

Antibiotic resistance is a serious public health problem and the risk for ineffective treatment of infections is a growing problem. Annually, there are approximately 2 million people in the United States who suffer from antibiotic- resistant infection with at least 20,000 reported deaths. Globally, there are 700,000 deaths annually and if there are no novel antibiotics found, the numbers will escalate to 10 million deaths annually by 2050. Historically, fungi have been exploited medically by humans for their antimicrobial, anti-cancer, and anti-inflammatory properties. The biochemical potential of fungal species is poorly characterized even among the known species of fungi and thus more studies on fungi could lead to a higher chance of antibacterial compound discovery. To test this assertion, we assayed the antibacterial activity of 18 cultures of macrofungal species isolated from microbially species-rich environments against both antibiotic resistant and non-resistant bacteria. Our methods included co-culture assays, Kirby Bauer assays of fungal extracts, and DNA barcoding and phylogenetics to provide molecular identification of our samples. Our objective for this study is to characterize the potential of locally acquired fungi to produce antibacterial compounds. Our results confirmed many species of fungi to produce bioactive compounds which inhibit the growth of bacteria. We found that 6 of 18 our cultures capable of inhibiting gram-negative and/or gram-positive bacteria. In addition, two fungal isolates from the species Panaeolina foenisecii and Tubaria aff. furfurecea were found to produce compounds active against methicillin resistant Staphylococcus aureus. Our findings demonstrate the potential and need for further surveys of antimicrobial activity in species of fungi producing macroscopic sporocarps.

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Graduate

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Biology

Molecular basis for a small amino acid requirement at the F-helix residue of CRP, Val183, in transcriptional activation

The Escherichia coli cAMP receptor protein (CRP) activates transcription by binding to DNA via its F-helix. Recent data from our lab showed that Val183, one of the F-helix residues, is important for the transcriptional activation of CRP because the amino acid size is small. In order to elucidate the molecular basis for this small amino acid requirement at the position, we first inspected the active CRP structure, which revealed that Ile172 is located near the Val183 amino acid. This led to the hypothesis that a large amino acid at position 183 may sterically hinder Ile172, thereby potentially leading to the loss of CRP activity. To test this hypothesis, we created V183I, a CRP mutant containing a larger residue (Ile) at position 183 and then in this mutant background randomized the codon for the amino acid at position 172 using the method of modified site-directed mutagenesis. The resultant mutant plasmid pool was then introduced to a CRP reporter strain utilizing lacZ as the reporter gene, and the transformed cells were screened for transcriptionally active CRP mutants. DNA sequencing of five representative mutants were selected for DNA sequencing, which revealed four Leu (with three different codons) and one Ile substitutions, meaning that Leu/Ile are optimal at position 172 for CRP function. This result is contrary to the expected selection of a small residue at position 172 to circumvent steric hindrance with Ile183. Therefore, a mere combined size of 172 and 183 residues cannot fully explain the Leu/Ile requirement at position 172. Our current hypothesis is that the Leu/Ile requirement at position 172 is to preserve the hydrophobic protein pocket surrounding 172 position intact which involves the nearby Ile144. We are currently constructing CRP mutant altered at position 144 to test if the hydrophobic nature of Ile144 is indeed important for CRP activity.

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Graduate

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Department of Biology

Understanding the Function and Structure of Cancer-Specific Glycosylated MUC1 Specific Antibodies

Cancer is ranked as the second leading cause of mortality in the U.S. and is a significant health problem worldwide. Antibody immunotherapy has been a constructive way to fight against various cancers in the field of oncology. Mucin 1 (MUC1) is an important glycoprotein responsible for protecting the organs' epithelial lining in normal healthy human tissues such as the stomach, eyes, lungs, and other organs in the human body. The N-terminal domain of MUC1 is composed of a repeated variable number of tandem repeat region (VNTR) that is generally found in healthy tissues and is highly glycosylated. However, in cancer cells, MUC1 displays truncated glycosylation, thus exposing the protein's VNTR backbone region, resulting in oncogenesis. By understanding the binding mechanism of antibodies that target cancer cells, we can treat different cancers. This project aims to understand the structure and function of cancer-specific glycosylated MUC1 specific antibodies. It's essential to understand the structure and function of antibodies that bind the VNTR sequence of MUC1 because this will help develop therapeutic drugs to combat different cancers. Our project will attempt this by testing recombinantly made mucin-specific antibodies, huVu-3C6 and huVu-4H5, by humanizing and expressing them using transient transfection of Chinese Hamster Ovarian cells (CHO cells). We predict that by understanding the changes in glycosylation of the immunodominant epitope of MUC1 affects the binding of MUC1 specific antibodies, huVu-3C6 and huVu-4H5. Based on our results, we can confirm that by humanizing Vu-3C6 and V-4H5, may have altered possible binding mechanisms. Although recent studies have identified specific binding epitopes of MUC1-related therapeutic antibodies, we still do not understand the impact of MUC1 glycosylation. This project's long-term goal is to understand and develop new antibody drugs to treat various cancers therapeutically using x-ray crystallography techniques. We will advance the structural mechanism of MUC1-specific antibody recognition for potential future immunotherapy research and development.

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Graduate

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Chemistry

Computationally Measuring the Interaction between BMAA and CuZnSOD

The goal of this project was to use computational methodology to examine the interaction between the nonprotein amino acid Beta-methylamino-L-alanine (BMAA) and the human wildtype version of the enzyme, copper-zinc superoxide dismutase (CuZnSOD). Specifically, how BMAA interacted with the copper(II) and zinc(II) metal ions in the active site of the enzyme. The research question was, “If BMAA is presented would it inhibit the function of CuZnSOD?” CuZnSOD acts as an antioxidant in a broad range of organisms by catalyzing the dismutation of the superoxide radical into molecular oxygen and hydrogen peroxide, and BMAA is a known neurotoxin produced by cyanobacteria. The first part of the project used IQmol to visualize BMAA in its free form, as well as its alpha and beta carbamylated forms, then copper(II) and zinc(II) ions were introduced and QChem calculations (Density Functional Theory method B3LYP with 6-31G* basis set) were used to optimize geometry and measure the interactions between BMAA and the metal ions. The second part of the project used molecular docking software (i.e. MolSoft) to measure and examine the interaction between CuZnSOD (PDB ID 1SPD) and BMAA in its multiple forms. The aim was to see if BMAA would bind up to the metal binding sites and block the enzymatic activity or if BMAA would chelate the metals from the enzyme, essentially altering its proper folding and function.

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Graduate

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Biology

Spatial Distribution of Tomentella fuscocinerea, the fungal symbiont of the Mycoheterotrophic Orchid Corallorhiza striata

Mycoheterotrophs are a class of plants that cannot photosynthesize and instead depend on mycorrhizal fungi in order to obtain carbon. Mycorrhizal fungi occur in soil, where they grow on the roots of a wide variety of plants. Mycorrhizal fungi facilitate the absorption of water and minerals for their host plants by serving as fine, hair-like extensions of the root. In exchange, plants provide mycorrhizal fungi with photosynthetically-derived carbon. However, because mycoheterotrophs are unable to photosynthesize, they cannot provide their mycorrhizal symbionts with carbon and thus have been classified as parasitic. However, recent studies have shown that the relationship between one mycoheterotroph, the Snow Plant (Sarcodes sanguinea) and its mycorrhizal fungus, the false-truffle (Rhizopogon ellenae), may actually be mutualistic. This hypothesis is based on a positive correlation between proximity to Sarcodes sanguinea and the abundance of Rhizopogon ellenae. The goal of this project is to determine whether or not the relationship between another mycoheterotrophic species, the orchid Corallorhiza striata and its mycorrhizal fungus, Tomentella fuscocinera, may also be similarly mutualistic. To achieve this goal, we collected soil cores at incremental distances away from 5 Corallorhiza striata individuals and quantified the abundance of all mycorrhizal species at each distance class using molecular DNA-based methods. Our results indicate that the relationship between Corallorhiza striata and Tomentella fuscocinerea does not appear to resemble the relationship between Sarcodes sanguinea and Rhizopogon ellenae that has previously been observed. We did not observe any positive correlation between proximity to Corallorhiza striata and the abundance of Tomentella fuscocinerea. Instead, we observed a stochastic distribution of Tomentella fuscocinerea. This project is a component of a larger research project which will explore the ecological relationships between various species of mycoheterotrophic plants and their fungal symbionts.

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Graduate

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Biology

Transcriptional activation activity of cAMP receptor protein is sensitive to amino acid size at position 183.

The cyclic AMP receptor protein (CRP) of Escherichia coli requires both CRP DNA binding and RNA polymerase recruitment for transcriptional activation. CRP uses the F-helix, a helix-turn-helix motif for DNA binding. This study investigates an F-helix residue, Val183 which has no known contribution to CRP function. To understand the role of Val183, the CRP mutant V183A was generated via site-directed mutagenesis. The transcriptional activation activity of V183A was higher than that of wild-type CRP, which may suggest that a smaller amino acid is superior at position 183. To test the hypothesis, additional CRP mutants at the position (V183G, V183I, V183M, V183F) were generated. V183G showed a slightly higher transcriptional activation activity than wild type, and V183I, V183M and V183F showed much lower activity than wild type. The finding is consistent with the original notion of smaller amino acid preference at the position for CRP activity. The structure of active CRP form shows that Ile172 is in close proximity to Val183 and suggests that a bulky residue at 183 may cause steric hindrance to Ile172 which may have detrimental impact on CRP function. To test the hypothesis, we randomized the codon for Ile172 in the V183F background and screened for active CRP mutants. Only Gly was repeatedly selected, which means that Gly is only acceptable amino acid at position 172 when a bulky Phe occupies the 183 position. The result suggests that the preference of smaller amino acids at position 183 for optimal CRP function is related to the size of amino acid at position 172. We are currently testing a working hypothesis that steric hindrance between the amino acids at positions 183 and 172 hinders RNA polymerase recruitment.

