VIRTUAL CREATIVE COLLABORATIONS UNDERGRADUATE RESEARCH CONFERENCE

Tuesday, April 13 to Thursday, April 15, 2021
University of San Diego
www.sandiego.edu/cc-urc
Office of Undergraduate Research

Student-faculty
Research
Scholarship
Creative Works

WELCOME to the Virtual Creative Collaborations Undergraduate Research Conference!

This year students will be presenting their research, scholarly activities, and creative works in a virtual format for the second year in a row due to the ongoing COVID-19 pandemic. However, twice the number of students as last year are participating, which is remarkable and further demonstrates their resiliency in the face of uncertainty. More than 120 students across a broad range of disciplines submitted abstracts. What is unique about this year is the diversity in format of the research, highlighting the many ways that undergraduate research can still be conducted remotely.

2020 was a historic year, highlighted by a global pandemic and racial unrest. Several of the research projects presented this week at Virtual Creative Collaborations address these issues and have the potential to make real contributions to knowledge and practice. Among the presentations are studies about health disparities in and discrimination against Black and Asian communities; demonstration of Seeloved1, a video conferencing app for hospitalized COVID patients; and the influence of fears of COVID-19 on the willingness to use telehealth mental services.

Virtual Creative Collaborations is an important part of Virtual Research Week at USD (April 12 - 16, 2021), which showcases activities across the university and honors students and faculty members who challenge themselves to extend learning beyond the classroom. We invite you to view and experience a variety of virtual presentations during this celebration of faculty-student scholarly collaboration. We also encourage you to interact with the students by asking questions and engaging them in conversations about their research via the comments box or live Zoom link.

Congratulations to all the student presenters and faculty members participating in the Second Annual (and hopefully last) Virtual Creative Collaborations Undergraduate Research Conference!

Elisa Maldonado Greene, PhD
Director

Disciplines & Schedule

ABTRACT BOOK

In keeping with USDs commitment to sustainability, the abstract book can be found online at www.sandiego.edu/cc-urc.

VIRTUAL RESEARCH WEEK April 12-16, 2021

Creative Collaborations Undergraduate Research Conference is part of USDs Virtual Research Week. For more information about offerings, please visit https://www.sandiego.edu/osp/research-week/2021.php

OFFICE OF UNDERGRADUATE RESEARCH

Established in September 2011 with a grant from the W.M. Keck Foundation and funding from individual donors, the mission of the Office of Undergraduate Research is to support undergraduate students in research, scholarship and creative activities. Underlying our mission is a commitment to equity and access, to ensure that all students are able to participate in and benefit from research activities both in and out of the classroom. The office provides services to both students and faculty members who mentor them in research activities, and encourages collaborations across departments, disciplines, and with the local and global community.

The University of San Diego is an enhanced institutional member of the Council on Undergraduate Research.

Life and Physical Sciences

A Chemogenetic Approach to Modulating the Hippocampus During Temporal

DANIELA ABOUCHEDID, MICHELLE ZAICHIK, and Jena Hales

Various studies examining the temporal aspects of memory have found the hippocampus to be highly involved with temporal processing. Previous research from our laboratory has provided evidence for the importance of the hippocampus in time duration discrimination; however, our use of perminent lesions limited our ability to disrupt hippocampal processing while leaving the brain tissue and connectivity intact. After conducting extensive literature searches, we found that chemogenetic techniques allow for specific targeting of an area, easy reversibility, and temporal control. Dr. Hales' lab has recently begun to pilot using virally-delivered DREADDs as an effective, minimally invasive method to inhibit the function of the hippocampus. The DREADDs being used in our laboratory are the inhibitory hM4Di DREADDs, which bind to an exogenous ligand, CNO, and inhibit the function of the targeted area in this case, the hippocampus. The hippocampus is only inhibited within a few hours of CNO administration, and otherwise, the hippocampus functions normally. This technique allows for within-subject studies to analyze the role of the hippocampus in multiple tasks. This review summarizes how DREADDs can be utilized in Dr. Hales' lab to target the hippocampus and explore its role within time duration discrimination.

A digital holographic microscope for polarimetry measurements to characterize living from non-living specimen

ALEXANDER RAMIREZ , Kent Wallace, and Ryan McGorty

It is likely that the first signs of extraterrestrial life outside our planet will be found on the micro scales. With digital holographic microscopy (DHM), volumetric imaging of samples on the micron scale may be used to track and characterize a specimen. This project outlines the development of a polarimetry technique that aims to capture the interaction between a light source and a sample, which encodes the polarization properties of a sample. Biological samples impose a polarization state that can be used as a discriminator between non-biological sources. Thus far, the polarization state of a sample has been analyzed through simulations and in a laboratory setting with the method of a rotating quarter-waveplate. These measurements will be compared to that of our new polarimetry method which integrates a set of linear polarizers, at angles of 0, 45, and 90 degrees, for instantaneous capture of the final electric field amplitude and phase for an illuminated sample. Current data and simulations confirm our ability to utilize the first method for measuring polarization properties, but more work is to be done to prove our second method mathematically and through simulation.

A Meta Analysis of the Relationship between Antibacterial Activity in Macroalgae and Collection Location in South and Central America

JESSICA ROSALES and Jennifer Prairie

Antibiotics are compounds produced by microorganisms that can inhibit the growth of bacteria. Historically, terrestrial organisms have been predominantly used to develop novel drugs, but in recent years researchers have turned to surveying marine organisms to open up the field. The need for novel and effective antibiotics has drastically increased with the emergence of multidrug-resistant bacteria. Secondary metabolites used as a defense mechanism against epiphyton and to regenerate quickly, are suggested to have antibacterial properties. Antibacterial activity has been detected in a number of macroalgae in a wide range of locations. Biotic and abiotic factors are known to influence this activity. Studies have identified location as a significant factor; however, few studies have looked at the relationship between activity and location on a larger scale in South and Central America. This meta analysis set out to determine whether the location where macroalgae were collected in South and Central America correlated with activity against the gram-positive bacterium Staphylococcus aureus and the gram-negative bacterium Escherichia coli. I collected papers to study activity from ethanolic extracts of Bryothamnion triquetrum, Caulerpa racemosa, and Caulerpa prolifera in Brazil, Costa Rica, Venezuela, and Yucatán (Mexico), then analyzed the relationship between the location and significant resistance, regardless of taxa. Several individual extracts displayed significant activity against the bacteria. Ethanolic extracts from macroalgae collected in Yucatan and at both study locations in Brazil were found to have significant antibacterial activity. However, there was no significant relationship between location and antibacterial activity.

A Natural Experiment Testing the Role of Specialization in Speciation of Seed Beetles

MARIELLE KRIVIT and Geoff Morse

Half of the world's multicellular diversity is found within plant-insect interactions. The unique nature of these relations frequently selects for specialization within specific insect lineages. One possible explanation for this bloom in diversity is that certain insect and plant lineages are driven by intricate coevolutionary relationships. Many phytophagous insects must overcome significant and toxic plant defenses by developing specific attack adaptations of their own. This evolutionary "arms race" often leads to specialization and subsequent speciation within many insect taxa. Seed beetles, however, impose a particularly intense selective pressure on plants by directly consuming plant offspring, contributing to widespread specialization between seed beetle species and highly specific host plants. Thus, it is highly unusual to come across seed beetles that are considered relative generalists. However, the Great Plains seed beetle, *Acanthoscelides fraterculus*, presents a mystery as it has been reared from host plants across diverse genera. To determine whether *A. fraterculus* is a true generalist or is actually composed of many specialist populations (or even species), I collected beetles at specific sites reared from hosts in the genera *Astragalus, Oxytropis, and Glycyrrhiza*. This was repeated across seven localities in Colorado. I compared the phenotypic and genotypic variation across *A. fraterculus* populations to determine whether the population structure is largely defined by host plant choice or geographic locality. Results from this experiment will provide insights into the mechanisms driving coevolution between phytophagous insects, which can contribute to understanding large scale community structuring and the formation of life's diversity.

Analysis of correlation in abiotic and biotic factors for A. senhousia mortality rate Effects of sediment type and predators on Asian mussel burrowing behavior, mortality, and byssal thread production

KAI MONTEIL-DOUCETTE and Nathalie Reyns

Invasive species can alter natural ecosystems by outcompeting the native organisms, significantly warping ecosystem food webs, and potentially leading to ecosystem collapse (Crooks, 1996). Human intervention has led to many non-indigenous species invading marine environments, and the rate of invasions have been increasing over the last 30 years (Ruiz et al., 1997). . Invasive species have been documented world-wide with approximately 15% of these considered detrimental to their new environment (Ruiz et al.,1997). Mission Bay, San Diego, CA, has a number of invasive species, including Arculata senhousia, an invasive mussel from Asia that was introduced through exported ballast water carrying A. senhousia larvae (Crooks, 1996). These mussels settle on the bottom (e.g., are benthic) and create beds on the sea floor that can be very dense with an average of 150 mussels (7,500 m^(-2)) (Crooks, 1996). In addition, they have a thin shell and create byssal threads to construct a cocoon which protects the shell (The Global Invasive Species Database). The combination of the mussels and cocoons create mats on the bottom that trap fine-grained sediments, displace native organisms, and create anoxic or low oxygen conditions in the sediment (Crooks and Khim, 1999). Thus, the objective of the proposed study is to better understand the abiotic and biotic factors that control the distribution of A. senhousia in Mission Bay. The significance of this study is to learn more about the factors influencing invasive species, specifically A. senhousia, so that future studies can work towards controlling these populations and eventually returning these ecosystems to their natural state.

Analysis of Diversity and Speciation Among *Ceanothus* Inhabiting Scale Insects (*Hemiptera: Diaspididae*)

BEN SNOW and Geoff Morse

Armored scale insects (*Hemiptera: Diaspididae*) are plant-feeding insects with species that have a usually high host range. Females are sessile for the majority of their life cycles, and juveniles are wind dispersed. Scale species are largely cryptic and are best collected through large-scale host sampling over large geographic ranges. Their mode of dispersal and generalist diet can be a driving force for speciation events. One particular host genus (Ceanothus) has multiple species found throughout the chapparal of the coastal mountain ranges in central California and Baja California. Currently, 28 species of armored scale are recorded as associates of *Ceanothus*, but it is unknown what the disparity and diversity in attack rate is amongst these species. These data are necessary to understand the ecological dynamics in this host-plant association. Here, I present the results of large-scale sampling of *Ceanothus* found throughout the San Diego County of California. Photography and morphological analyses will allow for species identifications based on characteristics in the literature (insect size, scale coloration, location on host plant) and will test specific hypotheses regarding species differences and host associations. Genetic analyses will confirm species identifications and provide insight into the force behind potential speciation events. Conclusions drawn from this analysis will provide insight into cryptic species diversity and speciation mechanisms for generalist insects. More specifically, information on host plant association and genetic information will be essential in understanding the relationship between cryptic species morphology, genetic diversity, and generalist speciation tendencies.

Analysis of Sediment Characteristics and Impact of Heavy Metals on *Arcuatula senhousia* in Mission Bay, San Diego, CA

JESSENIA MACIEL and Michel Boudrias

Heavy metals are naturally present in aquatic systems, but anthropogenic sources of metals can negatively impact the health of ecosystems by contaminating the water and sediment. Mission Bay is a highly modified shallow estuary located in San Diego, California that serves as the final destination of many stormwater outfalls, potential sources of high anthropogenic input. *Arcuatula senhousia*, an invasive filter-feeding mussel species, resides in Mission Bay and serves as a bioindicator because of its ability to accumulate heavy metals in its tissues. This study examined the relationships between the concentration of heavy metals in sediment and in *Arcuatula senhousia* tissue in relation to their proximity to stormwater outfalls in Mission Bay. *Arcuatula senhousia* and sediment samples were collected from 12 sites in Mission Bay, varying in proximity to stormwater outfalls. The shells, tissues, and sediment were dried and analyzed for concentrations of heavy metals (Cu, Zn, Pb) with an X-ray fluorescence spectroscope. The sediment was analyzed for grain size distribution using a particle size analyzer. Pb and Zn (ppm) concentrations were on average twice as high in sediment at sites farther away from storm drains. All three heavy metals displayed a positive relationship with fine grained sediment. There was no significant difference in heavy metal concentrations in the tissue of *Arcuatula senhousia* closer to and farther away from stormwater outfalls. These relationships provide implications for understanding how anthropogenic sources of metals impact estuarine ecosystems and suggests that other factors may determine heavy metal loading in suspension-feeding bivalves in Mission Bay.

Annulation Reactions of Bis-Nucleophilic Alpha-Aminoboronates

BRENNAN MCMANUS and Tim Clark

The goal of this experiment was to investigate the reactivity of organic compounds containing a boron group and a nitrogen group known as an alpha-aminoboronate. The unique characteristic of these compounds comes from having two reactive sites for bond formation. This unique reactivity was envisioned as a way to access biologically important ring structures. Initial efforts focused on the synthesis of the aminoboronate substrate. The conditions had to be optimized in order to synthesize the amino-boronate. The essence of these reactions was changing the functional groups; the starting point was an aldehyde or ketone, which then became an imine. Two aldehydes and two ketones were found to be reactive under these conditions. There was varied success leading up to the synthesis of the amino-boronate with future work looking promising.

Assessing the Relationship Between Changes in Corn and Soybean Density and Nitrogen in Nearby Streams within the Watersheds of the Midwestern United States

EMMA HIRSCH and Ronald Kaufmann

As the United States population continues to grow, increasing demand for food production"such as corn and soybean-based products" will escalate over time. While corn and soybean are staple crops throughout the nation, their cultivation is associated with harmful practices. For example, increased nitrogen concentrations within runoff can cause eutrophication within the water systems of the Midwestern United States. Previous studies have shown a correlation between increases in anthropogenic land use and nutrient concentrations in nearby waters; however, few studies have recently looked at the Mississippi River Watershed and the influence of increasing corn and soybean densities on total nitrogen content of nearby waterways. Utilizing GIS to spatially analyze corn and soybean density from 2006 and 2019 and classify corresponding total nitrogen data, this study focused on understanding the percent change of the two crops within the Mississippi River Watershed. It additionally examined if these changes correlate to differences in total nitrogen in nearby waters. While corn and soybean densities increased overall from 2006 to 2019, there was no significant correlation between percent change of agricultural plot density over time and total nitrogen in nearby water bodies. The lack of correlation between the variables may point to an underlying variable that was not studied. Specifically, recent changes in agricultural processes or rainfall could influence this correlation. Thus, this study appeals to future research to further understand factors influencing total nitrogen within the waters of the Mississippi River Watershed over time and in relation to crop planting trends.

Assessing the Use of Microbial Fuel Cells for Sustainable Wastewater Treatment

COLMAN JOHNSON and Eric Cathcart

Conventional wastewater treatment by activated sludge and anaerobic digester technologies are energy intensive, produce large amounts of biomass, are incapable of treating high concentrations of COD and fail to sustainably recover energy from the oxidation of organic material. Microbial Fuel Cells (MFCs) including Aquacycl's BioElectrochemical Treatment Technology (BETT) offer a sustainable alternative to conventional treatment as they are capable of converting chemical energy contained in biodegradable substrates directly into electrical energy (DC current), dissolved CO2, and new molecular water while maintaining low energy expenditure, low biomass production, and high treatable ranges of COD. In this study, MFCs are compared to conventional wastewater treatment in terms of efficiency and energy recovery to assess the potential benefits of utilizing MFCs, especially regarding sustainability. Additionally, we evaluated the normalized energy recovery (NER) of BETT over 10 treatment cycles using batch flow and determined that MFCs are capable of treating higher COD concentrations, require a smaller energy input to operate, and can produce a net positive energy that therefore offers a green source electricity. With human consumption of natural resources at an all-time high, it is imperative that new technologies are developed that mitigate environmental degradation while maintaining high efficiency. Doing so in the context of wastewater treatment is crucial as the U.S. alone uses 322 (Bgal/d) of water, 11% of which requires treatment before it is once again safe for human consumption and release into natural systems.

Assessment and Mitigation of Sewer Line Repairs in Environmentally Sensitive Areas, San Diego, CA

VIOLET QUINN and Eric Cathcart

In cities throughout the United States, municipal gravity fed lines are typically located within undeveloped canyons due to ease of placement and accessibility. These canyons contain sensitive ecosystems that play an essential role in ensuring the wellbeing of the surrounding environment and are thus considered environmentally sensitive areas (ESAs). In the City of San Diego, there are over 2,850 miles of sewer lines and approximately 320 miles of these are located within ESAs. To conduct maintenance and repair on these lines, the California Environmental Quality Act (CEQA) requires compliance with established regulations. This study specifically addresses Norfolk Canyon, an ESA with dilapidated sewer lines, and the hydrological and biological considerations under CEQA that are required before repairs can begin. Our study is a review of the sensitive wildlife and plant species identified within Norfolk Canyon as well as hydrologic criteria used to determine erosion potential. Assessing these criteria is important to minimize and mitigate any possible sewer maintenance impacts and to preserve ESAs. Population growth has both increased the need for open space and thus the importance of ESAs, as well as increased flows in municipal sewer systems. Due to these effects, it is especially important that sewer lines are maintained and repaired to reduce the probability of sewage spills, which have the potential to cause severe detrimental impacts to the City of San Diego's overall environment.

Assessment of Amathia verticillata (Bryozoa) Percent Cover and the Composition of Associated Communities in Mission Bay, San Diego

ZACHARY ORMOND and Michel Boudrias

The anthropogenic introduction of the non-native *bryozoan Amathia verticillata* to Mission Bay, San Diego, California has caused concerns regarding its ecological impacts to this estuarine environment. Capable of rapid reproduction and growth, it can quickly overwhelm native species, as well as develop into a stable habitat utilized by other species. We monitored the composition of the taxa living within individual *Amathia* and percent coverage of a population of *Amathia* living on the South Shores dock in Mission Bay from July to November 2020. We hypothesized that percent cover along with the total number of individuals and taxa utilizing *Amathia* as a habitat would increase as water temperatures increased. Water quality parameters and percent cover were measured weekly over the course of the 17-week study. One colony was collected weekly to analyze the composition of the community using *Amathia* as a habitat. The *Amathia* colonies quickly reached and maintained a dominant overgrowth of the dock, covering up to 100% of the surface of the dock for the majority of the study when water temperatures were warmest. During the first weeks, *Amathia* colonies were dominated by low abundances of invertebrates, followed by a consistent increase in total number of individuals and species richness as water temperatures increased, thus supporting our hypothesis. During the midsummer, *Amathia* develops into a habitat for native fauna, hosting up to 11 different species at a time in a single colony. Our results provide evidence that non-native species, like *Amathia verticillata*, can have positive impacts on local ecosystems.