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Psychology

The Effect of Motivative Point-of-Purchase Prompts on Children's Restaurant Menu Choices in an Analogue Setting

Over the last three decades, the prevalence of obesity in the United States has continued to increase. This is particularly problematic for children, as childhood obesity is likely to continue into adulthood and is associated with a variety of health issues such as type 2 diabetes and hardening of the arteries. Point-of-purchase prompts, which are words or images at the point of food selection that encourage consumers to select healthy options, have been only somewhat successful in previous research. This is likely because these prompts help consumers discriminate between the nutritional values of food items rather than motivating consumers to choose healthier options. Common marketing prompts however, especially those with unhealthy foods, have successfully utilized cartoons and bright colors to influence selection by children. Similar marketing strategies, while not commonly used with healthy foods, may be used to increase children's selection of healthy options. Therefore, the purpose of the current study was to apply common unhealthy food marketing strategies to healthy entrées on a kids' menu to increase the proportion of healthy orders by children on an online, analogue restaurant menu. Implications of the results for how healthy foods are marketed in restaurants and other settings will be discussed.

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Graduate

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Biology

Population Genomics of the Native and Invaded California Range of Palmer Amaranth (Amaranthus palmeri).

Palmer amaranth (Amaranthus palmeri S. Watson), a forb native to the Southwestern United States, has become a new and significant challenge in modern weed management over the last three decades, most recently establishing itself in agricultural systems within the Californian Central Valley since 2015. Palmer amaranth's range expansion potential is well-documented in the Eastern United States, where it went from a relatively unknown plant to a weedy species of major concern over a short period of time. The recent expansion event into Central California warrants an examination of where the new weed infestations fit into the population structure of Palmer amaranth in the Western United States and what difference in population genetic statistics may be exhibited by the new California populations versus those in Palmer's native range. To this end, we have collected tissue from individuals sampled from both these regions and generated a pilot panel of variant data to identify (single-nucleotide polymorphisms and indels) for preliminary population genetic analysis. Ongoing analysis of 24 individuals over five million SNPs from our pilot panel has lent some evidence for individuals from Palmer's native and the newly invaded regions clustering separately in PCA analyses. Efforts are underway to extract DNA from our remaining tissue samples which encompass more sampling sites. Once this work is complete our analyses could show us what genetic differences exist between the invaded range and individuals within the native range. Ultimately, the results of this study could be used to inform weed management practices in the impacted California agricultural systems.

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Graduate

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Chemistry

Developing a Chemical Database to Analyze Molecular Excited State Information

The main objective of this project is to create a chemical database that can store excited state information. Current chemical databases consist of quantities such as physical properties, ground state geometries, and sometimes NMR or IR spectra, however there is minimal or no information available about electronically excited states. Part of the reason for this is that excited state information tends to vary significantly between different types of molecules, and this makes it more difficult to store and process. For this project, a prototype of an excited state database was created using twenty organic molecules. The data was calculated using the commercially available Q-Chem software package and visualized using IQmol. The relevant data from the output files was then extracted using a Python script. The computed data includes optimized molecular geometries, SCF energies, IR/Raman frequencies, and excitation energies. For prototyping, the calculations were done at the Hartree-Fock (HF) level of theory using configuration interaction singles (CIS), the Tamm-Dancoff approximation (TDA), time-dependent density-functional theory (TDDFT), and a Gaussian basis set, 6-31G. The extracted data for each molecule includes its Cartesian coordinates, SMILES nomenclature, molecular geometry, CIS/TDA/TDDFT energies and amplitudes, orbital energies, and the excitation calculation methods and bases. In addition, the excitation energy trends that exist between the molecules in the database were analyzed using hierarchical clustering and then visualized using a dendrogram. Ultimately, additional data from a large number of molecules will need to be generated in order to create a robust database that can be searched and used to better understand patterns and behaviors of excited electronic states.

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Chemistry and Biochemistry

Development of positively charged ferritin protein cage as a building block for ordered protein array materials

a. Introduction

Cage-like proteins, like viral capsids and ferritins, are ideal synthetic nanoscale building blocks for constructing 3D array materials. The main characteristics that make them ideal are their homogneous size and structure, the ability to encapsulate various functional cargo materials in their interior cavities, and the ability to utilize their exterior surfaces to facilitate the directed assembly of individual cages. This research looks to design and express a mutant ferritin protein cage with a positive surface charge. Once developed, this mutant could be mixed with negatively charged protein cages to form an ordered protein array material via electrostatic interactions.

b. Methods

The surface charge of the subunits will be changed by nine point mutations (A18K, N25K, C90K, N98R, C102K, H105K, N109K, D123K, E162R). Special care was taken to ensure the use of codons found with the highest frequency to increase the chance of better protein expression in E. coli.

c. Results

Thus far, we have designed our protein gene for the mutated ferritin subunit and a research plan. We will custom order the synthesis for the protein gene from ThermoFisher Scientific. We also linearized the pET-30a cloning vector using PCR. We will integrate the synthesized protein gene into the pET-30a vector using the NEBuilder Assembly kit. We will then express the ferritin mutant in E. coli expression system and purify the protein.

d. Conclusion

Given the successful synthesis of our designed protein gene and integration into the cloning vector, we hope to begin expressing the ferritin mutant with our E. coli expression method. The next step in this

research would be to utilize the electrostatic interaction between the positively charged mutant and negatively charged wildtype of ferritin to facilitate self-assembly into an ordered protein array material.

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Civil and Geomatics Engineering

An Introduction to Structural Health Monitoring

This presentation introduces applications of Structural Health Monitoring (SHM) in damage identification for existing infrastructure. Concepts of SHM are derived from structural mechanics and dynamics; including vibration analysis which can be translated into algorithms for sensing, data acquisition, and signal processing. Through this, it is possible to incorporate a machine-based learning approach to damage detection. The research incorporates analytical techniques and technology to determine the status of existing structures. The processes utilize visual sensing, vibration monitoring, and damage detection. This is conducted through image processing tools and code written in MATLAB. The research conducted demonstrates an application of various methods and techniques of Structural Health Monitoring in civil engineering structures, like buildings and bridges. Discussions include solved examples for technical concepts in SHM.

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Graduate

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Psychology

Exploration of HRV as it Relates to Individual Differences in Cognitive Functioning

Heart rate variability (HRV) is a measure of time differences between each heartbeat. HRV reflects the direct influence of the divisions of the autonomic nervous system and the indirect influence of the brain. Previous research has suggested that HRV correlates with complex psychological processes such as cognitive functioning (Thayer & Lane, 2009). In the present experiment, we investigate the relationship between individual differences in HRV and cognitive function. The first goal was to use wearable devices to investigate the individual differences in morning and evening HRV. The second goal was to determine if there is a correlation between a person's HRV and their accuracy and reaction time on a difficult cognitive task. First, we used EliteHRV™ 'wearable' devices to create each participant's HRV profile by monitoring HRV under different conditions. Next, we measured each participant's HRV while performing a task-switching paradigm online. A one-way ANOVA suggested no individual differences in participants' HRV across different times. A Pearson's r suggested a medium-strength positive correlation between HRV and reaction time on correct trials. This research suggests that higher HRV is related to increased reaction time and less impulsivity.

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Chemistry and Biochemistry

Gold(I)–NHC-catalysed synthesis of benzofurans via migratory cyclization of 2-alkynylaryl ethers

Benzofurans are fused heterocycles that have been found in natural products and widely used in pharmaceuticals. Recently, advances in the chemistry of gold(I) complexes for synthetic schemes has made benzofuran synthesis from alkenes and alkynes much more straightforward. Despite these advances, synthesis of 2,3-disubstituted benzofurans from O-alkylated phenols remains a challenge due to lower reactivity of ether oxygen. Herein, we report the synthesis of benzofurans via gold(I)-NHC activation of 2-alkynylaryl ethers that proceeds via migration of the alkyl group. Reaction development, substrate scope, and mechanistic studies will be presented.

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Department of Biology

Determining Saccade- like Body Turns Refinement in Pogonomyrmex occidentalisis in Navigational Route Establishment

The proposed research focuses on how animals navigate their surroundings and interact with dynamic environments. The harvester ant species, Pogonomyrmex occidentalisis, is a good model for understanding how animals use visual features for navigation. They produce saccade- like turns (SLTs) towards learned features during navigation to maintain trajectory. This behavior allows the ant to sample the visual environment intermittently and correct their routes after encountering an obstacle within their foraging routes. The lab conditions are set to have fixed naturalistic panorama arena and to film the ants during their walks to identify SLT production. To quantify the changes in behavior the start and end of SLTs will be analyzed in relationship to the visual cues characterized from the naturalistic panorama. The outcomes of this research will provide a better understanding of the neural mechanisms with respect to the application of dynamic control systems. By using ant behavior to approach this study, we are able to enhance our basic science knowledge, provide us with new models and serve as inspiration for bio-inspired machines.

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Psychology

Time Perspectives influence on Mating Strategy

Mating strategies are how people get into relationships through sorting potential partners as either short-term or long-term. Mating strategies have been linked to various individual differences. Yet, the topic has had little investigation of its relation to how people think about their past, present, and future, or what is called 'time perspective.' How people think about time likely influences their views on relationships. We propose that people's perceptions of time will influence whether they want a short-term or long-term relationship. Participants were administered the Zimbardo Time Perspective Inventory (ZTPI) and The Expanded Multidimensional Sociosexual Orientation Inventory (EMSOI). The ZTTPI measures a person's time orientation. It was developed by Zimbardo and Boyd (1999), who defined six time perspectives including past positive, past negative, present hedonistic, present fatalistic, future-orientated, and balanced. The EMSOI measures a person's mating strategy preference. We found that a) past positive, future, and balanced time perspectives were positively correlated with long-term mating strategies and b) past negative and present hedonist were positively correlated with short-term mating strategies. These insights propose an alternative way of understanding mating strategies and can spawn new research in the domain. This can also lead to new interventions for romantic relationships as time perspectives can be shifted; thus mating strategies may be as well.

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Biology

Field ultrasound reveals reproductive capacity of federally endangered Blunt-nosed Leopard Lizards (Gambelia sila)

The Blunt-nosed leopard lizard (Gambelia sila) is an endangered species endemic to the San Joaquin Valley which has maintained federal protection for around 50 years. The species has experienced an 80-85% loss of their native habitat, which has contributed to its continued population decline. The recovery of G. sila has become crucial for preserving the biodiversity of the San Joaquin Valley. Since little is known about G. sila's reproductive output, conservation and recovery efforts rely on the reproductive information and historic data of various close relatives. Therefore, our experiment sought to explore the reproductive output of G. sila in the Panoche Hills region of the Northern San Joaquin Valley Desert. Between May and August of 2020, lizards were tracked using VHF temperature-sensitive radio-transmitter collars, captured, and measured. Portable ultrasound technology was utilized to assess egg development, egg size, and the number of eggs females carried. Following the 2020 field season, we analyzed our collected data using excel and found that female lizards have an average of 2 clutches per season, although some can have a 3rd clutch in 1 season. Each clutch had about 4 eggs with 2 eggs from each ovary with an average egg mass of 1.014 ± 0.698 g and an average clutch mass of 3.978 ± 2.881 g. The average relative clutch mass was calculated to be 10.7 ± 7.7%. These results provide a starting point for an ongoing research project observing the reproductive outputs of Gambelia sila throughout its native range. Conservation agencies will use this information to make crucial land management decisions.