Beach Water Quality Assessment in San Diego County from 2015-2018

ERIN LINCOLN and Michele Boudrias

Fecal coliform in beach water poses a human health risk when its concentration is over 400/mL. Two events typically increase fecal coliform concentrations: rain events that wash bacteria into the ocean through storm drains and sewage spills which lead to beach closures and advisories. In this study we examined the spatial and temporal patterns of fecal coliform concentrations off the coast of San Diego County from Oceanside to the Mexican border. Data was acquired from the California State Water Resources Control Board which included weekly measurements of fecal coliform concentrations across 41 sites over a four year period (2015-2018). Results show that, on average, across all sites and years, fecal coliform concentrations are well below the 400/mL EPA closure limit 97 percent of the time, with an average level of less than 200/mL. The majority of exceedingly high concentrations, between 1,000 and 16,000/mL, are concentrated spatially around 5 sites within 10 miles of the Mexican border and temporally after rain events or sewage spills. The results give us locations on which we can focus cleanup and mitigation efforts. Environmental managers can most effectively use their resources to concentrate on improving waste management in those 5 sites near the border. The result of this scientific analysis can be used for public policy and as part of the Equinox Quality of Life Dashboard.

Diversification of clover seed beetles in California (or not?)

Madison Moye and Geoffrey Morse

Seed beetles of the genus Acanthoscelides (*Coleoptera: Chrysomelidae: Bruchinae*), are specialists with an intimate and antagonistic relationship with their hosts. This intimate relationship can be a major driving force for evolution and speciation events. One relatively unstudied clade consisting of 3 described species (*Acanthoscelides inquisitus, A. napensis, & A. pauperculus*) is native to California and unique in that they are the only group in the genus known to feed on Trifolium (clovers), although only one host association has ever been recorded. I present the results of intense sampling of native California Trifolium clovers revealing 12 new host plant associations to *Acanthoscelides* beetles (species undetermined to date). Photography and morphological analyses will allow for species identifications based on characteristics in the literature (beetle size, coloration, hind leg anatomy) and will test specific hypotheses (associated with allometric scaling) regarding species differences. Genetic analyses will confirm species identifications and provide insight into the force behind potential speciation events. RADSeq whole-genome sampling and Sanger sequencing (performed to amplify both a mitochondrial and nuclear gene) are being performed to analyze genomic sequences on an individual and population level. Final conclusions will provide insight into insect diversification and the mechanisms by which speciation occurs for specialist insects. In particular, an understanding of the correlation between genetics and morphological variation is necessary to understand whether morphological traits indicate species differences or allometry.

Effect of Sea Surface Temperature and Chlorophyll-a on the Abundance of Tunas (Thunnus spp. and Katsuwonus pelamis) Along the Coast of Southern California from 1959-2019

PARKER S CLAY and Jennifer Prairie

Climate change has caused Earth's atmosphere to increase by an average on 0.74 degrees Celsius while sea surface temperatures have increased by approximately 0.67 degrees Celsius. Tunas (*Thunnus spp. and Katsuwonus pelamis*) are highly migratory, environmentally sensitive, and commercially important species. Here, we investigate the relationships between sea surface temperature, chlorophyll-a, and tuna abundances in catch per unit effort (tonne/set) along the coast of southern California from 1959 to 2019 using purse seine fishery data obtained from the InterAmerican Tropical Tuna Commission (IATTC) and hydrographic CTD data obtained from California Cooperative Oceanic Fisheries Investigations (CalCOFI). Sea surface temperature, chlorophyll-a concentrations, and tuna abundances varied widely throughout the 60-year time period. There was a significant positive correlation between sea surface temperature and tuna abundance, but a significant negative correlation between chlorophyll-a and tuna abundance. However, in both analyses there was a weak R2 value suggesting other factors, such as large-scale climate indices including El Niño-Southern Oscillation (ENSO) and Pacific Decadal Oscillation (PDO), may play a role in tuna distribution and abundance along the coast of southern California.

Effects of Plastic and Light Pollution on Chelonia mydas and Holistic Mitigation Policy Initiatives

CATHERINE WALKER and Michel Boudrias and Andrew Tirrell

Recent accelerations in coastal and international urbanization, with 40% of the global population living near a coast, threaten local habitats of the green sea turtle, *Chelonia mydas*. These threats remain generally unmitigated and unaddressed within legislation. Plastic and light pollution, proxies for anthropogenic impacts, are expected to degrade the environments of *C. mydas* and harm physiological health. Efforts to restore *C. mydas* populations are limited due to the lack of extensive understanding and comprehensive data regarding the longevity of the physiological impacts and environmental alterations throughout the C. mydas' lifespan. Therefore, this meta-analysis acts as a novel interdisciplinary synthesis of comprehensive effects on C. mydas populations. Research was systematically conducted by obtaining relevant existing publications and data regarding *C. mydas,* light pollution and plastic pollution with examples from Southern California and Baja. An extensive list of existing policies and gaps within any policy were recorded in order to create comprehensive legislative initiative recommendations. Synthesized results support that there are detrimental effects on the ecosystem indirectly affecting *C. mydas* and directly affecting their physiology particularly due to plastic and light pollution. Detrimental impacts include increased risk of mortality, decreased rate of nesting and decreased hatchling success. This study shows that the accelerated rate in which these pollutants occur has significant implications for the future survival, fitness and fecundity of the green sea turtle that need to be addressed within policy initiatives in order for mitigation to occur.

Effects of the Pacific North American Pattern on Climatic Trends in Northern Rocky Mountain Winters

GABRIELLA WHITTAKER and Andrew Nosal

One key effect of climate change is the decrease of terrestrial snow cover caused by shorter and warmer winters in alpine areas. In the Western US, the alpine snowpack feeds the watersheds, and a decline in snow would drastically alter fresh water sources for humans. While the effects in this area of other global oscillations such as ENSO have been thoroughly investigated, recent studies of the PNA relationships are lacking. This study aimed to analyze winter climatic trends in the Northern Rocky Mountains and their relationship with the Pacific North American (PNA) Pattern. Temperature, precipitation, snow water equivalent (SWE), and PNA data from existing sources was compiled and statistical analyses were performed. Results found that there is no significant temporal trend regarding temperature, precipitation, and snow water equivalent over the past 20 years. This is inconsistent with prior studies and is likely due to insufficient temporal and spatial data, therefore these results are inconclusive. A negative relationship was found between SWE and PNA. This is consistent with previous studies and further emphasizes the importance of studying the PNA as the climate changes. Lately, the PNA has tended to be in its positive phase during the Rocky Mountain winter which is a cause for less terrestrial snow cover. More extensive historical data is being analyzed to examine this relationship. Further studies will need to be performed to understand how a warming will affect the PNA and snowpack of the Rocky Mountains.

Evaluating Atlantic Bluefin Tuna (Thunnus thynnus) Landings in the Gulf of Maine Commercial Fishery

EMILY ANDRADE and Walter Golet

Atlantic bluefin tuna (ABT) have complex migration patterns and spend long periods of time distributed throughout the North Atlantic. While ABT have a large habitat range, approximately 80%of the tuna caught commercially comes from a relatively small ~88,000 km2 area of the Gulf of Maine. This area, however, is rapidly changing: herring, the main prey species of ABT have been declining in both density and condition factor (weight per length), and the Gulf itself is considered one of the most rapidly warming bodies of water. Both environmental conditions and food availability are expected to negatively influence ABT populations. It has been nearly four decades since the last synthesis of the commercial bluefin tuna fishery, and there have been major changes in the status of the western Atlantic bluefin tuna stock and in environmental conditions throughout the northwest Atlantic. We conducted an updated synthesis to identify changes in abundance, condition, phenology, gear selectivity, and regional movements by data mining the National Marine Fisheries Service Atlantic bluefin tuna commercial landings database. We found no clear distinction in ABT sizes between gear types. Condition factor appeared to decline over time, and the Gulf of Maine exhibited cyclical patterns in distribution and abundance of ABT. Finally, tuna sizes were dependent on seasons and years. The information from this analysis can be used to optimize tuna fisheries, both economically and ecologically, to ensure that populations of these trophically important pelagic fish species remain present and viable for years to come.

Evaluating the effect of the presence of sinking marine snow particles on copepod

RHONDA PAPP and Jennifer Prairie and Christian Briseño-Avena

Marine snow and copepods are important components of the oceanic biological pump, which is part of the global carbon cycle. Marine snow (aggregates of detritus, phytoplankton, and inorganic matter) play an important role in removing CO2 from the surface ocean by slowly sinking into the deep ocean, where it remains for thousands of years. Because marine snow is one of the primary food sources for copepods (microscopic crustaceans), it is important to understand their dynamics from the point of view of the organisms interacting with them. While there is some information on copepods reacting to the chemical plumes left behind by sinking marine snow, little is known about the copepod reactions to mechanical stimuli from sinking marine snow coming from above. Copepods have a sophisticated mechanosensory system (hydromechanical sensing) to detect objects approaching them, such as predators and food sources. Here, we explore how marine snow elicit motor responses, such as escape, attack, or capture in the copepod *Calanus pacificus*. We conducted a series of laboratory experiments using high-speed cameras to film tethered copepods in a tank and used MATLAB to track and measure the reaction distance to sinking marine snow from above and to classify the types of reactions in copepods. We observed different copepod behaviors and accompanying motion patterns of individual set appendages, including but not limited to: active movements, passive movements, reaction, no reaction, jumping, no jumping, feeding, no feeding, among others. Observing how copepods react and use their appendages when exposed to marine snow can help understanding the dynamics between copepod-marine snow interactions, which can be useful for models studying the implications of these interactions on larger scale trophic dynamics, and in turn the role these interactions play in the oceanic biological pump.

Future Climate Projections in Northwest China Using Streamflow Estimates Based on Water Balance Modeling

IRINA QUIBELAN and Zhi-Yong Yin

Climate change causes dynamic changes in precipitation and temperature which impact the hydrologic cycle raising concern for water sustainability. Numerous studies have conducted project future climate conditions because of its heavy influence on water resources. Streamflow projections using water balance modeling can provide long-term estimates of water variables. Water balance modeling keeps track of water input and output by accounting for precipitation and snowmelt, evapotranspiration, streamflow or runoff, and soil moisture. This project seeks to consider future climate projections through streamflow estimations in the northeastern Qaidam Basin in northwestern China where few studies on the impact of climate change on water resources have been conducted. Thornthwaite monthly water balance modelling was used to predict future climate using temperature and precipitation data. During the model calibration process, different model parameters (percentage of rainfall to become direct runoff, soil moisture capacity, the percentage of surplus to become runoff in a given month) were adjusted so that the model output's seasonal variation and the annual runoff matched as closely to the observed streamflow data within reason. These projected temperature and precipitation series have similar characteristics of interannual variability as the observed series, but also present long-term trends based on climate projections at the end of the 21st century (e.g., 1.5-6 centigrade temperature increases, negative 10 percent, unchanged, or positive 10 percent annual total precipitation with increased variability). The results suggested that climate change will not cause drought in this region despite rising temperature due to the offset of the increase in precipitation.

Genetic Variability of *Haliplidae* from Corte Madera Pond

TRISTAN MOTOYOSHI and Geoffrey Morse

Previous research has shown that Haliplidae, a family of small aquatic beetles, have the ability to disperse in response to environmental cues. With the threat of climate change on the rise, aquatic insects like Haliplidae face the potential to no longer have other locations to disperse to, which would have detrimental effects on the ecosystem. The present study aims to understand Haliplidae's ability to disperse in order to gain the information needed to aid in saving the species, along with understanding whether or not Haliplidae can survive the increasing effects of climate change on their habitats. We hypothesize that there will be specimens from the same species with different genomics due to dispersing from another location. In order to examine this, the genomic DNA of Haliplidae from Corte Madera Pond in San Diego was obtained and the Cox1 enzyme from each specimen was isolated (N = 60). We then used polymerase chain reaction to develop several copies for analysis and comparison to other specimens. Results of specimen sequenced thus-far show promising results for future analysis. Conclusions of genetic diversity and dispersal distributions in the collected samples of Haliplidae will be made when sequencing and analysis are finished.

Hippocampal CA2 and Temporal Memory

AKEMI ITO, AHMET KRAJA and Jena Hales

The hippocampus plays an essential role in memory formation, specifically episodic memory, which is responsible for coding both spatial and temporal aspects of an experience. Past studies have overwhelmingly focused on the functions CA1 and CA3 cell layers of the hippocampus, leaving the CA2 region relatively and notably understudied. This hippocampal subregion has been overlooked due to its small size and difficult to define borders, as well as the previous belief that it was just a transition zone in signaling between the CA1 and CA3. However, the CA2 cell layer exhibits some unique features in terms of gene expression, cytoarchitecture, signaling, connectivity between the intra- and extra-hippocampal brain areas, and encoding of memory. Our research team conducted a thorough review of the literature exploring the anatomical and physiological differences of the CA2 cell layer in its role in temporal coding, as compared to its neighboring CA1 and CA3 cell layers. In addition, we examined the value of specifically targeting the CA2 cell layer in future lesion studies in our lab while rats performed our Time Duration Discrimination behavioral task. We concluded that the CA2 exhibits a unique role in the encoding of temporal memory and should be considered as a target for future research into temporal aspects of memory processing.

Historic Water Temperature Variability as it Relates to Spawning Requirements of Bull Trout in Priest Lake, ID

SYDNEY SQUIRES and Eric M. Cathcart

Bull trout, Salvelinus confluentus, are a vulnerable fish species native to the Pacific Northwest. Bull trout require water that is cold, clean, complex, and connected to other bodies of water. These trout have been historically abundant in Priest Lake and other deep glacier lakes, but since the 1980s their population has been sharply decreasing due to habitat degradation, fragmentation, poor water quality, and poor fishery management practices. Bull trout need a minimum water temperature of 10 degrees centigrade to spawn and reproduce. This study analyzes historical water temperatures in Priest Lake in relation to the spawning temperature threshold of bull trout. Water temperature data was collected monthly by Selkirk Conservation Alliance from May through October in 17 geographically marked study areas from 1993 to 2019 using a YSI probe. From this large data set, temperature trends were then analyzed in Microsoft Excel and compared the environmental parameters required for bull trout spawning and vitality. Overall, water temperatures in Priest Lake can range from 6 degrees centigrade to 22 degrees centigrade in the summer months and have been steadily increasing with few of our study areas meeting the minimum 10 degrees centigrade required for successful spawning. Results of this study can be used in conjunction with historical land development records and other habitat fragmentation projects to explain the extreme decline in population and provide insight into restoration projects for bull trout in Priest Lake.

Historical Relationships between Snowpack in the Rocky Mountains of Colorado and decreasing water inflow rates in the Colorado River Basin.

Ryan Tessier and Ron Kaufmann

Climate change and drought have led to decreasing streamflow throughout the Colorado River Basin and at the same time it has seen increasing competition for access to the water from multiple states and countries. To assess the severity of the decreasing water flow, it is important to look at the source of water. Snow in the Rocky Mountains provides the flow of water in the river basin. This project has the objective of finding how much change has occurred in the snow of Colorado and in the inflow of water in the Colorado River Basin, and to analyze the relationship between snowpack and inflow. Finding this relationship will lead to a better understanding of the impact lower snow levels will have on the water levels in the Colorado River Basin. By looking at the snow water equivalent levels since 1979 at multiple locations in the Coloradan Rockies, significance of declining trends was evaluated and used to examine relationships with inflow rates at four different reservoirs in the Colorado River Basin. Decreasing snow levels have resulted in decreased water inflow into downstream reservoirs. Correlation analysis showed relationships between snow water equivalent in the mountains and water flow to the Colorado River Basin had statistically significant correlations. Historical trends of snowpack were not statistically significant decreases, but water inflow in the reservoirs had statistical significance in historical decreases. This can serve as a predicative model and should be used for water resource management.

Influence of Air Temperature, Sand Temperature, and Incubation Duration on Green Turtle (Chelonia mydas) Sex Ratios on Ascension Island and the Role of Inter-beach Thermal Variation

HEATHER FOLLO and Andrew Nosal

Marine turtles are known to undergo temperature dependent sex determination (TSD), making them susceptible to the effects of climate change and global warming. Previous studies have shown that marine turtle sex ratios can be influenced by sand temperature, incubation duration, and air temperature, among other factors. Considering global warming, the long-lived nature of marine turtles, and the propensity of marine turtles to produce more females in warmer temperatures, their adaptability to such rapid temperature changes is debatable, and they could face potential extinction. This study focused on determining whether sand temperature is most influential on male to female sex ratios on Ascension Island, or whether air temperature and incubation duration are just as, if not more, significant. Utilizing data from past studies, the 1998/1999 nesting season of the green turtle (*Chelonia mydas*) on Ascension was analyzed to discern whether significant differences exist between sand temperature, air temperature, and incubation duration between three major nesting beaches. A statistical analysis of these factors determined that sand temperature was the most significant factor influencing the percent of females hatched on the island and it had significant differences between the three beaches studied. The inter-beach thermal variation of sand temperature on Ascension Island is significant in allowing hatchlings of both sexes to be produced, and Ascension can be viewed as a conservation success story for having a relatively stable population size which can be attributed to differences in average sand temperature between beaches.

Is Rapid Diversification in Astragalus Driven by Interactions?

DOMINIQUE KEANE-CAWRSE and Geoffrey Morse

Astragalus is the most species rich genus of flowering plants in the world; *Astragalus lentiginosus* in particular has more named varieties than any other species of *Astragalus*. This host plant is involved in a mutualistic symbiosis with a fungus that concentrates defensive toxins in its seed coat; and it is involved in an intense antagonistic symbiosis with seed feeding beetles. In this study, I ask if rapid diversification in *Astragalus* is driven by these interactions. I look specifically at the symbiosis between the endophyte and the host plant and see if this is correlated with the host plant and the seed beetles. I focus on three geographically proximate varieties and ask whether there are real biological differences between them and if these are driven by differences in seed beetle and fungal associates. I show that these species differ significantly in seed morphology suggesting that differentiation in the seeds may be an important trait in distinguishing varieties. I show that seed beetles also appear to specialize and will present evidence that this might be linked to differentiation in a fungus that produces defensive compounds for the plant. These results suggest that coevolution may be driving rapid diversification.