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Chemistry & Biochemistry

Effects of Disulfide bonds between the CDR loops on Antigen binding in Camelid Antibodies

Antibodies are vertebrate immune system proteins consisting of two identical heavy and light chains. Antibodies possess six complementarity-determining region loops (CDR loops) which combine to form the antigen binding site. One exception to this model are the heavy chain only antibodies (HCAbs) found in camelids. In contrast to conventional antibodies. HCAbs only have a heavy chain, and thus bind antigen using three CDR loops. The third CDR (CDR3) loop in HCAbs is 3-4 amino acids longer than is typically found in human antibodies. The longer CDR3 loop in HCAbs is thought to be an evolutionary adaption that functions to provide a sufficiently large surface for antigen binding. A long CDR3 loop would have to be immobilized upon antigen binding, imposing an entropic penalty. One solution to this predicament is the preorganization of the long loop in a constrained configuration. In some cases, the long CDR3 loop found in camel HCAbs is hypothesized to be constrained by the presence of a non-canonical disulfide bond between CDR1 and CDR3. In this study, we examine the significance of this non-canonical disulfide bond on antigen binding. We chose a model system of a group of camel HCAbs that possess the non-canonical disulfide bond, which bind to Green Fluorescent Protein (GFP).

We then obtained mutants of the HCAbs in the system where the cysteines responsible for the disulfide bonds were replaces with alanine. The antigen (GFP) binding to the two versions of HCAbs in the model system will be compared using an enzyme-linked immunosorbent assay which can quantify the antigen bound HCAbs. Hence, we expect to find a lower amount of HCAbs without non-canonical disufide bonds bound to the GFPs when compared to the normal HCAbs with non-canonical disulfide bonds.

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Chemistry

Development of Fluorinated Precursors for Peroxyl Radical Clock

Peroxyl radicals are intermediates that propagate a free-radical chain oxidation process known as peroxidation or autoxidation. This is the chemical process behind degradation of petroleum products, biomolecules, polymer, and foodstuffs. Studies have shown cholesterol, present in foodstuffs, can easily undergo oxidative degradation in the air causing unwanted biological properties that can cause toxicity. Also, since the brain has high lipid content and high oxygen consumption, peroxidation plays a significant role in neurodegenerative diseases like Alzheimer's disease. Peroxyl radical clocks are simple and inexpensive methods of measuring rate constants of hydrogen atom transfer from radical trapping antioxidants (RTAs) to peroxyl radicals. RTAs are small molecules that slow down peroxidation and have long been a focus of research in the field. Radical clock methods typically rely on chromatography (GC, HPLC) to measure concentrations of oxidation products, but chromatography-based methods are reproducible only when all parameters of the method are conserved, and separation is sufficient. However, an 19F NMR-based radical clock method can be used with minimal or no modification to existing instrumentation since there is no actual separation of the analyzed mixture. With this hypothesis in mind, the aim of this project is to develop a fluorine-containing allylbenzene peroxyl radical clock for measurement of the rate constants of H-atom transfer using NMR spectroscopy. Synthesis and spectroscopic characterization of peroxidation products (standards) will be discussed in this presentation.

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Biology

Assessing the Longevity of Presenilin 1 in the Drosophila melanogaster model of Alzheimer's Disease

Alzheimer's disease (AD) is an age related disorder of the brain and currently impacts over 6.5 million Americans. AD causes neurons to degenerate rapidly and destroys synapses important for cell to cell communication, ultimately leading to shortened lifespans. The fruit fly, Drosophila melanogaster, has proven to be an excellent and useful model organism to study neurodegenerative diseases such as AD. The direct link between mutations in genes and progressive neurodegeneration in relation to aging remains unclear both in humans and the fruit fly model system. In our study, we aim to understand the longevity of our transgenic fly lines when expressed with the AD related gene, Presenilin-1(PSEN1). PSEN1 plays a substantial role in the health and functionality in both humans and flies, however, when mutated it can lead to aggressive neurodegenerative diseases. Our goal of this study is to observe what impact PSEN1 may have on the health and longevity when knocked down in the fruit fly. We have generated fly lines to express RNAi construct of PSEN1 to knockdown expression of PSEN1 pan-neuronally and in specific regions of the fly brain such as the mushroom body and ellipsoid body, two regions useful in visual guidance and learning and memory for the fruit fly. Our transgenic fly lines were created using the GAL4/UAS system which allows for control and activation of PSEN1 gene transcription respectively. The effects of the knockdown expression of PSEN1 was quantified during different stages of the fly's adult life (early, young, and old) to characterize progressive decline and longevity. Our results have shown fly groups with PSEN1 expression die when RNAi expression is knocked down pan neuronally. These fly groups die off at a much faster rate compared to our two other lines of expression in the mushroom body and ellipsoid body.

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Biology

Importance of N133 and E54 in stabilizing the inactive form of cAMP receptor protein in Escherichia coli

cAMP receptor protein (CRP) responds to cAMP, thus keeping the protein activity to the lowest possible level is as important as acquiring activity to the highest possible level in its presence. In Dr. Youn's lab, alanine substitutions of several CRP residues were identified that had elevated cAMP-free transcriptional activity. This work focused on E54 and N133 as both E54A and N133A displayed significantly increased cAMP-free activity. To determine whether the elevated activity in these residues is due to the absence of the original amino acid or the introduction of alanine, we separately randomized the codon for E54 or N133 and screened for CRP mutants who have higher cAMP-free activity than the wild type. Asparagine, lysine, serine, and threonine elevated CRP activity at position 54, and so did histidine, glutamine, and methionine at position 133. The results are consistent with the notion that the absence of the original amino acid at both positions is directly responsible for the elevated activity. E54 and N133 form an ionic interaction with each other in the inactive CRP structure. It was hypothesized that the substitutions listed above would result in elevated CRP activity by disrupting the ionic interaction. To test this hypothesis, we constructed a charge-swapped mutant N133D/E54K to create an artificial ionic interaction with non-wild-type residues at both positions with the expectation that the charge-swapped mutant would behave like wild type CRP. Unexpectedly, N133D/E54K displayed an elevated CRP activity like those of the two singles N133D and E54K, which fails to provide conclusive evidence that the N133-E54 interaction stabilizes the inactive conformation of CRP. Nevertheless, our data show that N133 and E54 residues are critical to keeping CRP inactive in the absence of cAMP. More studies are required to elucidate the molecular basis for the importance of the residues in the inactive conformation CRP.

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Graduate

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Chemistry

N-terminus truncation of Dps protein cage to study kidney filtration

a. Introduction

We have collaborated with scientists at Indiana University and demonstrated that DNA binding protein from starved cells (Dps), a 9 nm hollow-spherical protein, can pass the glomerular filtration barrier and is endocytosed by the S1 segment of proximal tubules. This result suggests that Dps holds great promise as a probe to advance our understanding of kidney filtration mechanisms. In this study, truncation of a set of amino acids from the N- terminus of wild type Dps (wt-Dps) was conducted to generate a smaller Dps cage, which could be used to investigate the effect of protein size on glomerular filtration.

b. Method

Site-directed mutagenesis techniques were employed to develop three types of Dps mutants, in which amino acids 2 – 5, 2 – 9, and 2 – 19 of wt-Dps were deleted, respectively. These mutants (DpsDel2-5, DpsDel2-9, and DpsDel2-19) were expressed through an E. coli expression system and purified using anion exchange chromatography followed by size exclusion chromatography.

c. Results

DpsDel2-5 and DpsDel2-9 were successfully purified from E. coli. Gel electrophoresis assay revealed that the molecular weight of the proteins decreased in the order of wt-Dps, DpsDel2-5, DpsDel2-9 as expected. Transmission electron micrograph observation of mutants indicates that both DpsDel2-5 and DpsDel2-9 maintain cage-like structure similar to wt-Dps. DpsDel2-19 was expressed in E. coli. However, the protein remained in cell debris rather than supernatant after the cell lysis step, suggesting that this mutant could form an inclusion body in E. coli expression systems.

d. Conclusion

Two mutants of Dps protein cages of smaller size, DpsDel2-5 and DpsDel2-9 were successfully developed. We will investigate the distribution and accumulation pattern of these mutants in the kidney.

DpsDel2-19 is likely to form an inclusion body in E. coli, thus we need to revise the purification procedure to re-solubilize the protein.

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Department of Psychology

The influence of self-deception and time perspective on stress: Buffers against poverty and self-deception.

Chronic stress is associated with many physical and mental health-related problems; therefore, it is essential that we better understand the causes of stress and possible remedies.

This study focuses on two stress-inducing variables: low socioeconomic status (SES) and economic inequality (unequal distribution of wealth) and two unique coping mechanisms, self-deception, and how people think about their past, present, and future, also known as time perspective. Participants in this study completed a survey consisting of questions about income, socioeconomic status, views on economic inequality, self-deception (BIDR scale), and the Zimbardo time perspective inventory (ZTPI). We found a significant negative correlation between wealth and stress and between wealth and views about the pressures of economic inequality. We also found a significant negative correlation between stress and self-deception, meaning that self-deception may be a viable coping mechanism of stress. Finally, we found that how people scored on the ZTPI was informative about how well they coped with stress. These correlations support that self-deception, and a positive time perspective may reduce the stress experienced due to income and economic inequality.

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Chemistry

Carbamazepine in Aqueous Environments

The focus of this project is to develop a detailed understanding of the photodegradation processes of carbamazepine which may potentially lead to the design of a more effective water treatment protocol to remove carbamazepine and similar environmentally persistent organic compounds from the water system. Carbamazepine is an anti-epileptic drug that's used to prevent and control seizures. Current research discusses the photodegradation processes of carbamazepine, however there is minimal or no information available about the photodegradation process of carbamazepine while reacting with water. This research is conducted by the use of computational chemistry to first understand the electronic structures of the molecule in its ground and excited states, and then to look into its degradation processes. This will be done in a quantum chemistry software package called Q-chem. All the calculations use density functional theory (DFT) with B3LYP as the exchange-correlational functional and the polarizable continuum model (PCM) to incorporate solvent effects. The ground states were optimized using a Gaussian basis set (6-31G**) and the vertical excitations, forces and relaxations were then computed using time-dependent DFT (TD-DFT) 6-31++G** as the basis set. Classical dynamics were used to simulate explicit solvation of carbamazepine using Tinker and VMD (Visual Molecular Dynamics) programs. The optical excitation spectrum was generated, and the lowest energy conformer was shown to be reasonably close to the experimental absorption spectrum. The lowest energy and also most intense transition is a π to π* transition primarily between the HOMO and LUMO. The initial forces were also generated and the impulse for each atom in carbamazepine was calculated (force/ at. wt.). States 1, 3, and 4 exhibited the highest impulses, with excitation into state 1 having the biggest effect on a non-hydrogen atom indicating this state may be the most likely to lead to degradation.

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Psychology

Investigating the Effects of Motivative Augmentals that Emphasize Positive versus Negative Reinforcement Contingencies

In the workplace, managers often run into issues with employee performance. In behavior analysis there are several interventions that have been shown to increase performance using positive or negative reinforcement. Positive reinforcement is the addition of a stimulus following a response that increases the likelihood of the same response in the future under similar conditions. Negative reinforcement is the same as positive, except instead of a stimulus being added, one is removed. But some of these interventions are resource intensive. Alternatives that are low-cost and low-effort, such as manipulating reinforcer value, are important to consider. Statements that manipulate reinforcer value (motivative augmentals) may highlight either positive or negative reinforcer contingencies, but it is unclear which would result in higher performance levels. The current study will utilize a reversal design to investigate the effects of motivative augmentals highlighting positive versus negative reinforcement contingencies on performance in an analogue work setting. The study will consist of 8-12 participants recruited from Fresno State courses. Participants will complete two concurrent work tasks that resemble typical duties of office staff in a hospital, inputting medical data and calculating percentage of appointment attendance. Motivational statements will be introduced to see whether those that highlight positive versus negative social reinforcers result in greater changes in response allocation. The results of the study will further the research on motivative augmentals and has potential implications for motivating employees in the workplace.

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Psychology

Standardization of a novel Tetris-like task for use in a Virtual Reality study of human perception

Perception can be altered by both bodily and stimulus-dependent orientation. Most studies in this domain have used methods that incorporate ‘passive’ tasks, such as imagining impossible body rotations or passively viewing rotated stimuli. Thus, we take the definition of a passive task to be: The presentation of non-participant manipulated stimuli from various perceptual orientations. However, there is a great deal of evidence to suggest that the ability to perceive a stimulus is highly dependent on the ability to act on that stimulus. Therefore, perceptual tasks that are passive may lead to incorrect or incomplete descriptions of orientation-specificity effects in perception. We plan to give an active task using a Tetris like game in VR while manipulating bodily, stimulus, and visual orientation of the participant and game ‘world’. As a precursor to this study, we needed to ensure that the sequences of Tetris blocks, or Tetrominos, used in the study are equally difficult. An online pilot was created to collect data using 10 randomly generated sequences of Tetrominos. Each sequence consisted of 70 individual Tetrominos, with 10 of each of the 7 types of Tetromino. The data were analyzed to measure possible differences in the difficulty of the 10 sequences. Several data were collected to assess the difficulty including but not limited to: The time when a Tetromino was created and when it landed, the number of rotations, the order of keypresses, etc. These data will reveal important aspects about player experience, ability, overall sequence difficulty, and more to be used within the follow-up experiment.

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Graduate

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Literacy, Early, Bilingual & Special Education

Undocumented: Journey to Higher Education in Uncertain Political Times

In the year 2012 after past failed attempts were made to provide relief to the large population of undocumented youth within the United States. Deferred Action for Childhood Arrivals (DACA) passed and was a historical moment for the undocumented community within the United States. Many of them including students would now be able to have access to some benefits as well as temporarily being safe from deportation. Today, among the current political climate the Trump Administration has tried time and time again to end DACA all together putting in jeopardy millions of people. As a result, there was a pause on new initial applicants and reducing the original two-year permit to one year. The purpose of this study is to showcase the benefits of DACA for the undocumented community and to develop a plan of action to offer more support to new rising scholars in K-12 and the undocumented population as a whole. Within this study, I have selected two participants to not only be part of this project, but also part of my professional development. They will teach and educate me just as much as I hope to teach and educate anyone who may read this study. They have participated in an initial and final reflective interview in regards to the 2016 and 2020 elections and political climate. This study will take a look at their journey to higher education, the formation of identity, and their perspective on past and current events. Using focused interviews, literature, resources, and a survey for data collection I plan to develop a plan of action and an in-depth analysis in hope of contributing to the field of education regarding undocumented students so that no undocumented person should ever feel alone, or as if they cannot prosper due to their legal status.

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Undergraduate

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Do Experienced Bowlers Exhibit the “Spare Fallacy?”

Past research from our lab has found that relatively inexperienced bowlers tend to feel more confident in picking up two-pins spare than in picking up comparable one-pin spares. In reality, they are more likely to pick up the one-pin spare. We call this the “spare fallacy.” In the present study, we wanted to see if this was also true for more experienced bowlers. We recruited 112 participants from a Reddit discussion group about bowling (r/Bowling). They rated how confident they felt, on a scale of 1 to 10, about picking up various bowling spares based on photographs of the pins taken from the vantage point of an actual bowler. Among the spares were three "critical pairs" that consisted of a single-pin (the 1, the 3, and the 6), and a corresponding two-pin combo (the 1-2, the 3-5, and the 6-10). In contrast with the inexperienced bowlers, these participants were more confident about picking up the one-pin spares ($M = 9.38$, $SD = 0.94$) than the two-pin spares ($M = 8.86$, $SD = 1.02$), and this difference was significant according to a paired t-test, $t(111) = 4.98$, $p < .001$. In other words, experienced bowlers did not show the spare fallacy. There were also significant correlations between the difference between participants' one-pin and two-pin confidence judgments and their self-reported highest score ($r = .29$, $p = .002$) and average score ($r = .27$, $p = .004$). This suggests that the better the participants were at bowling, the more clearly and accurately they distinguished the objective difficulty of the one- and two-pin spares. Thus, unlike many other cognitive and visual illusions (including the “hot hand” belief in basketball, the spare fallacy does seem to diminish with experience.

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Psychology Department

Enhancing the Spacing Effect with Different Encoding Methods

Previous research on the “spacing effect” shows that people learn more when learning sessions are distributed across time rather than massed (or crammed). The spacing effect has been shown to be present with both ‘restudy’ and ‘retrieval’ (testing) learning methods. We conducted two studies to explore whether the spacing effect can be enhanced using retrieval versus restudying learning practice during spaced learning sessions. Study one was in person, and study two was virtual. Participants were tasked to memorize 12 SAT word pairs. Participants learned by using a restudy or testing method in both distributed and massed learning sessions. Consistent with previous research, in study one, we found a spacing effect in where the distributed learning sessions (M=3.26, SD=1.78) resulted in better learning than massed sessions (M=2.53, SD=1.66). We also found that retrieval learning sessions (M=3.49, SD=3.49) resulted in higher word recall than restudying (M=2.30, SD=1.73). Most importantly, we found a larger spacing effect for retrieving learning sessions than restudying sessions ($F(1,134) = 11.87$, $p < .00$). These findings support an encoding explanation of the spacing effect and argue against theoretical explanations that describe the spacing effect in terms of deficient processing. The deficient processing theory indicates that distributed learning sessions allows for additional processing of the information when compared to massed information. Our results fit with a large body of research outside of the spacing effect on how disuse affects the accessibility of memories. Future research is discussed in terms of practical applications.

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Agricultural Business

Impact of Almond Plantings on Land Values in the San Joaquin Valley

This study evaluates the impact of almond plantings on land values in the San Joaquin Valley. Data collected for this study consists of land valuations derived from the “Trends in Agricultural Land and Lease Values” annual reports and land allocations derived from annual county crop reports. Data between the years 2000 through 2019 was gathered for this study. A land allocation model was derived based on previous literature studying land allocation. Differential framework for a multiproduct theory of the firm developed by Laitinen (1980) and Theil (1980) is used as a theoretical model to analyze the land allocation decision of San Joaquin Valley growers. The analysis even advances the empirical allocation model framework of Vorotnikova et al. (2017) by using panel data methodology. Descriptive data analysis shows that an increase in the land values positively correlates with the land allocation decision. The preliminary results suggest that the growers more likely choose the new land openings for almond production in the San Joaquin Valley, but this land allocation decision does not necessarily happen at the expense of other crops’ land allocation. Establishing a correlation between land values and land allocation allows for an improved understanding of economic decision making in the San Joaquin Valley agricultural real estate market.

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Biology

DNA methylation association to gene transcription in Rhizopogon vincolor and host tree Pseudotsuga menziesii (Douglas fir).

Mycorrhizal fungi are thought to be cooperative mutualists that functioned in aiding green plants to evolve adaptations for life on dry land. The relationships between mycorrhizal fungi and plants support over 90% of all known terrestrial plant life today. There are various types of mycorrhizae, but this study focuses on an ectomycorrhizal fungus, Rhizopogon vinicolor colonizing Pseudotsuga menziesii (Douglas fir). Ectomycorrhizal fungi form sheaths of tissue that bind to the exterior of a plant root and mediate all nutrient transfer between their host tree and the soil. Mutualistically, ECM are dependent on the host plant for carbohydrates while the plant receives mineral nutrients and water. Relationships like the ones between R. vinicolor and P. menziesii are essential for plant survival and a sustained ecosystem. Whole-genome bisulfite sequencing of R. vinicolor will be used to investigate methylation patterns of DNA in relation to gene transcription in R. vinicolor in a symbiotic relationship with P. menziesii. Next-generation sequencing permits the assembly of shotgun DNA libraries for both species with whole-genome bisulfite sequencing. DNA methylation is an important factor in understanding epigenetic gene regulation that can lead to future novel treatment proposals with ecosystem health in mind. Data acquired can be interpreted further to develop beneficial treatments for reforestation, silviculture, or any ecological health benefits from fungal-plant symbiotic species.