Lake Michigan Water Level Rise: Trends in Exposed Sand Cover at North Avenue Beach

MAGGIE SCHOLLE and Suzanne Walther

Between 2013 and 2020, water levels in Lake Michigan rose from an all-time low to the highest levels observed in nearly four decades, inciting dramatic shoreline changes throughout the Great Lakes. These changes are particularly noticeable at North Avenue Beach in Chicago, an artificial beach where rising waters have been addressed by dredging and the implementation of groins. Using a digital elevation model, we investigated whether sand loss was explainable by lake level change alone, or if other forces may be responsible, with particular attention given to hardened shoreline implemented north of the beach in 2016. We digitized the shoreline using spring season aerial imagery from 2012 to 2020 at the interface between wet and dry sand (east) and snapped the resulting polygons to a fixed edge (west). We then calculated beach area and related sand cover loss to water level change per the USGS station located approximately 2 miles south of the study area. Analysis reveals year-to-year loss in sand cover since 2013, with the largest single-year change occurring between 2018 and 2019. Of the six beach cells separated by groins, two cells failed over the study period, and middle cells experienced the largest individual sand losses. An inverse relationship with a slight lag exists between water level and these beach area changes. Observed sand cover loss markedly exceeded predictions based on inundation modeling. This suggests that linkages may exist between artificial shoreline modification and obstruction of sediment transport at this site.

Land Cover Change on Coyote Creek, Anza-Borrego Desert State Park

TIMOTHY LAYTON and Suzanné Walther

Coyote Creek, a stream located in the largest watershed in Anza-Borrego Desert State Park (ABDSP), is intermittent most of its length, with sections of perineal surface flow. Though desert aquatic species are adapted to survive the extreme variability in precipitation characteristic of the southwest, these habitats show evidence of negative climate impacts. Changes in stream flow that result in fragmented pools and dry streambeds, can reduce freshwater aquatic invertebrate species richness and biological diversity. Vegetation along the stream also influences flow and, therefore, freshwater fauna. California experienced a drought in 2011-2016, altering vegetation cover in the creek. This study focused on the Lower Willows section of Coyote Creek with the goal of quantifying the land cover changes between 2014, 2016, and 2018 using ArcGIS. Using 4-Band aerial imagery (USDA) clipped to the study area, analysis consisted of running Normalized Difference Vegetation Index (NDVI) to measure vegetation cover. To quantify the changes in land cover over time, in two-year increments, the raster calculator tool subtracts the older data set from the newer one. This creates a new raster image of the differences that were then re-classified into 5 categories highlighting gains, losses, and no change. NDVI successfully captured the vegetation distribution on Lower Willows, showing that vegetative land cover increased between 2014-2016, particularly in the downstream half of the reach, but decreased between 2016-2018. Vegetation cover in streams aids in retaining flow and desert aquatic species habitat, an important factor in arid lands conservation and management.

Medial Entorhinal Cortex Lesions Impair Subjective Time Discrimination in Rats

ANNETTE VO, KAYLA CAYANAN, and Jena Hales

Episodic memories represent experienced events, positioned in space and time. Previous studies have provided evidence that spatial and temporal processing takes place in the hippocampus with place cells that fire at specific spatial locations and time cells that fire sequentially throughout an experience (Eichenbaum, 2017). Recently, neural sequential firing has been identified in the medial entorhinal cortex (MEC), a region that directly projects to the hippocampus. This finding suggests that the MEC may provide temporal information to the hippocampus that is key to episodic memory formation and organization. However, previous studies on the temporal aspect of episodic memory have not manipulated time as a consequential variable, so the exact role of the MEC in elapsed time discrimination is unclear. To investigate this question, we used a novel time duration discrimination (TDD) task developed in our lab in which rats navigate a figure-8-maze with a delay box at the end of the central arm. Rats are rewarded if they make a left turn choice after a 10-sec delay or a right turn after 20-sec. After learning this discrimination, rats received excitotoxic lesions of the MEC or sham surgeries. Results of our experiment indicate that MEC-lesioned rats were significantly impaired at discriminating the duration of elapsed time, showing greater deficits at the longer relative to shorter time delay. Over the summer, we conducted an extensive analysis of the literature related to the involvement of the MEC in temporal processing, and discuss our findings in the context of the current literature.

Medicinally-Directed Organoboron Chemistry

CALISTA GILGER, Hannah Stuebe, and Timothy Clark

Boron is becoming an important element in medicinal chemistry as the versatility of the carbon-boron bond allows for the easy transformation to carbon-carbon, carbon-nitrogen, and carbon-oxygen bonds, all prevalent in biologically active compounds, including those in pharmaceuticals. The goal of my project, was to optimize procedures that transform heterocyclic ketones (compounds containing a carbon-oxygen double bond) into organic compounds containing boron. Several approaches to use these products to access important types of organic structures will be presented.

Model for Active Particle Swarming Analyzed

RYAN SNYDER and Dr. Ryan McGorty

For my research as a part of the physics program, I worked with Dr. Ryan McGorty on a solo project where we aimed to understand the way in which active particles may interact with each other and more specifically if and how those same particles could act as a swarm. We did this by using a system composed of Teflon disks which were made using a hole puncher in Teflon paper. These Teflon disks were then crafted to act as our model for active particles using camphor crystals on the water as the driving force. This system works as a model for active particles because the disks move on their own and are not being moved by an operator. From crafting these make-shift boats, we were able to analyze the structure and motion of the boats over time. We based our conclusions on a set of data, which had 100 boats in a petri dish and used a squirt bottle to introduce the water into the system, so the initial few minutes have been omitted from the data set. Using a modulated code based on 'trackpy', we found that the boats appeared to move together and swarm in different groups dependent upon the strength and tightness of groups of boats, however, more research is required to make a definite statement on whether or not active particles will swarm.

Modeling Monarchs and Milkweeds: How Climate Change Will Affect Species Distribution in Florida

CELESTE ELY and Wilnelia Recart-Gonzalez

Monarch Butterflies (*Danaus plexippus*) are predicted to go quasi-extinct within the next 20 years. Pesticides, pathogens, habitat loss, and the effects of climate change are all driving this charismatic and formerly widespread species towards unsustainably low populations. Climate change is increasingly of concern in terms of Monarch conservation because it exacerbates other factors, particularly, habitat fragmentation and depletion of the Monarch's host genus, the *Asclepias*. Monarchs are dependent on *Asclepias*, commonly known as Milkweeds, for their reproduction and success of multigenerational migrations. Monarch distribution is more limited by *Asclepias* distribution than by environmental factors; as such, understanding how *Asclepias* respond to climate change is an important element of Monarch conservation. How climate change will affect *Asclepias* and Monarch populations in Florida, a major Monarch migratory route, is not fully understood. To investigate this, I built a Species Distribution Model using the modeling program MaxEnt. By modeling the present and future distribution of introduced *Asclepias curassavica*, Florida natives *A. tuberosa* and *A. perennis,* and Monarchs within the state of Florida, I aimed to address how changing environmental conditions would affect the spatial distribution of Monarchs. Preliminary results indicate range reduction for both Monarchs and *Asclepias* species, with the potential for local extinctions of *A. currasavica* and *A. incarnata* within Florida. Further analysis will explore questions as to which host plants will be most important for future monarch populations and investigate trends in terms of the directionality of range change.

NMR structural studies of DNA duplexes containing unnatural base pairs: dNaM-d5SICS, dNaM-dTPT3, and dCNMO-dTPT3.

KODI THURBER, Marissa Patterson, Scott Kilcoyne, Dana Rosansky, Charolette Infante, Caroline Uhlig, and Tammy Dwyer

Unnatural base pairs formed between synthetic nucleotide analogs with hydrophobic nucleobases have been synthesized and optimized for replication, transcription, and translation in a semi-synthetic organism (SSO) by Floyd Romesberg and colleagues (Scripps Research and Synthorx). In order to provide structural insights into the unique properties of these modified duplexes, 1H NMR spectroscopic analyses with complete 2D NOESY assignments and quantitation are used to determine the spatial orientations of the unnatural bases within dodecamer duplexes. Restrained molecular dynamics simulations using Amber16 have yielded an average structure for the dNaM-d5SICS containing duplex which will be presented here. The dNaM-d5SICS containing duplex shows quite typical B-DNA structure for the Watson-Crick portions with localized perturbations in the region of the unnatural base pair extending only to the adjacent pairs. The d5SICS and dNaM moieties self-intercalate and stack with each other, as well as the nearest neighbor. We also report preliminary results on the structure determination of the dNaM-dTPT3 and dCNMO-dTPT3 containing duplexes. Given that the dCNMO-dTPT3 pair has shown the most promising ability in an SSO to store and retrieve information (in terms of the production of proteins with noncanonical amino acids, relative to dNaM-d5SICS and dNaM-dTPT3), structural comparisons may shed light on important recognition elements for the replication of unnatural base pairs.

Pollination and Parasitization through the Lens of Meta Analysis

KATHERINE GARCIA and Wilnelia Recart Gonzalez and Arietta Fleming-Davies

Pollination is essential for crops and many other flowering species. Parasites of pollinators could influence the future of pollination and flowering plants. A meta-analysis is a useful strategy to detect patterns across different studies collecting data on a similar subject. I will present results from a meta-analysis to determine how pollination is affected by pollinators infected with parasites. The project's data collection required keywords, finding, downloading, and reading research articles that discussed the impacts of parasites on insect pollinators. Data needed an infected insect pollinator, compared to an uninfected counterpart. Both entries must display the mean and standard error. Out of the literature papers downloaded, only 3.5 percent contained usable data. Over 1,400 different lines of data were extracted from the literature of 74 papers. The two most common insects were bees in the arthropod genera Apis and Bombus, which accounted for 23.5 percent of the study observations. The affected traits due to parasitization varied from behavioral, density, morphological, and physiological. Meta analysis determined that population density was the trait most impacted by parasitization, making up 53.5 percent of observations. Given the importance of pollinator populations for flowering plants, it is critical to measure the affected changes in pollinator population density. Our results predict that as the pollinator density is negatively affected by parasites, in turn, pollination will be affected, and therefore, important flowering plant species will be impacted. Furthermore, we found correlations that reinforce the importance of parasitism and its effects on flowering plant species.

Quantifying Physical Changes to Marine Snow Particles as a Result of Copepod Interactions

LEAH RING and Jennifer Prairie and Christian Briseño-Avena

The ocean plays a critical role in Earth's carbon cycle, as the largest sink for actively cycled carbon. Organic matter is transferred to the deep ocean in the form of sinking particles known as marine snow that are comprised of phytoplankton and other organic material. Marine snow is known to be an important food source for many types of zooplankton, including copepods, and studies have suggested that zooplankton feeding on marine snow may result in the fragmentation and deformation of these particles. However, there have been no previous observations on the physical changes to these particles immediately following copepod interactions given the small scale (micrometers) at which they occur. In this study, we aimed to determine how the size, shape, and number of marine snow particles are affected by interactions with copepods. To address this objective, we used a high-resolution camera to image a copepod as it manipulates and feeds on marine snow that was descending from above. MATLAB was used to quantify each particle's shape (using metrics of eccentricity and circularity) and size (in terms of area) over time. Then these metrics were compared before, during, and after the copepod interaction. Here, we will present results demonstrating that, after direct interaction with the copepod, marine snow generally fragments into smaller, less round particles. This finding suggests that copepod interactions may have implications for the settlement rates of marine snow since smaller and less round particles sink slower, thus affecting the transport of carbon to the deep ocean.

Quasi-Periodic Oscillations in Black Hole X-ray Binaries

Kathryn Anawalt and Theodore Dezen

Sufficiently massive stars end their lives as black holes, which may be surrounded by an accretion disk, formed by drawing material from the outer layers of a companion star. As the hot (>107 K) and ionized accreted gas spirals in closer to the black hole, a significant fraction of the liberated gravitational potential energy is radiated away as light. Such systems are known as black hole x-ray binary (BHBs) because the radiation is primarily in the X-ray regime. BHBs are observed to dim and brighten at almost regular intervals, with frequencies ranging from 40 Hz to 450 Hz, in a phenomenon called quasi-periodic oscillations (QPO). While the frequencies are thought to depend only on fundamental black hole properties such as mass and spin, the strength (brightness) and sharpness (coherence) of QPO power spectra are poorly understood. In this work we study the dependence of properties of the QPO power spectra peaks on dissipation fraction, which is defined as the fraction of accreted gravitational potential energy that goes into heating the region around the disk photosphere.

Sea Surface Temperature and Timing of Arrival for Peak Gray Whale Sightings in Santa Barbara, California

MELISSA BRIDGES and Andrew Nosal

Gray Whales, *Eschrichtius robustus* are keystone species that participate in the oceanic biological pump's nutrient cycling process by suction feeding at shallow depths on average less than 250 ft deep. They feed on a variety of benthic invertebrates, such as amphipods sp, depending on availability. *E.robustus* typically migrate from their summer feeding grounds in the Bering and Chukchi Seas to their winter mating and birthing grounds in the lagoons of Baja, California. Decreased amphipod densities during summer months in the Bering Sea may have altered gray whale foraging behaviors and typical migratory patterns searching for prey. However, no studies determine if gray whales follow a migratory path depending on sea surface temperature (SST). This allows room to analyze the relationship between seasonal change in SST between 2007 and 2019 and if there is any effect on the timing of arrival of peak gray whale sightings off the coast of Santa Barbara, California, en route to summer and winter migratory destinations. My study focused on gray whale sightings and average SST changes off the coast of Santa Barbara, California, USA. My results showed that gray whale sightings and increased SST had a strong positive correlation. However, there was no significant correlation between increased sea surface temperature and changes in the timing of arrival of gray whale sightings along the coast of Santa Barbara. My project's significance was to explore the relationship between SST changes and peak gray whale abundances en route to northern and southern migration destinations.

Spatiotemporal Variability of Foraminifera (*Protista*) off the Coast of San Diego

Bibi Renssen and Sarah Gray

Foraminifera are abundant in the marine environment and useful indicators of past and future climate change. However, there is no recent work on variation in fossil *foraminiferal* communities between 100-300m depth on the shelves of the California Continental Borderland, or measurable changes in *foraminiferal* communities over time or cyclical events. The goal of my research was to characterize fossil *foraminiferal* assemblages on shelves off San Diego to examine variability with water depth and dissolved oxygen over an 11-year time series. Samples were collected using a multicorer from three sites at 100-300 m depth on annual research cruises from 2001-2011. Planktonic and benthic *foraminifera* were extracted by sieving the upper 1 cm from each sample. *Foraminifera* were picked and mounted on slides for community analysis. At least 300 specimens from each sample were examined under a microscope and percent abundance of species was calculated. The most abundant planktonic *foraminifera* were Globigerinoides and Orbulina, and the most abundant benthic *foraminifera* were Cassidulina, Globo-cassidulina, Bolivina, Bulimina, and Cibicidoides. All *foraminifera* genera were observed at all stations, but at the shallowest station, Bolivina was most abundant, while Globo-cassidulina was most abundant at the deepest station. No temporal change was seen in the planktonic foraminifera community. In the benthic foraminifera community, spatial variability was consistent from 2001-2008, but relative abundance of *Cassidulina* in deeper stations increased in 2010. We observed a direct correlation between percent Bulimina and bottom dissolved oxygen. There was no change in community composition through time, likely due to sediment mixing.

Synthesis of a Mer Coordinating Tridentate Ligand that, on Binding to a Metal Center, Displays Improved Product Selectivity in Comparison to Other Known Ligand Systems

SAMSON HUI and Christopher J. A. Daley

Certain compounds are related to each other similar to that of identical twins. The pair of twins, termed enantiomers, are different as they are non-superimposable mirror images of each other similar to your left and right hand. When a product is composed of only one form of the enantiomers it is said to be enantiopure. In general, the process to make enantiopure products (only one twin) is difficult but methods have been developed to do it for a number of different enantiomer compounds. However, there is no singular method that works perfectly and efficiently for all compounds. Our goal is to develop a metal-based catalyst that will synthesize only the one desired enantiomer form of a target compound. Our catalyst system has its own enantiopure compound, termed a ligand, that when bound to a metal, will induce the desired selectivity. In general, to synthesize our ligand we use microwaves to heat our reaction. The product is then separated and purified via column chromatography and analyzed by NMR spectroscopy and X-ray crystallography, when possible, to confirm its structure. Here I present the work I have been engaged with as a researcher in the Daley lab. Specifically, I present (i) the synthetic methodology that was used to prepare our ligands and the corresponding metal catalysts, (ii) data from the spectroscopic analyses used to confirm the structures of these compounds, (iii) and the future direction of my project.

The Adverse Effects of Temperature Change on Suicide Rates

WILLIAM ALTINGER and Jennifer Prairie

Climate change has negative effects on the world including sea level rise and temperature increases. These changes have been found to increase mental health symptoms and numbers. Suicide is an extreme example of mental health consequences that has been addressed minimally when looking at the adverse effects of changes in climate and weather. The CDC states that a 35%increase has occurred from 1999-2018. The objective of this study was to uncover unseen relationships and trends between different aspects of temperature and suicide rates. Previous studies conducted attempted to uncover relationships between both, with a wide range of results. Methods took approaches to address both short-term and long-term changes with ambient temperature. Raw suicide rate data from 5 different United States cities were used to compare short-term effects of temperature changes and how the corresponding suicide rate was affected. Results were inconclusive between the different locations but between individual locations, relationships were generally linear. Temperature values were transformed to look at discovering trends and relationships not addressed in previous studies. Long-term relationships and trends were addressed using temperature and suicide rates from previous studies in J apan and Finland. No trends were shared between locations, indicating more variables than solely temperature were in play. More data, locations, and variables need to be included to make claims regarding suicide rate's relationship to temperature. This meta-analysis study has the potential to raise awareness towards the mental health effects caused by temperature changes, but also incite future studies to strengthen the conclusions made.

The Effect of Delayed Setting on the Chemical Plume of Sinking Marine Snow

BAILEY BASS and Jennifer C. Prairie and Nicholas Battista

Aggregates formed from phytoplankton in the surface ocean, often referred to as marine snow, play an important role in transferring carbon from surface waters to the deep ocean. Marine snow is a key food source for copepods, a common type of zooplankton. Copepods can use chemical sensing to detect marine snow, which leave plumes of organic solutes as they sink through the water (Turner 2015). However, marine snow does not always sink at a constant rate; previous studies have shown that these particles can slow down at sharp density gradients through a process called delayed settling (Prairie et al. 2013). This change in settling velocity may change the chemical plume left by sinking marine snow, thus affecting the potential for copepods to find and eat these particles. In this study, we mathematically modeled the concentration of organic solutes originating from a sinking aggregate to determine how the shape of its chemical plume is affected by delayed settling. Our model uses the advection-diffusion equation in spherical coordinates, applying boundary conditions for when the radius is equal to the that of the aggregate and when the radius is very large. We then solved the equation numerically using the finite difference method in MATLAB. Here, we present our results showing how the chemical plume changes over time and compare our findings to previous work done with a steady-state model. Our findings can help explain how delayed settling may impact a copepod's ability to locate marine snow, and ultimately the marine carbon cycle.

The Effect of ENSO on the Diet Composition of the Thresher Shark (Alopias spp.) in the California Current System

EMILY PIPKIN and Andrew Nosal

The El Niño Southern Oscillation (ENSO) cycle affects oceanic conditions including upwelling intensity, fish abundance, and productivity in the California Current System. Understanding how physical factors drive biological processes and trophic dynamics can help us better understand how future ocean conditions may impact ecologically and commercially important fish stocks. Few studies have analyzed the effect of ENSO on the diet composition and feeding habits of large predatory fishes. The purpose of this project was to study the impact of ENSO on the diet of the thresher shark (Alopias spp.) through a meta-analysis by relating diet composition data from different study periods to their corresponding oceanic conditions. The ENSO indices were taken and averaged for each study's sampling period, and the diet composition for each study was calculated by separating the prey items into two categories: cephalopods or fishes. No significant relationships were found, but there was a general trend of more cephalopods being consumed during strong La Niña years. These findings are consistent with previous studies which found that there tend to be more cephalopods in the California Current System in La Niña years for sharks to eat. These results can help us understand how ENSO affects ecological community interactions and trophic dynamics in the California Current System, which makes us better prepared to plan for the future.

The Effect of Universities' Sustainability Initiatives on Student Knowledge and Involvement Regarding Sustainability: a meta-analysis

Mia Westphal and Andrew Nosal

Sustainable initiatives at higher education institutions play a significant role in students' knowledge of and engagement with sustainability and environmental issues. Universities across the globe have conducted individual studies that address how their respective sustainability efforts have affected the student body. However, a global meta-analysis regarding patterns between institutional efforts and student populations is lacking. The purpose of this paper is to determine whether sustainability efforts at various global higher education institutions affect student's involvement in and knowledge about sustainability. Survey response data were collected from nine different studies at varying universities. The universities differ in annual budgets, student population size, and location thus making the study of these parameters in conjunction a novel meta-analysis. Average survey responses were converted to a 5-point Likert scale for simplified translation of data. University sustainability scores were calculated by determining the existence of sustainability-related parameters at institutions such as "recycling programs" and "green-building infrastructure". The analysis found that no significant relationship between university sustainability efforts and students' knowledge and involvement were found. Comparing survey responses across a multitude of global institutions is helpful in discovering how different sustainability initiatives at universities can consequently encourage engagement and improved knowledge on the student level. Information from this study could also be helpful for future policy or investment proposals for sustainable campus initiatives in the future.

The Effects of Seabirds on *Cylindropuntia Bigelovii* Growth

TATIANA THOMAS and Drew Talley

Baja California, Mexico is home to over 120 species of cacti. One ecoregion, which includes the Bahía de los Ángeles (BDLA) International Biosphere Reserve, harbors no less than 75 endemic cactus species. While studies have shown that there is an interaction between seabird activity and annual plant growth, this interaction has not been investigated for perennial plants, including the endangered Teddy bear Cholla (*Cylindropuntia bigelovii)*. This research focused on mining data in an unused dataset on cacti in BDLA, which included 8,000 observations spanning 25 years, to explore if the presence of seabirds on an island affects the growth rates of *C. bigelovii*. A very preliminary analysis of a small subset of these data, comparing 1996 to 2009, revealed a trend towards greater growth and much greater variability on islands without heavy bird use, relative to those with. Future analyses of these data will include all years for which data exist, as well as integrating mortality data to better understand the interaction between bird use effects. These data will provide important insight into controls on the population dynamics of this endangered species in the biosphere reserve.

The Relationships Between Climate Variability and Soil Element Concentrations Across Four Climate Regions in the United States

Madison Brown and Jennifer Prairie

Global temperature and precipitation variability not only has profound impacts on biota; but, recent studies have shown changing climate has produced significant changes in nutrient cycling and soil chemistry. This study examines the elemental concentrations of Al, Ca, K, Fe, and total C within four different climate regions across the United States (Northeast, Northern Plains/ Rockies, Southeast, and West) and compares the elemental concentrations in soil horizon A to precipitation and atmospheric temperature data from the U.S. Climate Data database. All elemental concentrations were obtained from the USGS. Results from the correlation tests showed that only one element (total C) had a significant relationship with temperature. Total C concentration had a significant negative relationship with temperature (p-value= 0.46, r=-0.17). All of the other elements no relationship with temperature and a positive correlation (Al: p-value=0.0006, r=0.70; Ca: p-value= 0.0004, r=0.72; Fe: p-value=0.03, r=0.48; K: p-value= 0.0001, r=0.76). Correlation tests results for element concentration vs. total annual precipitation found that all elements had a significant relationship. However, only total Carbon had a significant positive correlation (p-value=0.23 r=0.29). The remaining element concentrations all had significant negative relationships (Al: p-value= 0.09 r=-0.39; Ca: p-value= 0.11 r=-0.37; Fe: p-value=0.21 r=-0.29; K: p-value= 0.07 r=-0.41). Studies determining the relationships between elemental concentrations in soils and climate variability are becoming increasingly important for agriculture, groundwater protection, flood prevention, and are of critical importance to many of Earth's ecosystems.

Tree Mortality in the Sierra Nevada Mountain Range in relation to Insect Intrusion and Wildfires.

Anne Serrano and Ron Kaufmann

Forests are vital ecosystem regulators that stabilize the water cycle and climate, are home to a variety of organisms, and help to minimize carbon emissions. The California Sierra Nevada Mountain Range extends for around 400 kilometers and houses a wide array of tree species. Like many other organisms, trees are subject to environmental stressors, and in the past 50 years these have led to increased mortality of tree species. By understanding climatic disturbances within the Sierra Nevada Mountains, we can be better equipped to reduce tree morality. Defined disturbances such as increased wildfires and insect invasion in the last decade have been thought to adversely affecting the health, density, and diversity of tree species across the state. In order to confirm or deny these assumptions, data for this research was gathered every 50 kilometers across the entire Sierra Nevada Mountain Range. The data set is comprised of physically counting dead trees and identifying their cause of death with the categories of fire detections or clear insect disruption. For every 10 kilometers in the 2009 and 2019, this counting process was replicated for every 50-kilometer section. Through Geographic Information System analysis, both graphical analysis and relationship strength tests were conducted. According to the analysis, low relationships between fire detections and insects and tree mortality was concluded. However, the factors of insects and wildfires may only be a small part of the problem; including disturbances such as precipitation and climate change compounded with fires and insects may give insight into a more comprehensive study.

Using Unmanned Aerial Vehicles (UAVs) To Estimate Densities of Two Threatened Cactus Species in the Pinacate Biosphere Reserve, Sonora, Mexico

LEAH BARKAI, Paul Dayton, Ed Parnell, and Drew M. Talley

There are around 1400 species of cacti worldwide, and nearly half - 669 species - are found in Mexico, with 518 (77%) being endemic. This project focused on changes in cactus populations in the Mexican Sonora Desert between 2006 and 2019. The densities of two threatened cactus species, the saguaro (*Carnegiea gigantea*) and the teddy bear cholla (*Cylindropuntia bigelovii*), were recorded in the Pinacate Biosphere Reserve. Cacti were censused by analyzing photos from an Unmanned Aerial Vehicle ('drone'). Raw images were imported into ArcGIS Pro and stitched together to create a high-resolution map of all individuals in the ~100 km2 study area. We compared data from these images to densities recorded from on-the-ground surveys in 2006. Population declines were detected for both cacti (*C. bigelovii* populations decreased by 37%, and *C. gigantea* by 61%) between 2006 and 2019. To address concerns about the change in methodology between censuses, we used historical census data for *C. bigelovii* that were available for the years 2004, 2014, and 2018 from a small (~0.001 km2) study site nearby called Cactus Junction. A decline in *C. bigelovii* populations at Cactus Junction (~77% decrease between 2004 and 2018) suggests that the changes noted are not strictly a function of methodology. Precipitation data were analyzed as a possible explanation for these declines; however, my results showed no significant correlation between rainfall and cactus density. Additional surveys across a broader geographic region and comparing methodologies may provide insights into the cause of the decline in cactus.

Varying Tropical Storm Intensity and its Impacts on Local Fish Abundance on Moorea Coral Reef

ISABELLE DELUCA and Jennifer Prairie

Coral reefs are important ecosystems and are sensitive to climatic disturbances such as tropical storms. These phenomena are projected to become more frequent and intense as a result of climate change. By understanding potential biological impacts of climate-driven events, we can better predict future consequences. Disturbances that lead to loss in coral cover and consequently, loss of abundance within fish species can have detrimental effects on the health of a reef community. This study focused on Moorea Coral Reef in the South Pacific, aiming to explore the local coral reef fish abundance in relation to tropical storms of varying intensity. Data were gathered for 6 recent tropical storms that occurred in the area, with the intensity of each classified based on the storm's lowest measured pressure. These data were analyzed in relation to fish abundance records collected annually from 2006 to 2018. Percent change and total count of fish abundance from the reef were calculated. There was no statistically significant correlation between storm intensity and fish abundance for the 6 storms considered in this study. However, results from similar, more extensive studies indicate that tropical storms have varying negative impacts on coral reefs and coral reef fish species. Analyzing an expanded set of both fish abundance data and storm events may be necessary to characterize the relationship between storm intensity and populations of coral reef fishes.

Vertical Distribution of Soupfin Shark (Galeorhinus galeus) Off Southern California

ALYSSA A.K. VENERI and Andrew P. Nosal

Pelagic fish species commonly perform diel vertical migration (DVM), a common diving behavior performed daily where they inhabit surface waters at night and deeper waters (below 100m) during the day, with an abrupt descent at dawn and ascent at dusk. Less is known about the diving behavior of coastal species inhabiting shallower water over the continental shelf, such as the critically endangered soupfin shark (*Galeorhinus galeus*). In this study, we tagged 13 adult female soupfin sharks with pop-up satellite archival (PSAT) tags off La Jolla, California, USA. Tag deployment averaged 91.31±66.69 days. We analyzed the depth and temperature data recorded by shark-borne tags in R. The diving behavior of all 13 sharks resembled DVM (deeper during the day than at night), but on a much shallower scale of 5-10m and with gradual, not abrupt, descents at dawn and ascents at dusk. The sharks' depth was strongly correlated with solar elevation angle, which we believe is a hunting strategy. Soupfin sharks feed primarily on forage fish, whose silhouettes may be most visible by the sharks by descending deeper as the sun rises to maintain optimal contrast. This shallow variation of DVM was not expected, given previous work on the closely related (Family *Triakidae*) and sympatric leopard shark (*Triakis semifasciata)*, which exhibits reverse DVM, occupying warm shallow water during the day and descending into nearby submarine canyons at night to feed on squid. This study serves as a foundation for future studies to investigate soupfin shark diving behavior.

Well-Ordered Nickel Nanotube Electrodes as Non-Enzymatic Glucose Sensor

DEVIN THRUSH, Eleanor Gillette

With the inception of the first enzymatic glucose sensor in 1962, enzyme-derived blood glucose sensors have remained dominant in treatment and care of Diabetic conditions. These systems provide well understood and quantifiable detection mechanism with excellent accuracy and precision at concentrations near 7.8 millimolar. The natural selectivity of enzymes enables this accuracy and precision even in the presence of significant mixings of non-sugar substrates found in blood. However, the enzymes must be harvested from cell cultures, inflating manufacturing needs for manpower, nutrients, energy, and time, which must necessarily be passed on to consumers as cost. Post production, enzyme derived electrodes require specific storage environments to prevent denaturation of the enzymes. A Non-enzymatic based electrode may provide a far simpler manufacturing process, with metal based electrodes currently of significant interest. Current literature demonstrates the ability to control electrode properties through alloying of materials and manipulation of nanostructure among other factors. In this presentation we will discuss ongoing efforts to construct a nonenzymatic glucose sensor derived from well-ordered nickel nanotube structures generated from electrodeposition in aluminum anopore filter discs. Usage of electrochemical methods such as Cyclic Voltammetry has demonstrated stable and predictable reactivity with glucose in a significant range of solution acidities, from biological to heavily basic (7-14). The spectroscopic method SEIR (Surface Enhanced Infrared Spectroscopy) is currently under investigation as a method to probe reaction mechanisms on the electrode surface. Electrode mounting issues remain apparent, though methods of data collection and qualification have been established for continued study.

Humanities

A Cowboy's Life For Me?: Reclaiming the Classic American Outlaw

CLAIRE DUQUE and Atreyee Phukan

In early 2019, American rapper Lil Nas X made waves with the release of his viral, award-winning hip-hop/country crossover hit, "Old Town Road (Remix)." Black and openly gay, Lil Nas X both stunned and inspired an audience unaccustomed to seeing someone like him decked out in full rhinestone cowboy regalia. Few figures of American history have been as mythologized and romanticized as the cowboy, typically depicted as a lone, gunslinging, hypermasculine white man on horseback. However, the reality underneath the cowboy mystique is much closer to Lil Nas X than John Wayne-many cowboys were people of color, and many were queer. The term "outlaw" most basically refers to a person existing outside of the protection of the law, and is a status that has long been a position of refuge for those whom the law does not protect. That cowboys lived in an "other" society removed from civilization is a quality shared with the Atlantic pirates of the late seventeenth and early eighteenth centuries, another community that has suffered the queer erasure and whitewashing of history. My research seeks to challenge the conceptions we have of these classic American outlaws and explore their modern day reclamation and cultural revival, reflected in media like Black Sails and Brokeback Mountain. Finally, I aim to discuss the inherent personal freedom that occurs in the separation from a society in which shame and degradation are legally weaponized against the oppressed.

A Critical Examination of the Perversion of Antiquity by the National Socialist Party of Germany, its Promulgation in the Third Reich and its Perpetuation in Modernity

RUBY MEYER, Clara Oberle, and Ryan Abrecht

This paper examines the misuse of antiquity by the Third Reich and how these constructed, insidious ideas derived from antiquity, built in Nazi scholarship in the 1930s, echo into contemporary U.S politics despite having no formal support of a government unlike they once did. Thus far, the most helpful finding in my research can be labeled as the "narrative template of decline and regeneration," as historian Helen Roche coined it. That is to say, scholars of the Third Reich created a web of ideas derived from ancient Greece to soothe away the anxieties of post-WWI Germany and provide themselves and their fellow citizens with a vision of the future. This vision of the future and of "regeneration" complimented their rising and increasingly racialized nationalism. This vision was in turn developed into a plan of action by Nazi officials, who were eager to solidify their power and willing to weaponize antiquity in order to do so. Ultimately, this paper aims to provide the base of knowledge to critically examine neo-Nazism today, especially where it concerns the integrated aspects of antiquity-whether or not these ancient references are consciously interwoven into the rhetoric and behavior of the alt-right. The need for this kind of research is pressing. Indeed, as neo-Nazism becomes an ever more relevant threat, our collective knowledge of the historical roots and narrative of this most dangerous political movement must increase too and can serve as a form of resistance to this kind of politics.

A Machiavellian Smile or a Contagious Laugh? The Art of Gaining Power: a Sociolinguistic Analysis of Feminine Power in Emile Zola's Nana (1880)

MAISY FEELEY and Eliza Smith

In the naturalist French novel, Nana (1880) by Emile Zola, the women characters, Nana and Sabine, are each posed as a foil for the other. Nana is an extroverted prostitute outwardly raging war against a patriarchal society, while Sabine seems to accept relentless objectification by her husband and the men around her as a perfectly doting bourgeois wife and mother. In a novel full of historical, social, and political significance, I implement a sociolinguistic and sociohistorical approach in my analysis of Nana and Sabine and their subversion of societal expectations through their language, body, and participation in the institutions of marriage and motherhood. My research provides insight into how each woman either indexes their expected role or undermines it in relation to nineteenth-century societal conventions in France. Through this hybrid lens, I argue that neither Sabine nor Nana fulfill a simplified social role as expected and, in fact, their possession of power (or lack thereof) must be more finely deduced from key indexical elements such as the body and language. Furthermore, by analyzing Nana from a sociolinguistic point-of-view, I reveal the ways in which the novel's conclusion of Nana's ultimate rejection from society and Sabine's increase in power (a conclusion that aligns perfectly with Zola's naturalist vision), stems directly from their polarized ways of expressing agency in a man's world.

A Stolen Crown: Sexism, the Enlightenment, and Catherine the Great

RACHEL STEINHEISER and T.J. Tallie

This review of both the actual history of and the scholarship regarding the reign of Catherine the Great addresses the question of whether Catherine was truly an enlightened despot. An enlightened despot is generally considered to be a monarch who absorbed the ideals of the 18th century Enlightenment and implemented reforms for the good of the people, rather than for their own personal benefit. Through the discussion of five major topics, ample evidence is provided to suggest that Catherine was genuinely an enlightened despot. Those topics include the following: Catherine's use of propaganda, the impact of sexism and gender bias both on the primary sources that historians use to inform themselves, as well as how sexism has pervaded the works of historians, the changing interpretations of what constitutes an enlightened despot, and Catherine's policies and works she dedicated herself to throughout her reign in the 18th century.

Crazed Criminality: The Allure of Psychiatric Disability in Horror

MCKENNA MORET Atreyee Phukan and Mary Hotz

This project seeks to explore the link between evil, criminality, and mental illness that often appears in the horror genre. There is a link between evildoings and psychiatric disability that leads to a public perception of those with psychiatric differences as dangerous, out of control, and capable of acts no other would commit. I argue that this intrinsic otherness is projected onto unknowing and well-versed audiences alike through tropes such as the homicidal maniac, the escaped psychiatric patient, and associations of the supernatural with psychiatric conditions. The sources investigated here will include the Stephen King novels Carrie and Misery and three horror films, The Roommate, Fatal Attraction, and The Lodge, all of which use explicit or implied mentally ill persons to reveal the villain's motivations. Ideas such as stigmatization, taboos, and gender roles will contribute significantly to the analyses of these sources. This project seeks to better understand the conscious and unconscious association of psychiatric conditions and evil, but also to question whether there is an appropriate way to incorporate mental health into the horror genre. Is it inherently problematic to use mental illness as a trope in horror, or is it something that can be done in a way that facilitates thoughtfulness and education about psychiatric disability? The goal is to investigate the potential consequences of its representations of mental health conditions and ultimately better understand the place of tropes concerning them, even if they do not have a place at all.