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College of Health and Human Services

Spatiotemporal Analysis of the Roadside Transportation-Related Air Quality (StarTraq) project and the Neighborhood Characteristics

Located in the Central Valley of California, Fresno is known for having high particulate matter levels, which different immediate local sources can influence, and the regional pollution trends that change over time. The objective of this study is to demonstrate the relationship between the road-side air quality information of particulate matters collected in zip codes in the Fresno/Clovis area and these spatiotemporal factors. Real-time air quality monitors, along with devices that allowed for GPS tracking and temperature measurements, were used to measure the levels of particulate matter 2.5 (PM2.5) and black carbon (BC) on the road-sides for different zip code areas through active transportation mode (walking). Measurements of various locations from the walking routes were taken multiple times during 2015 and 2017. The walking routes in the neighborhoods with distinctive neighborhood transportation characteristics, such as high-traffic vs. low-traffic, were selected and measured concurrently in pairs and repeatedly to obtain a more accurate parallel comparison for spatial variability. Our study confirms that the zip codes 93722, 93728, and 93706 had high levels of particulate matter, which may have led to increased levels of cardiovascular disease, asthma, and low birth weight in these zip code areas. The potential neighborhood characteristics that increase the particulate matter and black carbon concentrations are locations with proximity to highways, arterial and connector roads, the industries with the high volume of diesel freight, and the commercial areas with busy vehicular activities, and the unpaved areas.

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Child and Family Science

Family Functioning During the COVID-19 Pandemic

Introduction: The COVID-19 pandemic has transformed daily life. Families are experiencing an unprecedented situation with many parents working from home while also assisting their children with some form of virtual school. Families are having to adjust to a new way of living. The objective of the study is to describe the ways in which the pandemic has influenced daily family life for parents of children between the ages of 5-18.

Method: Six focus groups (n = 19 mothers, 70% Hispanic) were conducted between December 2020 and February 2021. Mothers participated in virtual focus groups and completed a brief survey. Focus groups were transcribed verbatim. Reflexive thematic analysis was used to analyze the data. Themes were coded using Dedoose software.

Findings: Parents are enjoying spending extra time with their children and partners. Most shared that they are happy to spend more time together, but quality family time is dampened by the detrimental effects of the pandemic. A significant number of mothers discussed how concomitant effects of the pandemic include an increase in unhealthy behaviors for both parents and children.

Conclusion: The results from this study highlight both positive and negative influences of the pandemic on family life. Families are enjoying having their children at home, with a number of parents sharing that they are even happier now that all family members are home together. Nevertheless, high stress, crowded conditions, financial strain, and boredom increase engagement in unhealthy behaviors during this time. Health promotion programs targeting specific aspects of family life during the pandemic may help alleviate family stress and improve overall family functioning.

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Mechanical Engineering

Shape Memory Alloy Blood Pressure Measuring Device

There are many commercial devices that can read blood pressure. However, most of them use inflated air cushion to manage the blood flow in the pressure measuring process. Because of that feature, the conventional devices need air pumps to inflate and deflate the air cushion. Even with latest technology on air pump used in the Omron HeartGuide (wearable blood pressure monitor), it's still bulky and heavy. In order for the device to become true wearable which allows user to wear the whole day with comfort, the device needs to be lightweight and compact. The proposed study has looked into the method that can provide similar blood flow regulating effect by using a class of smart materials, Nitinol wires. These shape memory alloy (SMA) materials are well-known for high weight-to-strength ratio suitable for providing sufficient squeezing force. One observed feature of SMA wires is that they will shorten from a stretch length with the application of heat. The heat is usually generated by applying an electric current through the wire. The researchers in this project have utilized this feature to design a wrist brace in such a way that the wrist brace circumference will reduce when the SMA wires are shortened. This phenomenon will create squeezing pressure on the wrist to regulate the blood flow. The designs have been realized by 3D printing for rigid components and silicone molding for soft components. For sensing the pressure and the blood flow, the study has followed the conventional methods used in existing blood measuring devices. All electronics and electrical signals are controlled by a microcontroller, Arduino. The data is transmitted to mobile devices and clouds via an onboard wireless transmitter. This study will result in the development of a novel and innovative wearable blood pressure measuring device that is economically affordable.

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Chemistry and Biochemistry

Gold(I)- Bronsted Acid Co-catalyzed Synthesis of Substituted Isocoumarins

Heterocyclic compounds are among the richest classes of organic molecules. Heterocyclic structural motifs are found within biomolecules such as amino acids, sugars, and nucleic acids. Also, many pharmaceuticals are derivatives of heterocycles. Isocoumarins are benzo-fused cyclic esters of benzoic acid. They are found in important molecules such as thunberginol A, isolated from the leaves of Hydrangeae Dulcis Folium, a flowering plant native to the eastern United States, and has been shown to have anti-diabetic properties. Isocoumarin is also part of the structure of capillarin, an anticoagulant used to treat blood clots. The broad range of isocoumarin applications and motifs within biological molecules and structures has motivated research into synthetic methodologies that use transition metal-catalyzed reactions. While such methods are effective in their synthesis, they often require harsh reaction conditions or deliver low yields. This project aims to develop a gold(I)-catalyzed cyclization reaction that generates isocoumarins in very good yields under mild reaction conditions. A range of 2-alkynyl benzoate esters was synthesized via palladium cross-coupling reaction and reacted in toluene in the presence of Nolan's gold(I)-NHC (N-heterocyclic carbene) complex and Brønsted acid. Results of reaction optimization and the substrate scope will be presented.

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Biology

Semantic CLustering in different neurocognitive groups

Alzheimer's disease (AD) is a neurodegenerative disorder that is characterized by significant declines in cognition and independent functioning. Given that interventions are most effective at the earliest stages of the disease, researchers have focused on Mild Cognitive Impairment (MCI), the risk state for AD. It is known that in healthy aging, semantic clustering (i.e., grouping to-be-remembered words by category) is an efficient memory strategy that aids recall. A hallmark of AD is the breakdown of semantic networks, which are involved in the clustering strategy. Therefore, in this study, we examined whether semantic clustering was impacted by the AD process itself. Participants included healthy older adults, individuals with MCI, and persons with AD. All participants were administered the California Verbal Learning Test-II, a neuropsychological measure of learning, memory, and semantic clustering. Results will be presented on the impact of MCI and AD on semantic clustering, which has significant consequences for learning and memory compensation.

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Chemistry

Natural Products Demonstrate Androgen Receptor Inhibitory Activity and Anti-Cancer Properties

Prostate cancer (PCa) is one of the most frequently diagnosed cancers among men in the Western world and among the leading causes of male cancer-related deaths. This cancer, including the deadly castration-resistant prostate cancer (CRPC), is mainly driven by the androgen receptor (AR)-regulated gene expression that is initiated by the binding of androgens (male sexual hormones) to the AR. Current FDA-approved treatments for CRPC patients that target the AR-signaling axis can only improve median overall survival by approximately 2-4 months. Natural products that have successfully provided the basis and inspiration for several effective anticancer drugs are envisioned to be a valuable source of novel AR antagonists with unprecedented chemical templates. Numerous natural product androgen receptor modulators (NPARM) have been reported to have the capacity to inhibit AR activity as well as the potential to suppress the prostate cancer cell proliferation and prostate tumor growth. Two such compounds are ganoderic acid DM (GADM) and epigallocatechin-3-gallate (EGCG). They are derived from the red reishi mushroom and green tea, respectively. Reishi mushroom has long been used in Asian traditional medicine to boost the immune system. Both GADM and EGCG have established AR-inhibitory patterns and can reduce cell proliferation in multiple PCa cell lines in a dose-dependent manner. They have also demonstrated in multiple studies to competitively bind to AR in the place of DHT to inhibit DHT and AR interactions. Furthermore, both natural compounds are shown to utilize their anti-cancer properties outside of the AR-signaling pathway, as GADM and EGCG induce apoptosis (programmed cell death) in PCa cell lines. This presentation will thoroughly review the potential and limitation of GADM and EGCG as AR modulators for further development.

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Psychology

Does Power Influence Attention? A Replication Study

We attempted to replicate a highly cited study claiming to show that feeling powerful improves people's ability to shift their attention in a difficult mental task. We did this because a) this study has never been replicated and b) many high-profile results in psychology have been shown not to replicate. (Psychology is sometimes said to be undergoing a "replication crisis"). In our study, college students (N = 119) recalled and wrote about a time when they had power over another person or a time when another person had power over them. Then they saw a series of large letters, each composed of many copies of a different smaller letter (e.g., a large O composed of many small Es). In the global task, they had to indicate as quickly as possible whether the large letter was a vowel or consonant. In the local task, they had to do the same for the small letter. Consistent with previous research using this task, we found that responding was somewhat faster in the global task than in the local task, although this was not quite statistically significant ($p = .07$). We also found that responding was faster when the large and small letters were both vowels or both consonants as opposed to one being a vowel and the other a consonant, and this was statistically significant ($p = .003$). However, there were no differences between the powerful and powerless conditions, suggesting that feelings of power did not affect attentional flexibility, as has sometimes been claimed. This was a part of a multi-lab project; a second lab also failed to reproduce similar results and a third is still in progress.

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Liberal Studies

Teacher Testimonio and Journeys into the Profession

This research is part of a larger study focused on strengthening pathways and opportunities into the teaching profession for under represented groups. In this paper we draw upon the testimonios of preservice and inservice educators to understand the complexities of assessing the teaching profession. Testimonios are a methodological tool that allows for deeper interrogations of social institutions to understand influences on the educational experiences of minoritized communities—in this case, educators of Color. Through an analysis of educators' testimonios, we are able to understand and learn more about the significance of personal backgrounds and the educational journeys as they relate to the goal of becoming a teacher.

This presentation draws upon testimonios with 10 preservice and inservice educators of Color. All participants identified as Latinx, first generation, female, daughter of immigrant parents, and Spanish speaking. Each testimonio lasted between 20-35 minutes and was recorded. All discussions were recorded and transcribed verbatim then coded to identify patterns and themes.

Our findings reveal three pertinent themes that will be shared during the presentation: First, educators shed light on various structural obstacles that they are forced to navigate in order to access the profession that in turn reinforces a sense of selflessness and commitment to be of service to others. While each individual brings unique backgrounds and nuances there are important similarities that emerged such as altruism, family, perseverity, and determination to realize their career goals. Testimonios also revealed a strong affinity to create a community of support with peers with shared experiences, including opportunities to be mentored and learn from more experienced educators. Structurally, participants all acknowledge how they are forced to negotiate the added strain of high tuition costs and the financial toll placed on them and their families.