Defending Public Health: The Lessons learned from COVID-19 in Italy and the U.S.

ALEXANDRA RETODO and Loredana Di Martino

The consequences of the COVID-19 pandemic highlight an urgent need for the reevaluation of the human conceptualization of health and our strategy for building systems that must protect it. The focus of this project is to analyze the Italian healthcare system (Sistema Sanitario Nazionale, SSN) in comparison with that of the United States and use them as a model to exemplify the global need to change our notion of health and wellbeing. Healthcare, especially in a pandemic, should not be a commodity. The U.S. follows a hybrid health system that is based primarily on private funds. Italy, on the other hand, has a strong universal public health system. Yet, the lack of preparedness in some areas, generated by recent economic and political austerity measures, was determinant to the outcomes of Italy's response to the pandemic. As I will contend, there are, however, other significant social determinants to health care. My claim is based on the theory of "Circular Health" elaborated by Italian virologist Ilaria Capua, who argues that the health of humans, animals, plants and the environment are interdependent. According to this theory, there is strong evidence that the mutualistic relationship between plants, animals, and humans contributed to the SARS-CoV-2 pandemic. Understanding this notion fully can also help find rational solutions for the future. In order to best treat and care for the wellbeing of all interconnected groups, there must be a cultural shift emphasizing an expansion in knowledge and increase in concrete actions towards social development.

El Rey Embrujado: Royal Inbreeding and Witchcraft in the Spanish Habsburg Court

EMILIA GONZALEZ and Molly McClain

My research centers on the fascinating character, El Embrujado (The Bewitched) King Carlos II of Spain (1661-1700, r.1665-1700) from the Austrian Royal House of Habsburg (1282-1918). King Carlos II, cursed with the widely recognized Habsburg practice of centuries of generational "royal inbreeding", consequently inherited a life of torment rooted in his severe mental disabilities and physical abnormalities; which in return earned him the epithet of "The Bewitched." In the sphere of modern age curiosities, a group of characters known as Gente de Placer (people for pleasure), who were often labeled as "monsters","strange" and "freakish" surfaced onto the royal courts with the purpose to entertain kings and courtiers through their physical and behavioral abnormalities. Interestingly, Carlos II was born with both physical and mental conditions that mirrored those in the gente de placer?? who were regularly hired as novelties by the royal courts for the purpose of amusement, entertainment and in some cases, validation of superiority. Witchcraft and other supernatural elements served as a scapegoat for monarchs and the common people of Spain as they were forced to reconcile the idea of their disabled king"s divine right to preserve an already deteriorating empire with the notion that those disabled were "monsters" and inferior.

From Sustenance to Decadence: A Literary Exploration of Modern Lifestyles Driving Climate Change, Media's Propagandized Involvement, and Reconnecting with Nature as a Potential Solution

SAMUEL HIXON and Brad Melekian

In the last 250 of the 200,000 years humans have inhabited the earth, climate change has grown from an inadvertent byproduct of industrial and technological progress to a well-understood consequence of our modern lifestyles that, if unaddressed, threatens to extinguish its human authors. This study draws from an array of literary and scientific sources to examine the modern consumerist lifestyle, the media's role in creating it, and the causal relation of such a lifestyle to anthropogenic climate change. Henry David Thoreau's criticisms of 19th century New England society will be used as an anachronistic lens, with specific focus on the notion of an uncritically accepted lifestyle which strays far from necessity. Next the role of modern media in proliferating consumerist lifestyles and neoliberal ideologies is examined. Finally anthropogenic climate change is detailed as a consequence of ubiquitous modern consumerism, and reconnection with nature is investigated as a potential solution.

Glittering Mirrors of Divinity: A Case Study of Three Female Mystics and their Negotiations of Authority in Medieval Christianity

VIVIEN VAUCHER and Ryan Abrecht

Much of medieval Christian historiography centers on formal clerical figures in Christianity and often lacks focus on women and their important spiritual roles. My research investigates the lives of Christian female mystics in the Middle Ages and how expectations of gender and imbalance of power between clergy and laity shaped their roles in their own communities and within the greater church. More specifically, how were female mystics' community roles influenced by their gender and their connection, or lack thereof, to the church? My work focuses on three women, Hildegard von Bingen, Julian of Norwich, and Marguerite Porete, in order to develop a specific understanding of how lay mystics and clergywomen negotiated space and belonging within their communities. Although women can be held back by their gender within the Christian church, I argue that instead of being held back, these mystics utilized spirituality to make claims to religious authority rather than making appeals to the institution of Christianity. With this focused gendered lens, I intend for my research to provide commentary specific to clergy and laywomen, as well as engage in a larger discourse surrounding medieval women's claims to Christian authority.

Guns and Steel: The Makings of the American Military-Industrial Complex

Brett Ralls and Ryan Abrecht

As we move into the year 2021, we as a country find ourselves all around the globe in many aspects. From economic policy to a diplomatic presence, the American flag stretches far and wide across the globe. We currently have roughly 800 military bases located outside of the United States, which are located in over 80 countries worldwide. A staggering number when you start to think about it, not to mention the money allocated to keep our military machine humming, which according to the Department of Defense 2021 budget is around $740 billion for national security. $705 billion is directly going to the Department of Defense alone, and year after year, we find more and more going into our national defense budget. Dwight D. Eisenhower warned the American people of this military-industrial complex in his farewell address and warned that the military machine the U.S. had created following World War II had hurt the country's domestic policies. The United States spend more money than any other nation globally, and for that, we have fallen short within our own country, which has hurt the American people. Eisenhower was right and our current state in foreign policy and military industry are key examples of that. The military-industrial complex has hurt the U.S. economically by putting more dollars into war than domestic spending, militarily with endless conflicts, and politically within congress since that time following the World War II.

How the 2017 Revival of the #MeToo Movement Fails Black Women

KC MCQUAID and Ryan Abrecht

This paper will examine the 2017 revival of the MeToo Movement as it relates to the different experiences held by white women and black women in America. These two groups are compared by: their status in the eyes of the white patriarchy, their access to obtain help, and whether they were given justice. In this paper, justice is interpreted as whether the courts found in favor of the survivor, decided on a genuine punishment for the attacker, and if any change in legislation, policy, or treatment occurred. My paper examines the different experiences of white women and black women during the 19th century in America. The 19th and 20th century portion will briefly assess early women's rights movements. The next part of the paper goes into the ways that sexual assault cases of black women were handled before the 2017 revival of the MeToo Movement. In particular, I look at who was believed in various cases. The third part of my paper introduces the context of the MeToo Movement's revival and then examines any changes in the experience of black women and white women survivors. Then I show how the latter comparisons to prove that while the condition of white women has improved, the MeToo Movement has not done enough for black women survivors. A focal point of this analysis will be how the white patriarchy has enabled the sexual assault of women and that only giving justice to certain women can help to reaffirm the white patriarchy's existence.

I'm You, You're Me, and the Greater We: A Work of Identity And Belonging From a Muslim-American Perspective

SHAN ALI MALIK and Atreyee Phukan

The Western world is experiencing a resurgence of accepted nationalist and xenophobic fervor, which calls into question the issues surrounding the themes of patriotism, purity, and homogeneity. Immigrants and religious minorities are the targets and scapegoats for national fears and alienation. Our society still is affected by deeply rooted and conspicuous and subconscious nationalism and persistent cultural discrimination towards specific peoples and identities, and has profoundly affected Muslims in America. Islamic immigrants and culture remain widely discriminated against and misunderstood. This begs the question, what does it mean to be American? Is there an established set of national characteristics in a country defined by "cross-cultural contamination?" I will conduct research into the meanings and consequences of the topic of identity from the political backgrounds and contexts of the world that I and individuals of Muslim and immigrant background have seen, and the world events that have personally affected us and shaped our outlook on the theme of belonging. Exploring my own personal experiences as well as those of similar backgrounds, ongoing cultural and political conflicts that continue to surround identity in the US will be researched, and the importance of umma as an Islamic way of life and concept of community and its benefits for the greater society. I will engage in a holistic study of what the meaning of identity and belonging in our undeniably multiethnic American society are, especially within the historical context of the War on Terror years up to its continuation into the present day.

In Order To Graduate: Happiness Symposium

Noah Stroosma and Atreyee Phukan

My big research question is: what is the key to happiness. I am using a symposium based off of Plato's Love Symposium in order to explore this concept from many different lenses. These different lenses will all be explored through the "Stairwell Seven", a set of unique characters within my symposium. A symposium is a drinking party where everyone gives a speech on the same subject. I would set this in a modern day atmosphere of a 10 year high school reunion. A group of friends will be drinking and reconnecting, when one of them poses the question: what is the key to being happy? This group of friends for my purpose will have had very little contact over the last ten years. Also they will all have chosen different paths in life. Each of my characters will deliver a short speech explaining their point of view. The views I would like to explore are that the key to being happy is either purpose, freedom, simplicity, fame and fortune, power, living in the moment, and individual validation through self love. My corresponding speakers would then be a mechanic who went to trade school, a nature photographer, a farmer, a musician or actor, an ambitious CEO, a surfer, and an artist. I will also have one more speaker who's role will be similar to that of Alcibiades in Plato's symposium. Please enjoy my symposium, and reflect on which argument is most agreeable for long lasting happiness.

Looking Into the History of Type I Diabetic Medical Devices: From the Development of Synthetic Insulin to the Artificial Pancreas

GARRETT KURTZ and Kenneth Serbin

While Type I diabetes is an autoimmune disease that deprives a patient of a key hormone, insulin, it often is confused with its more common brother, Type II diabetes. It is important to highlight the two diseases as distinctly different, yet it is also imperative to recognize the Type I diabetic disease community independently. Research regarding the impact of medical devices within this disease community is rather thin; most of the literature is focused on either the present-day devices or the discovery of insulin, there is few accounts that provide a greater understanding of these devices and their social impact. Thus, this project answers the question of how these devices came about and specifically sheds light on the development of the Type I diabetic device industry over the past century. Not only does this thesis track, relate, and analyze key breakthroughs within the field in order for one to understand the development of modern diabetic medical devices, it highlights Type I diabetics themselves. Technological advancement within the medicinal field has crucially revolutionized the Type I diabetic device industry and has allowed patients to live a normal life with much fewer restrictions compared to previous eras. While these devices are currently at work in the diabetic sector, the development of the artificial pancreas (the first subcutaneous AI controlled organ) provides hope to other areas of medicine and disease communities in the future who seek to use similar devices in order to deliver other types of medication.

McCarthyism & Political Bias in Higher Education

Noah Kracht and Kathryn Statler

The American school system has a direct line to cultural norms in our culture. The education curriculum during the Cold War, was centered around political ideologies. The classroom environments and ability for professors to expose students to ideas about democracies and communist nations was a dangerous environment. The concept of political bias in school is something we are no stranger to today. McCarthyism and the massive witch hunt for those with taboo political leanings is a well documented phenomenon that has had an effect on our political discourse in academia. The relevance of this research to American society today is clear, as higher education in particular is a place in which fear of certain ideas, and a refusal to engage in a healthy debate should never be something that takes place in American education. A comprehensive study of one America's most notorious fear campaigns, and its effect on America's political culture and system of education is a great way to bring attention to what could happen if any particular idea is ostracized and "othered" the same way communists and the communist system was during the Cold War. It is important to the field of history itself in that all views and sides of a narrative are fairly examined and understood.

Multilingualism An Opportunity or a Barrier

KATERYNA KOLIESNIKOVA and Sara Hasselbach

In my research paper, I want to answer the following questions: What are the opportunities and challenges presented by multilingualism? How might multilingualism benefit individuals, enhance communities, enrich cultures and foster social cohesion? To what extent might multilingualism disadvantage individuals, dilute culture, divide communities, or fragment societies? The end of the XX - the beginning of the XXI century is characterized by intensive globalization processes associated with a mass migration of the population. An essential component of these processes is active linguistic contacts between ethnic groups, which leads to a large-scale spread of multilingualism and its varieties on our planet's territory. Multilingualism is an opportunity for communities, groups, institutions, and individuals to consistently use more than one language and apply them in everyday life. Multilingualism is becoming increasingly essential and becoming an integral attribute of the modern information society: approximately 75% of the world's population speaks two or more languages. Consequently, multilingualism is a natural phenomenon and a subject of study for a large number of researchers. Every language expresses ideas in its own particular manner, giving us the ability to see things from another angle, thus allowing us to gain new insights into ourselves, our native culture, and the world. It can spark creativity and give individuals an exciting new window to view the world and make decisions.

Neglect at the U.S.-Mexico Border: How Children of Immigrants Are Harmed by an Incomplete Look at Immigration History

ALEXANDRA KRACOFF and David Miller

Many scholars have written about the controversy of immigration and, while the literature on immigration focuses on many different aspects, children are seldom mentioned in this literature. When children are mentioned, they are not directly focused on, which is problematic considering children are often at the center of the immigration controversy. What are the consequences and implications of children going unaddressed in immigration literature even though they are at the center of the issue? The events currently occurring at the U.S.-Mexico border have shown that children are too often inadvertent casualties of exclusionary immigration policies that only directly mention these children's parents. Decades of anti-immigrant policy have created a disregard for the children of immigrants as the public does not understand the scope of how they are affected and the lawmakers do not acknowledge the harm of the laws they are creating. It is important to bring children to the center of immigration research because they are the ones being affected by these exclusionary immigration policies; moreover, the children of immigrants are often overlooked because they do not fit the standard negative stereotypes about immigrants, so there is no space for them in how Americans have historically come to learn to think about immigrants, causing them to be left out of the literature. The gap in immigration literature in the United States is an explanation for the exclusionary policies currently in place that neglect the overall health and safety of the children of immigrants at the U.S.-Mexico border.

Poetry: Untranslatable Beauty

YITING CHENG and Atreyee Phukan

Poetry's concise style allows poets to conceal the strong emotion and meaningful symbols in the short but beautiful texts. Yet, in this paper, I am going to argue that poetry is not easy to be translated by translators, especially by those some who are not even poets. If the poets do not translate their poems by themselves, the translated version may seem like a completely new poem due to a translators' subjectivity. Moreover, translation studies are not only about linguistics and philology but also about cultural expression, politics, and nations, which Emily Apter has argued in her book The Translation Zone: A New Comparative Literature. Thus, even poets themselves may have no way to translate their original poems into other languages due to expressional differences. This paper also explores what if the translations of poems that do not work well in poetry and use unsuccessful translated poems as examples to see what the problems are. Indeed, not all poems cannot be translated successfully. There are still some types of translated poems that work well as the original poems, such as the poems with no unique cultural and historical meaning and expression and the poems that have no rhyme, sound, and the poems without specific shapes and forms. In this paper, I will ask how original poems become altered through translations, and whether the "beauty" of a poem's integrity is lost.

Sex Work in World War II: Criminalized at Home and Commended Abroad

LINNEA LEIDY and Kathryn Statler

In this thesis, I illuminate the ways in which the United States government bolstered the sex work industry in France and perpetuated the hypersexualization of French women in order to motivate American soldiers and incentivize them to perform their best on the battlefield. I then point out the ways in which the American government scaled up its policing of the domestic sex work industry during the same time period by using American women in a different but similarly exploitative manner. A crucial link is missing in existing work relating to the topic of World War II sex work industries: the direct comparison between the United States government's attitude towards, portrayal of, and involvement in the sex work industry in France during World War II, and the United States government's attitude towards, portrayal of, and restriction of the sex work industry domestically during World War II. It's important to examine these two research topics, simultaneously, because only in studying the disjunct between the two case studies does it become apparent how readily the US government used and abused women in order to further their international and domestic agendas. While it is important to ensure that justice is served in individual cases of sexual abuse, the United States military was also complicit in the abuses committed by individual offenders and ought to be held accountable as a governmental body, and not solely as a collection of individual 'bad apples' who took part in these atrocities.

Shakespeare and Mercy: Ethics, Aesthetics, and the Asymmetry Claim

EMMA HEFLIN and Maura Giles-Watson

The relationship between ethics and aesthetics is seldom clear. Some philosophers go so far as to deny the relationship altogether, claiming that moral value should have no bearing on aesthetic appraisals of artworks. Others believe that ethical flaws can constitute real aesthetic flaws in a work, but that positive ethical traits are incapable of lending aesthetic merit. This view is otherwise known as the asymmetry claim. I seek to refine this view as it is presented by A.W Eaton in her paper 'Where Ethics and Aesthetics Meet: Titian's Rape of Europa,' by addressing The Merchant of Venice and Titus Andronicus and their treatments of the virtue of mercy. I argue that positive ethical traits may increase the moral understanding of the viewer and lend themselves to establishing aesthetic virtues such as subtlety or harmony in a work. I focus mainly on the characterization of Aaron the Moor in Titus Andronicus, arguing that his virtuous act of sparing his son's life adds invaluable moral complexity and aesthetic merit to an otherwise brutal narrative. The asymmetry claim as Eaton presents it focuses on how works that are propagandistic and attempt to positively influence our ethical behavior are at best aesthetically inert. However, through Shakespeare, I will discuss why it is impossible to assert that all instances of positive ethical traits in art must be of this nature, and how some may truly enhance the aesthetic qualities of a work.

Spirituality: Understanding its Place and Significance in Interdisciplinary Research

LAY CATHERINE and Mary Hotz

In crucial moments of history, entire civilizations have turned to spirituality in all its forms to seek understanding and to find hope. But, in Western society, in particular, spirituality has commonly been defined within a colonialist framework that places the study of spirituality within the academic disciplines of religion and philosophy. In the 21st century, research shows that there is a growing popularity to stray from this tradition and to embrace spirituality as ambiguous and free of structure. There has been a rebirth in the promotion of spiritual practices as they were once explored by ancient societies and are still practiced by Indigenous peoples today. I invite readers to abandon linear frameworks surrounding spirituality and to begin examining it as an interdisciplinary practice connected to the experience of being human and thus free from the worship of deities or adherence to traditional religious practices. My research will explore definitions of 'spirituality' that present it as a human experience, and as a source of collaboration and clarity between humans. I will explore these definitions across the disciplines of history, art, and literature to reveal the inherently humanist, rather than only political, relationship between faith and ways of being. In art displays and performances, the experience that is shared with the audience is so undeniably reflective of the human experience that it is, I argue, innately spiritual. My examination of literature will similarly explore how fictional representations of life produce feelings of togetherness and meaning that are akin to spirituality.

State-Sanctioned Violence against Black Women and Girls

MEREDITH WIGGINS and Channon Miller

Black women and girls can be victims of state-sanctioned violence no matter their age. Yet their experiences with violence are often erased from the media when it comes to analyzing and addressing state-sanctioned violence. They are not treated with the same protection as middle and upper-class white women, in part, because they are often viewed outside the ideal of “womanhood.” Oftentimes Black women and girls are lumped together in a monolith. Yet the enforcement of school discipline policies, which are often based on unfair stereotypes, is a real problem. Black girls are often unfairly targeted by teachers, principals, and school police officers and are disciplined at extremely high rates. Black girls are viewed to need less neutering and protection than white counterparts their same age. The Black experience is significantly shaped by violence, but for Black women and girls, that violence is racialized and gendered. In 2015 the movement #Sayhername was formed to bring awareness to the countless number of Black women and girls who have fallen victim to state-sanctioned violence. Black women are the fastest-growing prison population and thus disproportionate incarceration rates are a serious issue.

The Battle for Humanity for Chinese American

TIFFANY TRUONG and Colin Fisher

The immigrant minority population has countless been subjected to discrimination and inequality throughout American history. Built on the basis of racial stereotyping, Chinese Americans have been a targeted group for many myths that foster the segregation of their community. This unethical and immoral mentality of the minority group is dangerous when coupled with an environmental disaster: the Bubonic Plague. From 1900-1904, San Francisco was struck with the harsh onset of the Plague. Rather than trying to prevent the spread and quickly develop treatment, White city councilmen decided to hide the epidemic and ultimately sacrificed the Chinese population to the disease for their own selfish gains. Does the White-dominated government viewing of the Chinese and Chinese American population as the causation of the plague create an impetus to delay necessary recovery? This is a continuous problem even in modern society, as demonstrated by the ongoing COVID-19 pandemic. As classified as Chinese origin, the current pandemic is eerily similar to the 1900 San Francisco Plague, both being used as outlets for blame on the Chinese population. These mentalities degrade and punish undeservingly on the Asian population, slandering the Asian identity and pride as demonstrated by the rising hate crimes throughout America (e.g., on elders, in Asian plazas, on historical monuments, etc.) Drawing on the inequity of the minority group, my research plans to expose and draw attention to the continuous social injustice and unethical treatment of the White American society.

The Evolution of Magna Carta

ANTHONY SPADINI and Ryan Abrecht

The tale of Magna Carta's role as a stepping stone to modern democracy is an old one, with many prestigious names both championing the Charter as an example of English devotion to liberty and qualifying its impact and relevance to modern democratic values. After centuries of debate, the broad consensus of modern scholars is that Magna Carta owes its existence far more to circumstantial and pragmatic baronial concerns rather than to a cultural inclination towards liberty that would eventually lead to modern democracy. By this understanding, Magna Carta is thus a chance event vaguely pointing towards democracy rather than a progressive stepping stone leading to it. This project aims to complicate the picture by tracking both the origins of Magna Carta in the Twelfth century and its evolution over the course of the Thirteenth and investigating to what degree larger trends towards political freedom influenced both the content and the use of Magna Carta. By putting this famous document in conversation with these trends and other events influenced by them, this project will bring greater balance to our perspective on Magna Carta and deepen our understanding of the origins of our democracy and inspire reflection on how the events of medieval England can inform our continued political evolution in the present day.

The False Reality of the American Dream

SEANTE-BRIANNA MCGLONE and David Miller

How has the narrative of the American Dream shaped economic development for Black people post-Civil War? Slavery ended over 150 years ago and yet there is still minimal progress toward economic equality for black people, why is that? This research paper contributes to the debate on the myth of the American Dream and whether it is achievable for Black Americans. This paper also highlights the dominant discourses of perceived equality and opportunity for black Americans in all backgrounds using sources like W.E.B DuBois' Philadelphia Negro case study. Throughout history, the American Dream has been a central part of American culture and value system. Since the nation's founding, the American people have a prevailing cultural sensibility that has been optimistic and convinced of America's inherent goodness. Using the William Buckley and James Baldwin Debates of 1965, this unique American mythology has Americans believing that this country has made, and continues to make, steady progress toward racial inequality, despite our tragic racial history. Centuries of violent massacres and class dividing rhetoric have paid tribute to this stagnation of progress and closing of the racial wealth gap. Today, large corporations are marketing the American Dream and based the entire American economy around housing, education, and income. Looking back at all of our historically exploitative practices to keep racial discrimination alive, the 'American Dream' was a rising position of power by installing fear and prejudice over another group of people to prevent them from achieving economic equality as the laws change to accommodate people of color.

The Imperative Mood: A Collection of Short Stories

THOMAS DOLAN and Halina Duraj

The United States is an uneasy palimpsest of the West’s myths and stories, with classical and biblical forms scrawled across new geographic and social realities. Yet while these foundational stories continue to enjoy a certain cultural prestige, they are of ever diminishing relevance: The Odyssey is a minivan, Achilles is a tendon, and the Christian narratives––once religious truth––now approach a moral and cultural equivalence with their Greco-Roman counterparts. As particular collections of stories, they have become unmoored from the culture built around them. To investigate the consequences of this transformation, my collection of short stories will take its characters and scenarios from the Christian Bible and Greco-Roman myth, but its logic, priorities, and settings from the American human and their country: freeway construction will become indistinguishable from that of a cathedral, Theseus and the Minotaur will meet the 1998 Tobacco Master Settlement Agreement, and Pontius Pilate will have his writing workshopped. By forcing these foundational sources of the West to occupy the same narrative space, I explore how they are made different, and understood differently, within a culture simultaneously forgetting, rejecting, and reinterpreting them.

The Jezebel and Welfare Queen: The Long-Lasting Effects of Old, Racist Stereotypes during the Coronavirus Pandemic

EMIN BAGHDASSARIANS and Channon Miller

With the coronavirus pandemic at its peak, the veil of American exceptionalism has been lifted. It is now more evident than ever that 'equality' in the United States is only a facade, leaving the most vulnerable group in America to fend for themselves once again. This is not the first time, however, that black women have been the target of societal scrutiny and governmental negligence. The use of negative stereotypes against black women have, including the Jezebel during the slavery era or the Welfare Queen during the 1980s, legitimized their demonization and abuse. Today, the continual problems faced by black women can be traced back to these stereotypes, with more and more women losing their lives to medical malpractice and governmental negligence. By analyzing medical documents, news articles, and personal writings, I showed how these two stereotypes lead to black women being reduced to 'breeders' during the years of slavery and policing their bodies through forced sterilizations during the 1980s. I contextualized these racist ideals in the current political and social climate, with rampant racism in the medical field and lack of aid during a global pandemic that has left many helpless.

The Vietnam War and the Death of Bipartisanship

CAMERON DAVIS and Ryan Abrecht

This project analyzes the death of bipartisanship within the United States government during the Vietnam War, and looks at how these effects continue to negatively impact the domestic political world today. The project features three main sections, with the first focusing on United States entry into the conflict within the context of the domestic political climate. I open with the Gulf of Tonkin incident and subsequent resolution in 1964, which was proposed by President Lyndon B. Johnson and approved by all but two members of the United States Senate, allowing the US to increase its military presence in Southeast Asia without a formal declaration of war. This section closes by focusing on the following four years, leading up to 1968. The next section focuses solely on 1968, and the major events of that year. The year began with a major event ¬– the Tet Offensive – which swung public opinion against the war. The year also featured the assassinations of Martin Luther King, Jr. and Robert F Kennedy, the Democratic National Convention in Chicago and the protests and violence that overshadowed it, Richard Nixon defeating Hubert Humphrey for the White House, and rising social tensions in the United States. My final section looks briefly over the rest of the 20th century and major moments in US politics, such as the Watergate Scandal and how these events furthered the partisan divide within the country; however, it mostly focuses on the modern political climate. I analyze the increase in partisanship from the 1960s to modern day and look at how people like Richard Nixon led directly to the likes of Donald Trump through increased executive powers, and the stubbornness of both parties in working with each other.

The War on Black America

Ezra Roberts and Ryan Abrecht

The federal government has long either worked to or at the very least allowed the oppression of the black community, often to the advantage of other communities developing in the United States. The purpose of this paper is to demonstrate using the War on Drugs (1971-2020), that the federal government has either subtly or outright supported the economic and social oppression of the black community by relying on the legacy of slavery. Many scholars have shown differing opinions on this, Hannah Jones of the 1619 project argues that systematic racism and anti-black racism is built of the legacy of slavery, while Ta-Nehisi Coates of Howard University would argue that the federal government has actually worked to maintain the status quo of the legacy of slavery for economic reasoning, that by keeping black suppressed and uneducated whites and more favored ethnic groups may profit from it. Through this paper and by examining the war on drugs I intend to show that both theories to an extent are true. While systematic racism may be built on the legacy of slavery it is perpetuated for economic benefit by the federal government.

Women in Egypts New Kingdom

KAILA MILLARD and Ryan Abrecht

My paper is a comparative study on the lives and social expectations of women in Ancient Egypt, focusing mainly on the contrasts between the nobility and the common woman. These comparisons are achieved through an analysis of primary (images from tombs, Herodotus etc), and secondary written sources (books, journals), along with primary sources consisting of tomb paintings, statues, and mummified remains. In regards to nobility my focus is mainly on the wives of the pharaohs, In the past the literature and research has focused mainly on the men of Egyptian times (Rameses, Tutankhamen, Khufu, Kafre) but very little has been written about the women (a notable outlier is Hatshepsut). It's important to explore the history of women to dispel any misconceptions and misinformation which may have emerged in the past (most commonly found in Exodus). I believe that the common woman had much more freedom in their daily lives than the women in the upper class did.

Engineering, Math and Computer Science

3D Printing with Recycled Ocean Plastics

Harrison Mello and Frank Jacobitz

The rapid growth of the many large garbage patches in the world's oceans has been of increasing concern over the past several years. According to the National Oceanic and Atmospheric Administration (NOAA), garbage patches are the result of 1.8 trillion tons of discarded plastics being caught in the oceans' natural gyres, which concentrate the plastic waste into large patches in their centers. This plastic intrusion into the oceans harms the delicate ecosystems of the marine habitat. Currently there are multiple initiatives attempting to remove this obscene abundance of plastic; however this results in the secondary issue of relocating the removed plastic waste. This project proposes taking ocean plastic and reprocessing it into different mediums such as filament for 3D printing. The results of this project support additional research on the material quality of ocean plastics; specifically, the different distinctions of polyethylene terephthalate in ocean deterioration and how they can best be recycled. 3D printing provides a unique avenue on how we could utilize discarded plastics. This analysis looks at the manufacturing process of transforming the recovered plastic waste into usable filament through the extrusion process. The culmination of this project's research and testing will result in the production of a usable spool of 3D printing filament that can be useful for a variety of applications.

A low-cost submersible digital holographic microscope for in situ microbial imaging

ALEXANDER RAMIREZ, LIHAO ZHENG, BEN SCHIERMAN, LENA BELVIN, TYLER BURCH, BRANDON DALPORTO, Kent Wallace, Andrew Mullen

Microscopes used for studying environmental microbes are typically designed for use in a laboratory setting, this usually requires extracting a sample from its place of origin before examination. Here we present a low-cost submersible digital holographic microscope (DHM) designed to image small marine organisms (such as bacteria and plankton) in their natural underwater environment. The system achieves sub-micron spatial resolution and uses artificial intelligence for detection and tracking. The instrument also aims to reduce the cost of manufacturing. "Off the shelf" components were selected that provide accurate results without sacrificing data quality. The DHM itself costs under one thousand dollars and features a low-cost high-resolution camera, the Arducam MT9J001, interfaced with our artificial intelligence via a Raspberry Pi and Google Coral Tensorflow accelerator. Preliminary testing indicates data acquisition in our submersible for up to 3 hours at depths upwards of 30 meters. Additionally, our artificial intelligence is currently capable of tracking up to 10 areas of interest in a fraction of a second via the neural net used in combination with the Google Coral.

Analysis of Fresh Water Hydraulic Engineering Development and Impact Through Ancient History

REIJER DEN DULK and Jae Kim

The transportation and use of fresh water has been a critical component to the foundation of civilizations and societies throughout history. The natural and manufactured flow of fresh water has led to the engineering of numerous hydraulic tools that have impacted the structure of power, cultural achievement, and civilization growth globally. This research project focuses on analyzing how fresh water hydraulic engineering has scaled since ancient history and the impact that fresh water storage, transportation equipment, and accessories have had on society. Through the socioeconomic status of the surrounding communities as well as the rate and trajectory of dispersion, this research explores the context that led to the development of new hydraulic inventions. With a combination of historical and manufacturing analysis, hydraulic engineering is illustrated to have vast agricultural and industrial influence. Fresh water hydraulic engineering has aided in the unequal distribution of wealth and furthering of systeming oppression within societies as inventions stretched globally and as the flow of fresh water was manipulated to a greater degree over time.

Design and Testing of a Water Filtration Device Using Plant Xylem to Remove E. Coli

DIANE CASTELLANOS, MIREYA ROBERTO and Frank Jacobitz

"Access to water and sanitation for all" is the sixth United Nations Sustainable Development goal. While most countries have access to water sources, not all of these sources are considered reliable, or clean, by the standards set by the World Health Organization. In Uganda, rural towns often do not have access to clean water from public municipal sources due to the lack of infrastructure and sanitation. Instead, water is obtained from boreholes, wells or surface sources, potentially containing toxic metal or bacterial contamination. The use of such untreated water often leads to diarrheal diseases, one of the leading causes of death in Uganda. Our filtration device is designed to improve the quality of water available in rural Uganda. The device uses organic materials, such as plant xylem, to clean the water from biological contaminants, and also uses locally-available materials for the apparatus. Ongoing work considers solutions for the pressurization of the water to be filtered, securing the xylem in a housing mechanism without water leakage, and testing for the removal of E. Coli in the filtered water. Different pressurization methods to increase the flow rate of water through the xylem sample are being considered. Additionally, four designs for the xylem housing mechanism to avoid leakage are being tested. The removal of E.Coli will then be verified using the final filtration device design.

Developing Water Quality Indices and an Interactive Data Visualization Platform for the Tijuana River Estuary

MARYAM AL KHALEEFA, MOHAMMAD ALAJMI, HUSSAH HASSAN, ABDULRAHMAN ALMUDHAF and Marissa Forbes and Odesma Dalrymple

Trash and Sewage runoff have led to pollution and environmental injustice in the Tijuana River Estuary, which affects the marine organisms, coastal ecosystems, and the habitats surrounding the estuary. The polluted water from the sewage runoff can lead to months of closures of the Imperial Beach shoreline each year. Water quality and nutrient parameters are sampled and monitored from nine stations by the Tijuana River National Estuarine Research Reserve in 15-minute and 30-minute intervals, respectively. The four active stations considered in this project are Boca Rio, Oneonta Slough, South Bay, and Pond eleven. The purpose of this project is to develop water quality indices to improve and assess the interpretation of water quality to the public and create an interface to display the data on an interactive platform. The experimental methods are interviewing experts and researching case studies on the development of water quality indices on existing estuaries. The parameters considered for this project are temperature, pH, dissolved oxygen, turbidity, salinity, orthophosphate, chlorophyll a, and ammonium. We will use and modify the Canadian Council Ministries of Environment and the National Sanitation Foundation methods as they can be utilized for estuaries. Statistical analysis will be conducted to compare the two methods. ArcGIS, Google Earth, and Shiny by RStudio are the interactive platforms considered. The next phase of our project is to calculate the water quality indices using the two methods with the parameters considered and analyze the results and findings.

GTRI Automated Security Testing Platform

BRENTON KEARNEY and HENRY BERGER and IRINA NADONG and SEAN RHOADS and Sean Fitzpatrick and Cezar Danilewski and Jay Kunin and Charles Pateros

When developing software, no matter the purpose or end goal of the program being written, one of the most important aspects of the software development life cycle is testing. Testing can be as minimal or as extensive as one chooses, but proper testing can often require nearly as much time as it takes to write the software itself. While it is necessary to thoroughly test code for an important project, that takes a lot of the developers' time away from focusing on adding new features. For this reason, we are working with the Georgia Tech Research Institute (GTRI) to develop a system that provides automatic security and code quality assurance testing that will reduce the amount of time needed to test programs. The automation process we are developing will create virtual servers and automatically deploy software to those virtual servers in order to complete unit tests in a shorter amount of time. The testing will be done primarily using programs such as OpenSCAP and Sonarqube that we will automatically configure for the needs of the project. Our system is a continuation of the work from a senior project team from 2019-2020, and will likely be continually developed with new features after our completion in the Spring of 2021. The end goal is for GTRI to be able to use this newly developed system with in-house research projects to speed up their own development timelines.

Passive Scalars and Scalar Vectors in Isotropic Turbulence

SABRINA SMITH and Frank Jacobtiz

Turbulent motion of a fluid is characterized by random-like fluctuations, which effectively transport and mix momentum, heat, or mass present in the flow. Often scalar concentration fields are used to describe the presence and evolution of a substance in a flow, e.g. the concentration of heat or salt in the oceans. While the evolution of such scalar quantities is dependent on the velocity field, previous studies have found differences in the dynamics between the velocity vector and scalars quantities. This research project addresses, through volume visualization and statistical analysis, the properties of velocity, scalars, and scalar vectors. Scalar vectors are obtained from three independent scalars by imposing a condition similar to that of mass conservation in the case of an incompressible velocity field. This approach may help to identify the impact of mass conservation on the properties of scalar vectors when introduced into a turbulent field. It was observed that the probability density function (pdf) of the time change of the velocity field (i.e., the fluid acceleration) is more closely related to the pdf of the time change of a scalar vector. This result indicates that scalar vectors more closely resemble the dynamics of the velocity field than passive scalars. This new observation will help to develop a more accurate understanding of how passive scalars evolve in turbulent motion.

Project Pixelated: A Video Game Dedicated to Arcade Culture

NOELLE TUCHSCHERER, BREE HUMPHREY, ABDULQADER KOSHAK, OMRI OR, Erich Waas, and Charles Pateros

In recent years, video games have overtaken music, movies, and television as the most lucrative faction of the entertainment industry, but this widespread success has largely bypassed one form of gaming. The retro arcade was once a hub for casual and hardcore gamers to test their skills against a variety of classic games, but they have become increasingly difficult to come across since the turn of the century. Our game, 'Hi-Score', is designed to recreate the atmosphere of the arcade in gameplay, story, and aesthetic. The 2-D pixelated game is built using the Unity Engine, and will feature levels with game mechanics based on the most popular arcade games of all time. The controls will be simple enough for anyone to grasp while still providing a level of challenge that will satisfy long-time gamers. As such, we hope that this game will encourage both new and veteran players to enjoy arcade culture in all of its pixelated glory.