Teacher testimonios lend important contributions to how we understand structural and institutional obstacles that educators of Color face during their journey to becoming a teacher. While all participants stated that they are committed and willing to overcome these challenges, we must consider the many others who did not make it this far in the process and a loss of talent that can otherwise lend important contributions to schools and the broader community. As a teacher pathway project, our findings

underscore the importance of colleges and universities being intentional and consistent in their engagement with future educators, including being financially and culturally accessible.

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Chemistry

Autism's Double Empathy Problem in Drosophila melanogaster

Several psychological studies have suggested that autistic individuals socialize better with their autistic peers than with neurotypical peers - a phenomenon called the “Double Empathy Problem.” At least one study suggests that people with autism spectrum disorders and other neurological conditions such as ADHD and schizophrenia may tend to engage in nonrandom mating with each other.

One limitation of human studies is that they do not exist in a cultural vacuum; that is, participants are necessarily affected by cultural values. Autism is a unique neurological condition because it is currently diagnosed most often by empirical methods rather than medical confirmation testing. As a result, autism is under-diagnosed in people of color, lower-class, and female populations. This is one tangible example of the impact of empirical, culture-specific documentation and diagnosis. It is for this reason, among others, that scientists pursue medical confirmation tools.

The purpose of this study is to add to community knowledge of the neurological basis of autism spectrum disorders. Namely, we will use Drosophila melanogaster to demonstrate whether the Double Empathy Problem is a phenomenon that can be observed using the Fragile X syndrome (FXS) D. melanogaster model. Fragile X syndrome is the most prevalent monogenic cause of hereditary autism currently known; it is the most common autism D. melanogaster model.

We hypothesize that if the Double Empathy Problem has a neurological basis, then it will be observed via discrepancies in the patterns of FXS/wildtype courtship assays as compared to FXS/FXS and wildtype/wildtype. A null result does not necessarily rule out neurological underpinnings, but further testing, perhaps with different animal models, will have to be conducted to demonstrate the relationship between the Double Empathy Problem and neurological differences between autistic and neurotypical populations.

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Biology

Effectiveness of Acetylcholinesterase Inhibitors in Reducing Symptoms of Alzheimer's Disease in Drosophila Melanogaster

In Alzheimer's Disease (AD), one of the first types of neurons affected is those containing the chemical messenger acetylcholine, which transmits modulatory signals throughout large portions of the brain. The breakdown of this neurotransmitter results in the destruction of neural connections, leading to memory loss, reduced executive function, and disturbed sleep. The purpose of our project is to determine whether the inhibition of acetylcholinesterase, which has the effect of prolonging the activity of acetylcholine in the remaining neurons, in Drosophila melanogaster fruit flies reduces these symptoms of AD.

Flies aged 1-5 days and expressing AD were split into two groups and tested in three separate experiments. One group received the acetylcholinesterase inhibitor treatment, administered through feeding, while the other served as the control group. To test the flies' spatial memory, flies were placed on a heated plate containing a single cool spot. The time taken for the flies to remember the location of the cool spot in relation to surrounding visual cues was measured. To test the flies' executive function, a tap-down apparatus was used to observe their ability to plan their movements when faced with an obstacle. Finally, the Drosophila Activity Monitor (DAM) was utilized to measure the flies' cycles of wakefulness versus sleep.

We hypothesized that AD flies receiving the acetylcholinesterase inhibitor treatment would perform better in the different behavioral tasks compared to the control group, indicating a reduction in symptoms related to AD. Preliminary data suggested that the treated flies navigated the heat maze faster, exhibited advanced obstacle avoidance planning, and experienced less sleep disturbance relative to the untreated flies. The implications of our data suggest that, like human patients afflicted with AD, flies that are given acetylcholinesterase inhibitors demonstrate improved behavioral function and use of this treatment helps further the fruit fly model of AD.

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Chemistry

A comparative study of the photoexcited states of phenylurea herbicides

Photodegradation is one of the primary abiotic mechanisms by which organic molecules can break apart. In the Central Valley, a large quantity of these herbicides are used every year and can affect the environment, particularly through the water supply. After they serve their purpose, the herbicides themselves can cause soil and water contamination. They also degrade through many different pathways forming products which are potentially more toxic than the parent compound, presenting health risks to humans and the environment. The use of photodegradation may allow us to see the herbicide's product be less harmful to the environment. In this project, we calculated the excited states, initial forces, and state derivative forces of several different phenylurea herbicides using quantum chemical methods to help predict how these molecules degrade. The calculations were done using Q-chem, a commercially available software package using density functional based methods with Gaussian basis sets (6-311G** and 6-311++G**). Various classes of functionals (B3LYP, CAM-B3LYP, B88-LYP, and w-B96) were used to compare the structure and properties of the different phenylurea herbicide molecules. As a result of comparing molecules' excited states, we decided on CAM-B3LYP out of the four functional methods to move forward with the state derivative forces calculations and future works. We found many similarities between these molecules but also some very interesting differences. If the photodegradation products for a given class of molecules can be accurately predicted, this can potentially lead to developing safer but effective alternatives for widely used pesticides.

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Plant Science

Effect of salinity levels and Gibberellic Acid on Cotton Growth and Physiology

The objective of this experiment was to evaluate the effects of varying amounts of salinity and gibberellic acid on the growth rate and physiology of cotton plants. We transplanted 27 cotton plants into large pots with 9 of the pots having no saltwater added to them before transplanting, 9 of them having a medium amount of saltwater added to them (10-12dS/m), and the last 9 having a high amount of saltwater added to them (16-19 dS/m). The plants were given 64 oz of water every other day when they were watered. The gibberellic acid was sprayed onto some of the plants through random assignment. The plant height was also recorded along with the total number of leaves on the plants being counted weekly. After harvest, plant samples were collected from each treatment and analyzed for their biomass and salt content. Preliminary results indicate that the gibberellic acid increased plant height as the hormone helped those plants overcome the adverse effects of the salts. Chlorophyll content was also measured in the leaves of the plants throughout their different growth stages. Complete analysis of the observations will be reported in the poster.

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Psychology

Examination of the role of indexical voice information in earwitness testimony: Pilot study

Previous research has shown that memory for spoken language is highly dependent on the voice of the speaker. This experiment was conducted to test the indexical recognition of phrases to collect data for future research projects. The future research projects are meant to study ear witness testimony with each experiment's method becoming more sophisticated. The experiment directly following this one uses the phrases in this study, but will incorporate them into vignettes that participants will only hear instead of reading. There are 10 pairs of lists consisting of eight phrases in each list and in the experiment following this one, the lists of phrases are incorporated into vignettes. Like in this experiment, there are 10 pairs of vignettes with eight phrases. The vignettes were designed to easily switch the two sets of phrases out for each other. The experiment was conducted online through a survey using Qualtrics and participants were all Introduction to Psychology (Psych 10) students at California State University, Fresno (Fresno State). For every pair, there is version "1" and "2" and the participants were randomly assigned to one of the versions for the entirety of the experiment. They were shown a list for 30 seconds, complete two minutes of math problems, and then answered 16 "yes" or "no" questions. Data analysis will show how distinguishable or undistinguishable phrases are to their corresponding pair to serve as a guide for future research and its results.

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Physics

A Qualitative Comparison of Experimental and Computational Methods to Create Pendulum Art

Pendulum art is a pattern traced out on a horizontal canvas by paint falling from a swinging pendulum. We developed a computational model for a system consisting of a simple spherical pendulum and the falling paint drops. The pendulum art created by the simulation was compared to actual pendulum art to verify the validity of our model. We considered two variations of our computational model for the system. The first assumed that no energy was lost by any part of the system due to friction or air resistance. The second assumed that the pendulum's motion was damped by friction. For each model, the derived differential equations were solved numerically to find the pendulum's trajectory. Simulated paint drops were initialized at intervals along this trajectory, and their final positions on the canvas were calculated with projectile motion equations. These final positions traced out the simulated pendulum art. The first variation of our model produced a symmetric pattern that differed significantly from observations of the physical system. The resulting patterns from the second variation of our model agreed with the observations. This shows that friction is an important factor in the computational model. Further research could be made toward quantifying the difference between real pendulum art and our computational model.

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Socioeconomic Status in Mild Cognitive Impairment and Alzheimer's Disease

Objective: Declines in cognitive functioning are a hallmark of Alzheimer's disease (AD) and its risk state, mild cognitive impairment (MCI). It is known that socioeconomic status (SES) and educational level generally impact cognition. This study examines lifetime changes in SES and education in relation to the cognitive functioning of older adults specifically with MCI and AD.

Methods: Participants included healthy older controls (n=54), individuals with MCI (n=63), and persons with AD (n=16). Participants rated their childhood and current SES statuses as Wealthy, Well-Off, Average, Somewhat Poor, and Poor. SES mobility was defined as "stable" or "upwardly mobile" (i.e., increasing from childhood to adulthood). Education was defined by total years of education. Participants also completed the Wechsler Test of Adult Reading, a measure of premorbid intelligence, and the California Verbal Learning Test-II, which assesses semantic clustering. Semantic clustering is a strategy in which people group to-be-remembered words by category to aid in recall.

Results: Regression analyses showed that only in those with upward SES, premorbid intelligence and education predicted semantic clustering, with education emerging as an independent predictor. When broken down by diagnostic groups in those with upward SES, premorbid intelligence and education were predictive of clustering only in healthy controls, but not in MCI or AD.

Conclusion: These results suggest that in healthy aging, lifetime increases in SES enhance the ability to use an efficient memory strategy. This relationship is most apparent in those with more years of education. The results of this study suggest that SES is not a fixed concept and that SES mobility could be a factor to consider when evaluating cognition in older adults.

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Effects of Political Orientation on Decision-making about Partisan Information

Research on higher-order processing demonstrates that individuals overestimate how

much information is needed to make decisions when compared to how much information is

actually needed (Klein & O’Brien, 2018). The present study aims to extend this finding using partisan information to investigate if political preference varies this effect.

In the study, participants will be presented with an article advocating for prison

sentencing of juvenile delinquents from a right- (i.e., Fox News) or left-leaning (i.e., CNN) news source in 10 segments. Half of these participants will be predictors, who are tasked with predicting how much of the article will need to be read to agree or disagree with the main argument from either news source. Whereas the other half of participants will be experiencers, who will read a segment of the article at a time from either source until they have decided they agreed or disagreed with the article.

Currently, data collection is in process. However, it is hypothesized that: (1) predictors

will overestimate how much of the article will need to be read compared to how much

experiences read; and (2) predictors will estimate needing to read more of the article when from a news source that aligns with their political worldview and predict reading less when from a news source that conflicts with their worldview.