Qualcomm Computer Science Senior Capstone

AVA GERAMI, EMMA LARA, NICO DENNIS, SHAYDON BODEMAR, VLADIMIR PINCHUK and Chuck Pateros

Qualcomm is a frequent and high-volume purchaser of a variety of expensive software licenses used by their engineers to design their products. Since each of these software licenses as well as their engineers' time are very expensive, Qualcomm seeks to purchase just enough licenses to avoid overspending while also fully equipping their engineers. USD was brought in to help via a Capstone project, with the first of two distinct objectives being to create software to automatically plot tool usage for easy viewing by high-level decision makers. This software has already been implemented, and can be used for a number of different applications as a Python package. Deemed "coolranch", it allows for easy plot generation based on existing data alongside many features for styling such as colors, labels, added lines, variable sizing, and more. The other aspect of this project is to create a User Interface with underlying algorithms to generate profiles representing estimates of what future usage will look like. Deemed "spicynacho", this application will be able to take historical data and create profiles representing estimates of what new and upcoming projects will need. The user will be able to search and edit existing profiles, and create new profiles as modified combinations of historical data. This application is web-based and will take advantage of the prior "coolranch" portion of the project for viewing the profiles as graphs. The end user of this application will be able to scale projects by component, and by ratio when compared to other licenses.

Seeloved1 Video Conferencing Application

ROSALYN ARVIZU, ANDRES RIVERA, TANYA KEVAL, ANDREW BENNETT and Jay Kunin and Chuck Pateros

The COVID-19 pandemic has forced hospitals to restrict family visitations, separating loved ones during times of crisis. Now, these families must rely on video conferencing applications that either do not prioritize ease of use (e.g. Zoom) or are not available across all devices (e.g. FaceTime). This issue is not limited to patients and their families; anyone who is technologically challenged or requiring extra accessibility may struggle using the currently available applications. Seeloved1 is a real-time video conferencing Web application aimed at resolving many of these accessibility issues. This application includes a passwordless login system involving email authentication to provide security for users without them having to manage their passwords. Users have the ability to add and save Contacts for quick 1:1 calls or save Groups to easily call up to 5 others with a single click. Using an open source web conferencing service, we can support calls with up to 6 users. We are implementing only the most essential functions including a self-mute button and chat ability in order to create a video experience that focuses on personal connection. Seeloved1 strives to connect people via video conferencing who have historically run into challenges with technology, accessibility, and software compatibility. By the end of the spring semester, we hope to have a functional Web application with both free and premium options, giving our client a foundational structure that can be both expanded upon and translated into mobile apps.

Simulation of Flow Over a Roughness Element

IAN SYSYN, Patrick Bonner, Frank Jacobitz

A design focus of transportation systems is the reduction of aerodynamic drag forces in order to increase overall energy efficiency. An important component of such work is the transition of laminar to turbulent flows in the boundary layers developing on the vehicles' surfaces. Laminar flows generally result in lower drag forces and higher energy efficiency, but turbulent boundary layers can improve the stability of lift forces generated by airfoils. The laminar to turbulent transition occurs naturally in boundary layers, but the flow can also be tripped to become turbulent by surface roughness, imperfections, or protrusions. This study considers the flow around a cylindrical roughness element under laminar inflow conditions. The simulations aim to reproduce an experiment performed at the German Aerospace Center, which visualizes the transition of the laminar boundary layer ahead of the roughness element to a more vortical flow state in its wake through the use of temperature-sensitive paint. The simulation consists of a Blasius boundary formation ahead of the roughness element and an interaction of the boundary layer with the roughness element. The simulations show the disturbance of the boundary layer by the roughness element and the development of a more complex, vortical wake flow downstream. The analyzed velocity profiles and temperature variations compare with data provided by the German Aerospace Center, with next steps including the comparison of wall shear profiles in order to confirm an accurate simulation model.

Stokes Polytopes

PAYTON ASCH, Sophie Bierly, Tristan Daniels, and Satyan Devadoss

Mathematicians studying combinatorics and topology have been obsessed with the associahedron for the past 30 years. During the SURE program of 2020 we researched a largely unknown set of shapes called Stokes Polytopes containing the associahedron. These shapes fall on a spectrum between the most simple shape, the n-dimensional cube, and the most complex, the n-dimensional associahedron. From papers written by Yuiley Barishnykov, Frederic Chapton, and many others we were able to understand the different ways these shapes are defined. These definitions include Q-compatibility and Hyperplanes derived from polyominoes. Q-compatibility takes two vertices of the shape given and asks if a line exists between them. This definition is great for exploring lower dimensional components (vertices and edges) of the shapes, but is not great if we want to know about the top dimensional (facets and ridges) components. The other definition takes a set of squares that are glued together such that a path of squares is formed, and uses a specific set of rules defined by Barishnykov to extract a set of equations. These equations when considered together are dual to the Stokes Polytope associated with the polyomino. This definition gives a more holistic view of the shape. Our goal is to find a good way to label these shapes and glue them together to create something that we call the Stokes Complex.

The Feasibility of Consumer-Based Carbon Capture Devices

ERIC MCGAW and GABE GOINS and Marissa Forbes

The science, technology, and economics of large scale direct air capture (DAC) have all advanced greatly in the past decade. Since the signing of the Paris Agreement in 2015, 'negative emissions technologies' have become necessary tools for climate mitigation efforts to succeed. The most commercially and economically viable technology to assist these efforts is capturing carbon through Direct Air Capture (DAC). While large-scale DAC devices and systems have been designed, evaluated, and constructed in recent years, small-scale, consumer based devices have not received the same attention as their larger counterparts. This research assesses whether or not a small-scale, consumer-based direct air capture device is technically feasible and economically viable. Recommendations are made for potential future design projects, including a potential Senior Design Capstone Project.

Top Mobile Vision: Cloud Video for Waste Management

MOHAMMED ALJAROUDI, TATIANA BARBONE, FAISAL BINATEEQ, KHALED ALOUMI and Charles Pateros

Waste collection companies across the country collect millions of tons of trash and recycling from residential and commercial customers. Collection service verification is essential to operating efficiently and profitably. However, with any service, missed collections can occur, so companies need to be able to easily investigate and resolve a claim of no service before spending time and other resources to dispatch their assets a second time. The purpose of this project is to develop a software solution for the waste and recycling industry. In partnership with Top Mobile Vision (TMV), this project will integrate with existing cloud-enabled video hardware systems installed on trash and recycling trucks to extract the identifier of each bin as it is collected through the use of QR code stickers. The remote video monitoring system currently offered by TMV is not available when trucks are offline, and collection verification is infeasible without witnessing the bin lift in real time or downloading the videos afterward, which is not time-efficient. To resolve this, our solution offers a web application for complete awareness of what is happening with vehicles and drivers at all times while functioning as a reliable and user-friendly interface. In the future, QR code stickers will be distributed to more bins to reach more customers, which will save time and resources, resulting in higher customer satisfaction.

Usability and Customer Experience for Transportation Systems

Andrew Plaza, Miles Maloney, Raquel Valdez Diaz, Natalie Malmgren

Demand for seamless and intuitive Human-Machine Interfaces (HMI) is increasing for public transportation systems across various cities. Along with this increase in demand is the challenge of improving traveler experience for different user demographics, especially users with disabilities. The current issue is that the transportation interface is too limiting and not as intuitive for people with disabilities to use, and customer experience could improve with a better implementation of HMI methods. To solve this problem, we started by documenting and analyzing the current state of HMI methods and upcoming interactive technologies. We are currently working on implementing gesture recognition and natural language processing concepts to design a contactless virtual ticket agent. This agent will allow the transit rider to have an oral conversation with our device about tickets and passes, initiate a purchase, or find directions to a destination. With this project completed, public transportation systems will be more accessible & HMI will become clearer for Cubic's transportation systems. Customer experience with transportation systems will be improved, especially for those with disabilities.

VillageTech: A Web Application for The Brink SBDC

CADEN KEESE and JORDAN ROSS and GRETTA VON TOBEL and NADEEN ABDULKARIM and Jay Kunin

The Brink SBDC at USD is one of the many San Diego sects that are a part of the Small Business Development Center Network. The SBDC network is part of the Small Business Administration, a United States government agency that provides support to entrepreneurs and small businesses. Today, many entrepreneurs and business clients come to the Brink SBDC looking for business advice and guidance. Consultants at the Brink and other SBDCs provide training, mentoring, and consulting to these business clients. However, these consultants are stuck using antiquated software and are unable to easily distribute information. VillageTech is a web application that would provide a central location for all of its resources. Creating this application will give clients, consultants, and administrators one place to go to view and manage all of their Brink SBDC resources. It will give more organization for these users and allow consultants more time to deal with complex issues with their clients.

Social Sciene and Behavioral Neuroscience

"If we could change ourselves," we can change the world: Empathy and the Possibilities for Transformative Education

ALYSSA MUGAVERO and Carlton Floyd and Thomas Reifer

Our education system emphasizes a set of narratives that promotes profits and power over human needs. A number of scholars, including but not limited James Baldwin, Samuel Bowles and Herbert Gintis, Henry Giroux, Paulo Freire, bell Hooks, and Martha Nussbaum all seem to agree on this point. One might say that we educate to serve some particular societal desire to gain or maintain power over others, and that we do so at the expense of finding agency with others, of seeing our own humanity in others. This educational paradigm produces, alienation, othering, and stratification that increasing poses a threat to the human species and other living things. An alternative equality paradigm, one that recognizes our interdependence, our connectivity, and our need for empathy and cooperation with others may allow for a new sense of genuine sense of belonging, where students and humanity as a whole might thrive and flourish, confronting humanity's urgent challenges and allowing for personal and social transformation on a global scale. Using a sociohistorical, explorative approach, I analyze contemporary practices of education, especially in the United States, with a specific focus on the question of the Other, that is arguably needed if we are to transform education in ways that promoted cooperation and the common good. Specifically, I explore: What can we do pedagogically and more generally to help compassion and empathy become integral to our ways of interacting socially, in ways that allow us to create a better future for students and for all of humanity.

Be Big or Go Home: What Determines the Winner of Fights in Hockey?

JESSICA ONG and Nadav Goldschmied

Aggression, more specifically fights between players, has always been a central part of the NHL. Many spectators enjoy watching fights during hockey games and they make the games more entertaining. Since fighting is such a central part of hockey culture in America, we wanted to analyze various factors that may play a role in the outcome of a fight. By using NHL provided and fan-reported data from hockey fight websites, we ran an archival study of the nature of fights and various interacting factors from the past four seasons of the NHL. We found that there is no home-player advantage when it comes to fan-reported fight outcomes. We also found that although difference in height doesn't predict fight outcome, weight does; the heavier player is more likely to win the fight. Also, we found that the more "one-sided" a fight is (fans decided a clear winner), the fight is perceived as more exhilarating (rated higher by fans). Lastly, fans are more likely to participate (vote on a winner) if a fight is perceived as more exhilarating.

Change of Venue Survey: An Analysis of Appellate Court Transcripts of Murder Trials from 2000-2020

ANNA ANCONA and RILEY BARRANTES and CARA MCCORMICK and Nadav Goldschmied

A court can move the location of the trial to another county if the jury is proven to be biased upon a motion of change of venue. This study surveyed change of venue motions to explore their prevalence and success rates by state. To determine which factors influenced the change of venue success rates, researchers studied court transcripts of appealed Murder convictions from all 50 US states during the 2000-2020 timespan gathered from Nexis Uni. The National success rate of change of venue for these cases was 23.5%, however, it was found that change of venue was filed and granted disproportionately across states. Additionally, the success rate varied by the race of the defendant, as white defendants were more likely to be successful compared to black and latinx defendants. Future research should widen search parameters to include cases not resulting in a conviction to determine if the changes of venue affected the outcomes of the trials.

Effectiveness of PCIT for Children with Clinically Elevated Externalizing and Internalizing Symptoms

MARIAH COOK and Lindsey Ringlee and Kristen McCabe and Argero Zerr and May Yeh

Parent-Child Interaction Therapy (PCIT), an effective treatment for child externalizing symptoms (Ward, Theule, & Cheung, 2016), has been found in a few studies to have a beneficial effect on child internalizing problems (Eisenstadt et. al, 1993; Chase and Eyberg, 2008). It is possible that reductions in parent depression and stress are partially responsible for improvements in child internalizing (Hirshfeld-Becker & Biederman, 2002), given the relationship between the two. Using data from two clinical trials employing culturally modified versions of PCIT: GANA (n = 40; McCabe & Yeh, 2009) and PersIn (n = 32; McCabe et. al, 2020), we hypothesized that young children with clinically significant externalizing symptoms would experience a significant reduction in both internalizing and externalizing symptoms. Additionally, we predicted that the relationship between improvements in externalizing and internalizing would be mediated through improvement in PDS. As hypothesized, our analysis found that there is significant pre to post treatment improvement in internalizing ($t[62] = 9.11$, $p < .001$; $d = 1.15$) and externalizing symptoms ($t[66] = 14.47$, $p < .001$, $d = 1.77$). Additionally, the relationship between externalizing improvement and internalizing improvement is partially mediated through parent's stress improvements ($a = .19$, $b = -.23$; Sobel test $p = .01$), but is not mediated through parent's depression improvements ($a = .02$, $b = -.60$; Sobel test $p = .38$). These findings suggest that PCIT may be a valuable option for treating children with co-occurring internalizing and externalizing symptoms, and that this is partially a result of the positive effects of reduced child externalizing symptoms on parent stress.

Examination of Birth Order and Personality Effects on Coping Strategies in Light of COVID-19

STEPHANIE VAVRICEK and Rebekah Wanic

Personality has been connected to many outcomes, including coping strategies and their effectiveness. Research on birth order has suggested personality differences but there has been little evidence collected to connect birth order, personality and coping. The present study was designed to address this deficit. One hundred and six participants completed a self-report questionnaire designed to identify Big Five personality traits and coping methods. Correlational analysis revealed a significant relationship between emotional stability coping style. Specifically, it was positively associated active and negatively associated with avoidant coping. Contrary to expectation, there was no relationship between birth order and either personality or coping style. The results are discussed in terms of connection with prior work.

Free-Throw Performance Under Pressure in Collegiate Basketball

SAMANTHA WANE, CAMRYN MAY, Mike Raphaeli and Nadav Goldschmied

Free-Throw Performance Under Pressure in Collegiate Basketball Samantha Wane, Camryn May, Mike Raphaeli and Nadav Goldschmied (PhD) The current investigation explored performance under pressure focusing on free throw shots (FTS) in collegiate basketball. FTS are unique in this game since the shots are launched from the same distance and the shooters are not guarded. Pressure was assumed since we only studied FTS in close games (3 or less points differential between the competing teams) towards the end of the game. Using archival data from the National Collegiate Athletic Association from the 2007-2008 through 2019-2020 seasons, we found a relationship between time and frequency of FTS showing that trailing teams fouled more towards the end of the game, with the intention of quickly regaining possession to overturn the score (Navaro et al., 2009). Secondly, FTS shooter season averages were compared with performance in high pressure situations, demonstrating that overall good FTS shooters performed similarly well under pressure times. Lastly, we investigated the outcome of 48,109 FTS in high pressure situations that occurred in the last 60 seconds of the game. We found that FTS performance was better when the shooting team was ahead rather than trailing or tied. These findings suggest that shooters who are ahead may enjoy a "psychological cushion" since the outcome of the game does not depend solely on their success.

Indigenous Resistance and the Dakota Access Pipeline

SYDNEY JANSSEN and Julia Cantzler

Stemming from centuries of settler-colonial violence and environmental injustice, #NoDAPL - the largest contemporary Indigenous movement in the United States - was born. The #NoDAPL movement began in April 2016 as a form on Indigenous resistance to the implementation of the Dakota Access Pipeline on the Great Sioux Reservation. The purpose of this study is to analyze and evaluate the dynamics of Indigenous resistance in the #NoDAPL movement and how social movement actors in the #NoDAPL movement address broader concerns related to Native American sovereignty, environmental inequality, Indigenous health, and settler colonialism. This sociological research utilizes a case study approach by constructing a comprehensive narrative of the historical context and the contemporary dynamics of the conflict between members of the Standing Rock Sioux Tribe, Indigenous allies, non-Indigenous allies, Energy Transfer Partners, the state of North Dakota, and the federal government. Through the application of settler-colonial, critical race, medical sociology, and environmental justice theories, I examine the ways that this movement addresses not only the specific issue of the pipeline but also Indigenous Americans' broader concerns about issues of Native American sovereignty, environmental inequality, and the persistence of settler colonialism. The findings reveal that messages of environmental justice, Indigenous health, and Indigenous sovereignty are rooted in the core of Indigenous resistance in the #NoDAPL movement. Existing knowledge and literature in Indigenous sociology is minimal and primarily devoted to the history of settler colonialism and its lasting impacts on tribal communities. Future work should expand Indigenous sociology research and further address the #NoDAPL movement's relevance to understanding ongoing efforts to decolonize settler-colonial nations and its advances in Indigenous sovereignty, health, and the environmental protection of Indigenous resources.

Influence of Fears of COVID-19 and Overall Psychological Distress on Willingness to Use Telemental Health Services

KAITLIN WILLIAMS and Jennifer Zwolinski

The deep impacts of COVID-19 have changed many facets of our lives which has resulted in increased fears and mental health concerns. One recent study found that college students are reporting remarkable problems with academic, health, and lifestyle-related concerns given the negative impact of COVID-19 (Son et al., 2000). Given the benefit of telehealth on psychological outcomes (Pennant et al., 2015) and the clear need for college mental health support during the lockdown, the current study will investigate the relationship between one's willingness to use telemental health, COVID-19 fears, and mental health functioning. I propose that higher scores on the COVID-19 Fears scale will be associated with an increase in college students' willingness to use telemental health services. I also propose that willingness to use telemental health services will be associated with an increase in overall psychological distress across the last year. Participants will include USD college students enrolled in Psychology 101 in fall 2020 and spring 2021 who completed self-report measures including fear of COVID, distress across the last year, stress management, and perceptions of telemental health. ANOVAs will be run to evaluate my hypotheses. Findings from this study can provide insight into future outreach programs concerning mental health on college campuses.