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Department of Public Health and Department of Theatre

Water Quality and Safety in Treated Recreational Waters: A Review of Aquatic Health Code Compliance Records in Fresno County, California

Swimming, playing, and relaxing in public pools and spa facilities provide health and pleasure benefits to individuals and families in a variety of venues. Such water related recreational or athletic activities in unsafe public pools and other aquatic facilities can lead to drowning, harmful exposures to pool chemicals, or waterborne illness. State and local health departments ensure safety and health of public pools, spas, and other aquatic venues for users through enforcement of the federal and state aquatic health codes. The objective of this research was to determine the extent of compliance with the state and local aquatic health codes in Fresno, California area public pools and spas, focusing on major water quality and facility health and safety issues. Research methods included looking up the publicly available inspection reports for public pools and spas in gyms, schools, hotels/motels, and apartment complexes located in the Fresno area, using the Fresno County health website. A random sampling approach was used to identify inspection reports, consisting of 64 hotels/motels, 27 apartment complexes, nine schools, and nine gyms, totaling to 109 reports. Inspection reports were evaluated against major

state and local regulatory criteria for health and safety of public pools, and the number of

violations were counted and categorized according to facility and violation types. Results

indicated that the highest number of violations occurred in hotels/motels (52.5%) and apartment complexes (31.3%). Hotels and motels had the largest amounts of total Maintenance/Operations (0.491) and Recirculation of Water Treatment System violations (0.548). Among all facilities, the most frequent water quality violations were in pH, cyanuric acid, and disinfection parameters (29.4%); serious violations resulting in closure of pools occurred in 9.3% of the inspected facilities. In conclusion, to ensure compliance with aquatic health codes and regulations, continued monitoring and enforcement of health codes in aquatic facilities are critical elements for the protection of public health.

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Psychology

The Relationship Between Hallucinogenic Drugs and Spirituality Beliefs and Practices

In recent years, there has been a resurgence of research looking into hallucinogenic drugs; however, there is a gap in the literature that addresses hallucinogenic drugs and their relationship to spiritual beliefs and practices. There are similarities to the subjective experience of taking hallucinogenic drugs and praying, meditating, and holding spiritual beliefs. For example, these three practices often give on a sense of connection with a higher purpose or being. In an anonymous survey, students were asked about their experiences with hallucinogenic drugs and cannabis as well as whether they prayed to a higher being and practiced meditation. The participant's spiritual beliefs were also assessed by the Transcendent and Transcendental Time Perspective Inventory (TTTPI), which assesses beliefs in a higher being and life after death. We did not observe a relationship between hallucinogenic drug use and spiritual belief scores generated from the TTTPI. We did find, however, that those that had used hallucinogenic drugs meditated more and prayed less; but there was no difference in prayer and meditation for those who had not used hallucinogenic drugs. These results give some support to the idea that people who meditate also seek a sense of spirituality through hallucinogens, but those that pray are restricted from experiencing hallucinogens because of the rules and folkways of their religion.

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Psychology

Are Anxiety and Risk Taking Correlated?

Previous research on anxiety and risk taking is inconsistent. Despite the intuitive appeal of the idea that people who are more anxious are less risk prone, the strength and even the direction of this correlation varies widely across studies (Maner et al., 2007). The purpose of the present study is to investigate this correlation further using two self-report measures of anxiety and two self-report measures of risk taking.

In the present study, 162 undergraduate participants from an introductory psychology course completed the Beck Anxiety Inventory (BAI) to assess anxiety symptoms, and the Penn State Worry Questionnaire (PSWQ) to assess general worry. They also completed the Domain Specific Risk-Taking Scale (DOSPERT) to assess their likelihood of engaging in risky behavior, and the Monetary Risk Questionnaire (MRQ) to assess their preference between sure dollar amounts and larger but less certain amounts. Participants completed the four measures online in a randomized order.

Our analyses showed that the two anxiety measures (BAI and PSWQ) were strongly positively correlated ($r = .472$, $p = <.001$) while the two risk-taking measures (DOSPERT and MRQ) were only weakly correlated ($r = .098$, $p = .507$). Most importantly, the anxiety and risk-taking measures were at best very weakly correlated. The BAI was weakly correlated with both the DOSPERT ($r = .072$, $p = .325$) and the MRQ ($r = .009$, $p = .971$). The PSWQ was also weakly correlated with both the DOSPERT ($r = -.005$, $p = .954$) and the MRQ ($r = .063$, $p = .928$). In essence, we found that anxiety and risk taking were essentially uncorrelated.

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Psychology

Universities Vs. COVID-19: A HotSpot Analysis

Universities in five different states are collaborating on an original large-scale COVID-prevention effort by asking many of their students to complete an innovative survey that strategically asks them to identify areas on and around campus that are “hot spots” for spreading the coronavirus. These universities—Virginia Tech, Appalachian State, Western Michigan, University of Kansas, and University of Florida—are also observing mask wearing, social distancing, and other COVID prevention measures in their communities to analyze the risk management and wellness precautions taken by students, faculty, and the surrounding communities. Mapping hot-spot areas provides invaluable information for prevention and intervention creation.

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Chemistry

Quantum mechanical particle-in-a-box revisited using NMR spectroscopy

The particle-in-a-box is used as a model system to emphasize the basic concepts of quantum mechanics in undergraduate chemistry laboratories. Delocalized electrons in a conjugated pi system can be approximated to a quantum mechanical model of a particle confined within the walls of a one-dimensional box, with the length of the conjugated system as the length of the box. Traditional particle-in-a-box experiments utilize the established relationship between wavelength at maximum absorbance and the length of the box. More than fifty years ago, Flewwelling and Laidlaw suggested an exercise using aliphatic polyenylic chains as a model to relate the nuclear magnetic resonance (NMR) proton chemical shift to the wavefunction-based estimate of electron density. Despite the value of the work to be applied to various areas of chemistry, the research is seldom referred to in the literature. With NMR spectroscopy routinely employed in undergraduate research and education, it is proposed to revive the application of Flewwelling and Laidlaw's ideas to polyenylic ions, as well as to alternative compounds for traditional particle-in-a-box experiments. The solutions to the Schrödinger equation of an electron in a one-dimensional box inversely relates to the wavelength at maximum absorption. Therefore, the chemical shift changes of specific nuclei with increasing molecular length can be empirically related to the conventional wavelength at maximum absorption in a UV-vis spectrum and thus the length of the box. The experimental details are developed such the investigation can be adopted either as an in-person laboratory or suitable for a remote demonstration of the concepts involved. The results demonstrate that both the electron density and the proton NMR chemical shift of a carbon center on a conjugated system are directly related to the length of the box and thus can be introduced as a routine experiment to understand quantum mechanical concepts using NMR.

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Psychology

The Association Between Bicultural Self-efficacy and Academic Achievement Among Latinx College Students: Is Academic Self-efficacy a Mediator?

The Latinx population is the largest and fastest growing ethnic minority in the U.S. yet it is still vastly underrepresented in the attainment of higher education. Existing literature indicates that bicultural self-efficacy (BSE: being able to effectively navigate the culture of origin and the host culture) among Latinx individuals predicts favorable outcomes pertaining to well-being such as lower depression and higher self-esteem. For college students, academic achievement is a key component of well-being, yet limited research is available describing the association within the Latinx population. While significant literature exists regarding academic self-efficacy (ASE) and its association to academic achievement, it is critical to examine its function as a mediator between BSE and academic achievement. This study aimed at evaluating a potential association between BSE and academic achievement and whether ASE might serve as a mediator in this relationship among Latinx college students. Participants (n = 245; 74% female, mage = 18.84) completed an online survey that included measures of bicultural self-efficacy, academic self-efficacy, self-reported GPA, and demographic information. Results obtained from regression analyses indicated that BSE and ASE were both positively associated with GPA (= .20; $p < .001$ and = .29; $p < .001$, respectively). Furthermore, analyses of indirect effects indicated that ASE did in fact fully explain the relationship between BSE and GPA [indirect effect: b = .03 (.01), CI= .01 - .06, $p < .01$ and direct effect: b = .04 (.03), CI= -.02 - .09, $p > .05$]. These findings show that BSE contributes to higher academic achievement due to ASE. Future research may include examining methods to promote BSE and ASE. Applications from these findings could contribute to development of curriculum to further develop BSE and ASE within the K-12 system to propel students from ethnic minority backgrounds toward higher education at increased rates.

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Chemistry

Utilizing radio-frequency plasma treatment to modify the surface chemistry of silk fibroin films

Silk fibroin (herein referred to as silk) has many properties that give it an advantage to traditional synthetic biomaterials. One property is that silk degrades enzymatically. Enzymatic degradation is tunable which allows silk-based materials to be deployed in a range of biomedical applications. Most studies that have modified silk degradation have done so by adjusting the bulk properties of the material. Changing the bulk properties presents a challenge because structural changes to the material can impact its intended function. In this work, we take steps to address this challenge by instead modifying the silk surface properties while still maintaining its bulk properties. The goal of this work was to alter the surface chemistry of the silk therefore creating a route to control enzymatic degradation.

We utilized radio-frequency plasma treatment to control silk film surface chemistry. Plasma treatment is ideal for the surface modification of polymer materials because it does not require any solvent and takes place at room temperature. Furthermore, plasma processing offers a broad parameter space, where variables include applied power, pressure, and precursor composition. We utilized pentane as a hydrocarbon plasma precursor to apply thin hydrocarbon films to the surface of silk constructs, thereby changing their surface properties. The plasma modified films were observed by trends of wettability through the use of a water contact angle goniometer. These data establish trends in wettability as a function of both treatment time and position of the construct in the plasma reactor. These studies represent the first steps in developing a comprehensive model to systematically control the surface chemistry of silk materials, which can be applied in future studies to evaluate their enzymatic degradation. The knowledge gained will allow us to better understand how silk interacts with biological environments.

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Chemistry

Targeting Cyclin-Dependent Kinase 9: Possible New Strategy for Treating Prostate Cancer

Current effective standard treatments for the early stages of prostate cancers are through androgen-deprivation therapies (ADTs). ADTs are central to the impediment of the androgen receptor (AR). Over time targeting the AR through ADTs becomes obsolete since it reprograms itself to become independent of the androgen and thus the disease progresses to an aggressive stage known as castration-resistant prostate cancer (CRPC). A novel solution to combat this resistance is to develop inhibitory drugs that will inhibit the transcription elongation of the AR. It has been reported that an inhibited activity of the CDK9 limits the phosphorylation of RNA Polymerase II and consequently halting the transcription elongation of the AR. Inhibition of CDK9 by current studied inhibitors, such as Roscovitine (IC50 = 0.60 μM) exhibited significant potential effects in halting transcription elongation of AR genes and thus halting prostate cancer cell growth by 35% (10 mg/mL) in prostate cancer xenograft models. This presentation will comprehensively review the potential of CDK9 inhibitors as a possible treatment for prostate cancer.

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Computer Science

Enhancing spacecraft cockpits in fully immersive virtual reality

The goal of this project is to implement a cockpit in fully immersive virtual reality (VR) for assessing the performance of users when interacting with a glass cockpit, which is a cockpit featuring electronic flight instrument displays (e.g. large LCD screens) as opposed to the traditional style of analog dials and gauges. It advances NASA's scientific and technological base by comparing task performance (e.g. target detection) with different types of user interfaces. The objective is to make sure that the most important tasks to be performed by the spacecraft crew are carried out effortlessly. We want to make it easier for them to switch between tasks and for someone else to take over. The project focuses on how to reduce human error by designing and assessing controls in a cockpit of a spacecraft using fully immersive VR; how it is possible to place the different elements right in front of the crew members so that there is less visual fatigue and they can focus on the tasks for a long period of time. VR provides a higher fidelity simulation environment earlier in the design cycle of a new cockpit, and has benefits in development cost and time. The experimental task is the game "Whac-A-Mole", where a cue is presented on the buttons (switches), and the user has to press the buttons as fast as possible. We consider different conditions where the whole capsule is rotating or shaking. In the VR environment, the user faces the glass cockpit containing a matrix of buttons. During the different tasks and conditions, we measure the response time, the accuracy of the responses. The observed differences across conditions stress the need of a realistic environment for assessing human performance in target detection tasks.

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Psychology

Environmental Acculturative Stress and Mental Health Among Latinx College Students: The Moderating Role of Maternal and Peer Relationships

According to Berry's process of acculturative stress, acculturation can result in a stress response which has been associated with negative mental health. This is of interest because compromised psychological adjustments early in life are associated with negative life course trajectories. The environmental domain of acculturative stress refers to the quality of the environment in the new culture (e.g., discrimination, opposition, and barriers). For Latinx first-generation college students (FGCS), environmental acculturative stress may stem from the college environment. Parents of Latinx FGCS may not be able to provide guidance in how to navigate the college environment. However, based on the interdependent nature of the Latinx culture, it is possible that social relationships can provide emotional security, thus buffering the harmful effects of environmental acculturative stress. The purpose of this study was to examine the relationship between environmental acculturative stress and mental health and whether maternal and peer relationships play a protective role among Latinx college students. Participants (n = 245; 74% female, mage = 18.84) completed an online survey that included measures of acculturative stress, depressive symptoms, anxiety symptoms, self-esteem, maternal and peer relationship quality, and demographic variables. Results obtained via multiple regression analyses indicated that environmental acculturative stress was associated with depressive symptoms (= .41; p < .001), anxiety (= .32; p < .001), and self-esteem (= -.24; p < .001). Furthermore, moderation analyses demonstrated that maternal and peer relationship quality did not act as a buffer in these associations. The findings further establish that environmental acculturative stress contributes to high levels of depressive and anxious symptoms and low self-esteem among Latinx college students. Considering that social relationships did not buffer the harmful effects of environmental acculturative stress, future research can examine the influence of social relationships in other ways such as whether it functions as a mediator instead of a moderator.

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Chemistry

Physical Science in the Elementary Classroom: Is It Happening?

Pre- and in-service elementary teachers' challenges in teaching science are well-documented with issues such as a lack of confidence with science concepts, a lack of appropriate curriculum, and a lack of broader institutional support. With the Next Generation Science Standards (NGSS), elementary teachers are now expected to teach science to all grades levels. The focus of this study is to determine if elementary school teachers intend to teach Physical Science in light of the NGSS. Guided by the "Theory of Planned Behavior", we conducted and analyzed interviews with physical science professors, elementary teachers, and professional development providers (n =9). We identified three main components to teachers' difficulty in teaching physical science which are: 1) They have restricted time to teach science, 2) they have a lack of confidence in their knowledge of the subject, and 3) they lack materials and support from their school systems. The results highlight that despite the introduction of the NGSS, similar issues face elementary teachers in teaching physical science. Teachers need further professional development to effectively teach physical science and there are systemic issues within their institutions that hinder them to teach physical science.

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Electrical and Computer Engineering

Concealed Weapons Detection Utilizing Machine Learning

The purpose of this project is to develop a system that detects concealed weapons on individuals using an infrared camera coupled with machine learning algorithms. Infrared waves can be utilized to image objects underneath a person's clothes along with the object's respective temperatures. This infrared camera and machine learning algorithm can filter out non-important energy signatures and depict a representative infrared digital image that contains more data than a regular camera image. For this project and study, the machine learning algorithm would be trained to recognize pistols and knives by parsing in various infrared images of pistols and knives into the Deep Convolutional Neural Networks (DCNN) algorithm. These infrared images would be gathered by taking infrared pictures of pistols and knives at various angles, positions, and forms of concealment. After training the machine learning algorithm, the overall system would be set up by integrating the infrared camera, machine learning algorithm, and their respective software with a Raspberry Pi 4. Tests would be conducted to evaluate the validity of the system by having a person walk into the detection area with or without weapons concealed. These tests would include the person holding the weapon out, hiding the weapon underneath their clothes, and partially obstructing the weapon with other materials. The results gathered would be discussed to analyze the accuracy, involvement, and potential improvements of the system. In conclusion, the concealed weapons detection system would be developed and tested to see whether the developed system involving an infrared camera along with the state-of-the-art machine learning algorithm could potentially detect hidden weapons on a person with high accuracy.

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Chemistry

Photodegradation Mechanisms of Imidacloprid in Water

The degradation mechanism of a neonicotinoid insecticide, imidacloprid, was studied using computational quantum chemistry. Imidacloprid is widely used in agriculture and can find its way into ground and surface water after use, and thus better knowing its degradation process can help with purification of water in the central valley. The research methods include use of Q-Chem to look at imidacloprid‘s excited states, solvation in water etc. Some of the computations done on this molecule include: choosing the best solvent model, looking at the effect of solvation model on the molecular geometry and the excitation energies, and looking at energy barriers for breaking various bonds in the molecule. We found that two solvent models, PCM (Polarizable Continuum Model) and Langevin Dipoles, were very accurate in ground state but PCM matched experiment better in excited state calculations. It was found that water has a significant effect on imdacloprid as it changes its geometry and excited states. The molecule’s N-N bond was found to be the most likely to break after excitation resulting in degradation. Also, the accuracy of calculations is affected by methodology used. For imidacloprid excitations, it was found that Density Functional Theory (DFT) worked best when the specific form of the functional known as CAM-B3LYP (Coulomb-attenuating method for B3LYP) was used. Therefore, careful selection of methods is crucial to get the desired and reliable results. In conclusion, to learn the degradation mechanism of imidacloprid, data on its solvation, excited states, bond breaking was collected which has shown a lot about this molecule’s degradation. Also, the process of selection of the best solvent model was accomplished which ensures that any future calculations will reliably reflect the behavior of the molecule. Further computational work on this molecule will reveal more about its properties and add to our understanding of its degradation mechanism.

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Electrical and Computer Engineering

Graphene ink-coated tungsten crucibles for Aluminum deposition by Thermal Evaporation

Tungsten crucibles, including boats and baskets, are widely used in thermal evaporation of metals used in electronic device fabrication. Aluminum evaporation is known to create issues such as the wetting of the backside of the crucible and the fact that it becomes very corrosive to tungsten at high temperature, which ends up creating cracks and holes and ultimately breaking the crucible, often times leaving the deposition incomplete. This issue prompts us to change the crucibles at each evaporation, and forces us to use more than one crucible for a single deposition, especially for thicker metal layers. In this experiment, we coated the same type of tungsten crucibles with graphene ink and tested them for Al evaporation. The graphene coating shows promise of great improvement for the Al deposition with crucibles lasting for an average of four runs. The graphene layer creates a barrier to wetting issues, and strengthens the crucible structure at high currents without compromising its effectiveness in the physical vapor deposition process.

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Criminology

The Effect of Social Media on Public Perception of the Police

This study discusses the potential types of content that may have an effect on people's perception of the police. The recent focus on police-community relations brings up the concern and need to measure how individuals view the police and how the media can impact these views. Due to the increased use of social media and the increased police content in the media, this study was designed to assess whether and how social media use and police content has affected students' perception of the police. This paper provides detailed information collected from undergraduate students at California State University, Fresno during the Spring 2020 semester. Student participants were asked to complete a survey in which they were asked to share information about their social media use, the content they view on social media, their views of the police, and whether what they have viewed on social media has had an influence on their views of police. Findings from this study revealed that social media has had an effect on students' perception of the police. Additionally, students reported that most of the law enforcement-related content that they have viewed on social media portrayed law enforcement in a negative light but they acknowledged both positive and negative aspects of law enforcement. Though most students responded that they trust the police and generally have neutral and positive views, findings suggest that their views and perceptions are indifferent.

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Genome-wide characterization of the WRKY gene family in the Salvia hispanica

The WRKY family is a family of genes in plants that encode transcription factors that play important roles in plant responses to biotic and abiotic stresses. This family has been widely studied in various plants; however, it has not been studied in chia (Salvia hispanica). The chia plant is of increasing interest due to its highly nutritious seeds; however, little research on chia genes has been performed. Better understanding of the plant molecular mechanisms is necessary for optimizing breeding and growing conditions. The goal of this study is to identify and characterize the WRKY gene family in chia. Based on whole-genome sequencing, 88 putative WRKY genes were identified in chia. A phylogenetic tree was constructed, and the chia WRKYs were assigned to three main groups based on the Arabidopsis classification system. Conserved motif analysis identified several interesting distribution patterns among the different group members. We are currently using qRT-PCR to further characterize the chia WRKY family members by analyzing their expression in plants treated with gibberellic acid, salicylic acid, and jasmonic acid hormones and in plants exposed to 4 °C. Altogether, our results will identify for the first time the putative roles that WRKY proteins play in the chia plant's response to different stresses. Moreover, the data generated in this project will fill the gap in chia research and supplement the existing literature on WRKY genes.