Investigating the Relationship Between Legal/Demographic Factors and Decisions to Transfer Minors to Adult Court - An Update

EDEN STILMAN and Nadav Goldschmied

In light of California's passage of Proposition 57 in 2016, the present study examines the relationship between legal/demographic variables and decisions to transfer juveniles to the adult court system. The goal of Proposition 57 was to increase the possibility of rehabilitation for youth by no longer leaving transfer decisions to the sole discretion of the prosecution but instead to entrust it to judges. We used a sample of 118 reports written by forensic psychologists on behalf of the defense examining the life circumstances of minors who allegedly committed serious crimes. Utilizing regression analysis, we found that close to two-thirds of minors were kept in the juvenile system whereas the rest were transferred. Minors with at least one murder charge were more likely to end up in adult court in comparison to minors who were not charged with homicide. We found no support of racial bias in transfer decisions but an overall considerable underrepresentation of whites in contrast to an overrepresentation of black and Latino juveniles in our limited data set

Maternal Autonomy Support and Toddler Performance During Two Teaching-Learning Tasks

KELLY MOLLOY, Matthew Chaffee and Adriana Molitor-Siegl

Recent conceptualizations of parenting distinguish three important dimensions: warmth, structure, and autonomy-support. Autonomy-support is particularly fascinating because it encourages volition and self-choice within the child, thus leading to greater intrinsic motivation. However, some research suggests that while autonomy-support optimizes development across broad domains, it may not be relevant in all situations. For example, it is possible that autonomy-support is beneficial in context-specific learning situations, such as during novel or complex tasks. The present study assessed whether maternal autonomy-support predicted better toddler learning during two different teaching tasks: one semi-familiar learning activity (a multi-dimensional shape puzzle) and a novel task (a lacing board). Independent coders rated several aspects of autonomy-support (e.g., promotion of initiative, power assertion, empathy) in 15-second intervals while watching 3.5 minute videos of 117 2 ½ year-olds and their mothers during each teaching task. A separate team of coders scored components of child performance, such as child attentional/affective behavior and achievement. Results indicated that maternal autonomy-support was associated with toddler performance mostly during the lacing task, but not the puzzle activity. This suggests that parental autonomy-support may be salient during novel or complex learning situations, rather than across all teaching contexts. Additionally, some partial correlations showed that certain autonomy-supportive behaviors were associated with child performance, suggesting that specific behaviors in certain contexts are more predictive of achievement than all characteristics of autonomy-support.

Perceptions of Benevolent Sexism and Their Implication for Women's Mental Health

ABBY KING and Kristen McCabe

Endorsing or experiencing benevolent sexism has been shown to have varying effects on women according to context. At work, endorsing and experiencing benevolent sexism has been found to negatively impact women's careers (Dardenne, Bollier & Dumont, 2007; Vescio, Gervais, Snyder & Hoover, 2005). In contrast, endorsing benevolent sexism in romantic relationships has been linked to greater relationship satisfaction (Brown, 2015). However, studies have not examined the effect of experiencing, rather than merely endorsing, benevolent sexism in romantic relationships on relationship satisfaction and other mental health outcomes, and it is possible that as in work settings, the experience of benevolent sexism may have negative impacts. Furthermore, studies have not considered whether endorsing or experiencing benevolent sexism in a work setting is related to poorer mental health in women. The current study will examine the relationship between endorsing vs. experiencing benevolent sexism at work vs. relationships to work/relationship satisfaction and mental health outcomes. In addition, we will investigate if the relationships between experiencing benevolent sexism in work or relationships is moderated by women's endorsement of benevolent sexism in that particular setting. We will recruit 250 participants from an online participant recruiter, and administer measures of relationship satisfaction, work satisfaction, endorsement of benevolent sexism, experiencing benevolent sexism at work and relationships, and perceptions of negative aspects of benevolent sexism. Results will have implications for how benevolent sexism affects women's mental health.

Recall of Fatalities in USA Mass Shooting Events

VICTOR FU, HANNAH JACOBS, SOPHIA KAHL, and Nadav Goldschmied

The aim of the current study was to investigate recall of mass shooting events among American college students and assess if general opinions held influenced how participants remembered these events. The study utilized a survey collected at the University of San Diego about the following mass shootings: Aurora Dark Knight Movie Theater (2012), Sandy Hook Elementary (2012), Orlando Pulse Nightclub (2016), Route 91 Concert Las Vegas (2017), and Parkland Marjory Stoneman Douglas HS (2018). The students were accurate at recalling the number of casualties of the Sandy Hook, Aurora Dark Knight Movie Theater, and Parkland HS mass shootings, with casualty counts in the teens. However, when the killings were in the medium/high double digits range as in Route 91 Concert Las Vegas (mean casualties estimate=44.8, SD= 34.44) and Orlando Pulse Nightclub shootings (mean casualties estimate=19.17, SD= 13.55), students depressed the number of fatalities, possibly because they could not fathom the scale of the carnage. The results showed no evidence to indicate that religious beliefs, support for NRA activities, gun ownership, or political affiliation affected their recall of fatalities in these mass shooting events.

The Effects of Ethanol and Housing on Zebrafish Behavior

RACHEL ALEF and Rachel Blaser

Zebrafish (*Danio rerio*) have been extensively studied in pharmacology research because they are model organisms for animals of higher complexity, like human beings. Genetically, zebrafish and humans are very similar. They have comparable brain structures and neurotransmitter systems. For this reason, studying how they respond to drugs of abuse may help us understand how those drugs affect humans. Using zebrafish to study drugs is ideal because they are cheap, easy to obtain, and reproduce rapidly and in large numbers. In this study, the interaction between ethanol dosage and housing conditions were manipulated and analyzed in regard to zebrafish behavior. It was hypothesized that ethanol should act as an anxiolytic, and if zebrafish are exposed to higher levels of ethanol, their behavior should demonstrate decreased anxiety (and vice versa). It was also hypothesized that zebrafish housed in groups of four should display less anxiety than fish housed by themselves or in pairs. Additionally, fish housed in groups of four that are exposed to high levels of ethanol are hypothesized to demonstrate the least amount of anxiety.

The Effects of Social Media on the Creative Process

DANIEL LONG, MOLLY LANAGAN, MIRIAN GUIRGIS, JACQUELINE MULCAHY, ERIN JONES, MAREN ALTVATER and Veronica Galvan

With the rise of social media and its prevalence in business, social, and artistic sectors, there are several questions regarding its effects on human behavior. One question that remains unanswered is how social media affects the creative problem-solving skills of individuals. Specifically, does social media stimulate or limit creative thinking? Previous research indicates that time spent on social media positively influences ideational behavior and the quality (but not quantity) of creative activity and accomplishment (Acar et al., 2019). By using the abbreviated Torrance Test of Creative Thinking (TTCT) and a survey regarding social media use, we intend to provide a more coherent deduction about social media's link to creativity. We plan to explore this relationship in participants aged 18-22 through their use of TikTok, Twitter, and Instagram. We will examine their engagement with any type of content on social media, whether that involves creation as an active user or consumption as a passive user. The survey will focus on active versus passive social media use and the amount of daily social media usage. We hypothesize that active users of social media will score higher on the TTCT compared to passive users.

The Geopolitical Expansion of China in East Asia

MYA RODRIGUEZ and Vidya Nadkarni

China has experienced tremendous economic growth over the past thirty years that has catapulted it to becoming the second largest economy in the world. China has sought to translate its increasing economic power into influence in Asia and globally. In my research, I seek to examine the reasons behind rising Chinese influence in East Asia. The hypothesis of the paper is the rising power equates to rising influence: China's rising economic and military power provides Beijing with the instruments needed to pursue a strategy for the expansion of geopolitical influence. As a power second only to the United States, China's policies since 2010 clearly demonstrate that Beijing's primary geopolitical objective is to achieve dominance in first East Asia and then expand outward to other areas of the region and the world. My argument will proceed in three sections. First, I will draw on power transition theory to explain why conflict between rising powers and dominant powers is likely. Second, I will offer trend-line GDP and trade figures as well as military expenditures and arms acquisitions to show China's remarkable growth in economic and military capabilities, which have allowed Beijing to become increasingly assertive in promoting its interests and projecting its influence in East Asia. Third, in four case studies I will catalogue how China's rise in influence has resulted in increasingly greater aggressiveness toward Japan, Taiwan, the Philippines, and Vietnam in supporting its maritime claims and in other bilateral disputes. In these case studies, I will also look at how China's actions are aimed at displacing US influences in East Asia, particularly through the modality of investment projects, such as the Belt and Road Initiative (BRI), China has sought to expand its geopolitical reach. China's expansion has many implications for regional security in East Asia and the global competition for power.

The Role of the Medial Prefrontal Cortex and Parietal Cortex in Memory and Spatial Navigation in the Traveling Salesperson Problem

ANAHI SALAZAR, FABIOLA SANCHEZ, and Jena Hales

The Traveling Salesperson Problem (TSP) is an optimization problem that requires subjects to identify the shortest route to travel from a starting to ending point, while visiting a certain number of targets. This task has been used in animal models, such as rats, to examine spatial memory and decision making while performing naturalistic foraging behaviors. Previous results from our lab have found that rats with hippocampal lesions are impaired across many different measures and spatial configurations in the TSP task, specifically on measures of spatial memory. Given the various cognitive demands of this naturalistic task, our lab was interested in examining the involvement of neocortical regions in rat performance. We conducted an extensive review of the literature examining the roles that the medial prefrontal cortex (mPFC) and parietal cortex (PC) may play in solving the TSP task. Various studies have found that the mPFC is essential for certain spatial and nonspatial cognitive processes, such as decision making, and aiding in both efficient and effective performance on tasks such as the delayed alternation task. These findings suggest this brain region monitors behavior to minimize mistakes and maximize rewards. Studies have also suggested that the PC is involved in visuospatial planning and spatial navigation across various spatial tasks. Our literature review presents the findings and results of a thorough examination of the functions of the mPFC and PC and provides a proposal for further examining the involvement of each region in the performance of rats on the TSP task.

The Urban Spatial: Bodies, Knowledges, and Transcendence in the Built Environment

DELANEY TAX and Josen Diaz

Historical and modern urban planning theory often focuses on an idealized body and subject, shaped by race, gender, class, and sexuality, that exists within the built environment. Thus, space is actively and passively divided into thresholds impenetrable by bodies othered by social and political ideologies. This paper explores what I define as colonial urban planning, or the ways in which modern and historical mechanisms of western imperialism are embedded into the way space is shaped and how bodies are restricted, bounded, or made invisible within the space. This investigation examines the frameworks present in colonial urban theory that engender meaning and knowledges onto bodies as they move or attempt to move through these thresholds. I understand race, gender, sex, and class identity not as a fixed reality that interacts with the urban form, but rather as fluid and manipulated by the urban form's embedded colonial constructs. Further, my work explores the existence of third space, or the hidden or invisible locations that center the politics of marginalization held by bodies who are conceptualized by colonial power as other. I consider forms of placemaking, such as art, contemplative studies, and protest, to be planning texts and read them as a subversion of colonial hegemonies within the urban form. Because of the variations of inclusion and exclusion that are a result of colonial planning logic, iterations of third spaces become sites of occupation, resistance, and homespace.

Uncertainty Reduction in Initial Interactions

MELISSA CABRERA and Jonathan Bowman

Uncertainty reduction strategies are among the most fundamental motivations for human communication. When interacting with new people, uncertainty reduction is a crucial tool people use to learn about that person and determine what their relationship will be like. Research related to the strategies that humans use to reduce uncertainty typically focus on initial interactions and the early stages of relationships. Many recent studies tend to focus on the comparison between computer mediated communication and in-person interactions. In contrast, the current project focuses on the strategies people are most likely to employ when they are working to reduce uncertainty in face-to-face interactions, with attention to the way demographics (e.g., race or gender) might impact the choice of strategies an individual is most inclined to select. While there has been some research relating to the way demographics might impact uncertainty reduction, specific strategies of uncertainty reduction are relatively unexplored from a demographic perspective. To collect data for this research, 190 participants from multiple demographic backgrounds answered an online survey. In the questionnaire participants were asked about which uncertainty reduction strategies they use during initial interactions. Consistent with the research hypotheses, there were differences in the strategies different racial and age groups used. Counter to prediction, there were no differences found in the way participants from different genders used strategies, specifically self-disclosure.

Arts and Creative Works

America's Finest Housing Crisis- Racialized Housing & Suburban Development

VICENTA MARTINEZ GOVEA and Shannon Starkey

U.S. Government operations between 1940-1950 brought unprecedented direct and indirect employment opportunities to San Diego, exacerbating an already growing housing shortage. To accommodate the thousands of new defense workers, the government produced the largest defense housing project to date in the small neighborhood of Linda Vista. However, this opportunity and largesse was extended primarily to a select group of white working-class families who had access to defense jobs and, consequently, subsidized housing. Military presence in San Diego during World War II shaped the design of homes and exclusively allocated housing, as both shelter and financial instrument, to white working-class families through restrictive racial policy and practice at the start of WWII to create the ideal white-middle class citizen. Racial minorities were excluded by the federal government and unable to take advantage of plumbing or heating services offered by a house due to an absence of unit design at their disposal. Government presence but limited progressive intervention in the housing industry created the circumstances to maintain a housing crisis rather than fix the problem that disproportionately affected racial minorities. This instance is clear with the intersectionality of the military, private corporations, racial construction and housing development in Linda Vista that created a thriving suburbia for white families. Due to systemic and institutionalized racism, Linda Vista never would have been accessible to all due to racial segregation within private companies sanctioned by public officials. With heterogeneous facades and homogenous floor plans, Linda Vista Defense Housing produced white middle-class citizens out of wartime workers.

Force, Flex, Dance

REBECCA M. NICKEL and Can Bilsel

My research focuses on the relationship between the body and architecture, specifically through the lens of performance art on oblique and dynamic structures. Orthogonal architecture remains generally unchallenged. In the 1960s and 1970s, Paul Virilio and Claude Parent partnered in an investigation of "the function of the oblique" as a third architectural order to supplement the long-standing vertical and horizontal orders. Parent's sister Nicole was a performance artist who developed a style of dance on these experimental oblique structures called LInclipan. Oblique structures and surfaces confront us directly with the force of gravity that we do not notice as we traverse orthogonal architecture. The oblique forces the body into an actively aware relationship to structure; we experience fatigue as we ascend inclined planes and we accelerate as we descend inclined planes. My research attempts to rescue and extend the discourse they began on the oblique with the application of a flexible object called the Steffen Polyhedron. This was discovered in the 1970s, and was the first and remains one of the only known non-convex polyhedra that maintains complete structural integrity as it flexes between two positions. While architecture is traditionally static, our bodies are the dynamic element that experience still architecture in motion. Because the Steffen Polyhedron can flex, there is a potential application at certain scales to create architecture that is dynamic, such that the body and architecture can enter into a mutually dynamic relationship - a performance.

Towards Decolonisation: The Role of British Notions of Land in Colonial Malawi

MAYAMIKO MATABWA and Can Bilsel

Land was a powerful colonial tool because it altered lifestyles of those on that land. This project is an exercise in and contribution to the discourse of decolonisation in Malawi, with emphasis on land. It seeks to map these histories as they are not widely known and detailed. The paper looks at the pre-colonial setting of Malawi and then moves to understand the various aspects of the colonial period. It ends with the post-colonial setting of the country and how that sets the scene for Decolonisation. Accessing this knowledge is a fundamental part of decolonising because with knowledge comes empowerment and self determination. Sources of information include literature that was produced by colonial authorities at the time as well as scholastic contributions that already existed on the issue. These were valuable sources of information because they provided insight into the state of the country at the time and also showcased the views that colonial authorities and later academics had on the topic. This paper is the beginning of my contribution to this topic of research as someone who grew up in Malawi in the present day, a quarter of a century after independence in July, 1964. The research also references case studies of other British-African colonies that allowed further insight into the overarching mode of rule that the British employed on a continent as a whole. These include the period of Villagisation that took place in Kenya and the planning of the towns in Ghana, post-independence by British authorities.

Transformative Empathy: The Power of Art Activism

SIENNA TODD and John Halaka

Art is fundamentally about seeing the world in a different way, and carries the capacity to facilitate empathetic interactions, communicate a message, and make a political argument more compelling. This visual language bridges verbal barriers and creates a form of communication that is more accessible, connecting on an emotional level that political conversations often fail to do. This ability to evoke empathy and present an idea in a unique way is the foundation for the idea of art activism, which is explored through a written research paper and a series of creative works in this interdisciplinary project. The series of case studies of feminist artists and protest movements connects to literature on the politics of protest and feminist political theories to understand art activism from an artistic and political feminist lens. To put art activism into practice, my creative works project explores art activism through a series of oil paintings, using art to promote women's rights by challenging the male-dominant lens through which we view female figures in myths and visually reinterpret their stories through a current feminist perspective. Reclaiming these mythologies through painting seeks to illuminate the instances of female suffering, strength, and power that are often overlooked, reflecting on the importance of storytelling in building solidarity and addressing women's issues. This research and creative work reflects the empathetic power of art activism, creating clarity by revealing truths about society that are not immediately visible and identifying the problems of our complex world to call for awareness and transformation.

Utilizing Counter Cartography to Reclaim Sacred Sites for the Cowlitz Indian Tribe

JACQUELYN CRANE and Gillian Shaffer

This project is built upon previous research centered on the historical implications and measurable outcomes of the private property system. I studied how the built environment changes when land is managed by an alternative to the questionable concept of private property. I asked this question through a cartographic lens, critiquing agendas behind map-making and the politics of representation that underpins the production of documents that claim ownership to land. I explored how the Cowlitz Tribe in the Pacific Northwest, with which I am affiliated, interacted with their lands pre-contact, and how impositions of the American private property system were justified. Private property is a western European ideal that aggravated indigenous communities. Private property aided Europeans in colonization efforts and gave them autonomy over the natural resources that properties contained. Understanding the specific power tactics that were essential parts of colonization emphasize the significance of having reliable, informative maps that bring awareness to how land was considered by Native Americans. The purpose of this project is to create a database and maps of sacred sites to determine which areas of land could be regained by the Cowlitz Tribe in order to take a stance against land dispossession and potentially grow tribal territory. A fundamental portion of my project is determining the possibility of regaining the land in which sacred sites were on. My design proposal is for the tribe to take over these lands, construct cultural resource centers, and utilize ancestral building typologies to house these resources for tribal members.

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In keeping with USD's commitment to sustainability, the 2021 Creative Collaborations abstract book will be available on the MySDMobile app and on the Office of Undergraduate Research web page during Research Week (April 12-16, 2021.)

With Gratitude

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