CREATIVE COLLABORATIONS UNDERGRADUATE RESEARCH CONFERENCE

April 21-23, 2020

University of San Diego

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of Undergraduate Research

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Research

Scholarship

Creative Works

WELCOME to the Virtual Creative Collaborations Undergraduate Research Conference!

This is an unprecedented year for Creative Collaborations. To reduce the risk related to the COVID-19 virus, we could not hold the conference in person this year. We wanted to keep the student experience as close to normal as possible, which is why we decided to move Creative Collaborations to a virtual/online event.

This year, more than 60 students across a broad range of disciplines are participating. Their resiliency in the midst of so much change and uncertainty in their education is nothing short of amazing. We encourage you to interact with them by asking questions and engaging them in conversations about their research. The engaged scholarship conducted on campus and presented today addresses a variety of contemporary issues and has the potential to make real contributions to knowledge and practice. Among the presentations are studies about the influence of space fiction on space policy; Accessory Dwelling Units as an affordable housing option in San Diego; movement patterns of leopard sharks off San Diego coasts; and the impact of Instagram on anxiety. We also have a group of students who collaborated with students and faculty from the Azrieli College of Engineering in Jerusalem, Israel presenting their research on wastewater treatment and treatment during water desalination.

Creative Collaborations is an important part of Research Week at USD (April 20 - 24, 2020), which showcases activities across the university and honors students and faculty members who challenge themselves to extend learning beyond the classroom. This year USD Research Week also coincides with the Council on Undergraduate Research (CUR) Undergraduate Research Week. We invite you to view and experience a variety of virtual presentations during this celebration of faculty-student scholarly collaboration.

Congratulations to all the student presenters and faculty members participating in the first ever Virtual Creative Collaborations Undergraduate Research Conference!

E M Greene

Elisa Maldonado Greene, PhD
Director

Disciplines & Schedule

ABTRACT BOOK

In keeping with USD's commitment to sustainability, the 2018 abstract book is available on the mySDmobile app during Research Week, and can be found online at www.sandiego.edu/cc-urc.

RESEARCH WEEK April 20 - 24, 2020

Creative Collaborations Undergraduate Research Conference is part of USD's 4th Annual Research Week. For more information about offerings, please visit www.sandiego.edu/osp/research-week/index.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

Variations in Zooplankton Biodiversity Across the Sargasso Sea

SAMANTHA AHLMAN, Abigail Kwiat, Andrew Measha and Jennifer Prairie

The Sargasso Sea is an oligotrophic high seas 'ocean desert' bounded only by the currents of the North Atlantic Subtropical Gyre. Despite low nutrient conditions and low primary productivity, the Sargasso Sea supports a large community of unique, diverse, and understudied organisms largely associated with the pelagic brown algae Sargassum, which spends its life circulating the gyre and creates 'oases' for organisms. Beyond the surface diversity of the Sargasso Sea, the mesopelagic (twilight zone) contains a vast reservoir of poorly sampled and understudied marine animals. Each of these organisms has a key role in the Sargasso Sea food web and contribute to biogeochemical/carbon cycling in this region of low productivity. It is therefore important to better understand the biodiversity in the Sargasso Sea to make effective conservation efforts and management plans. One useful conservation tool is environmental DNA (eDNA) analysis which can be used for biomonitoring of remote regions like the Sargasso Sea and twilight zone. Environmental DNA is the DNA that is shed by organisms as they move through the water and can be extracted from water samples and identified using species specific genetic barcodes (metabarcodes) to demonstrate the presence of a species in the water without having to capture or see them. In this project, an array of Sargassum-associated mobile, epipelagic, and mesopelagic fauna were collected, morphologically identified, and sequenced to see how biodiversity varied across the Sargasso Sea and with depth, and to create a metabarcode library for metazoans in the Sargasso Sea.

Anomalous transport across scales in crosslinked actin-microtubule composites

SYLAS ANDERSON and Rae Robertson-Anderson

The diffusion of microscopic particles through the cell is largely controlled by the cytoskeletal network, comprised of semiflexible actin filaments, rigid microtubules, and crosslinking proteins. Yet, how the interactions between actin and microtubules and the various types of filament crosslinking affect particle transport remain unresolved. In our experiments, we couple single-particle tracking (SPT) with differential dynamic microscopy (DDM) to characterize the transport of micron-sized particles diffusing through crosslinked composite networks of actin filaments and microtubules. Specifically, we investigate the impact of permanently crosslinking actin to actin, microtubules to microtubules, and actin to microtubules. By combining SPT and DDM, we are able to couple single-particle dynamics to ensemble transport phenomena, and link particle diffusion to the viscoelastic characteristics of the networks. We find that subtle changes to the crosslinking interactions between cytoskeleton filaments play surprisingly important roles in the anomalous subdiffusion that particles exhibit within a composite cytoskeletal system.

Daily otolith growth ring validation in the California killifish, Fundulus parvipinnis

EMILY ANDRADE and Drew Talley

Otoliths are a useful tool for understanding the ecology of many fish species. They can be used to identify the location, diet, and temperature conditions the organism lived in, as well as their age. This study is focused on validating the proposed daily otolith increment formation in Fundulus parvipinnis, or the California killifish. By determining the amount of time it takes for F. parvipinnis to deposit a ring on their otolith, the age of any field-captured California killifish can be calculated. From an initial population of thirty captured F. parvipinnis, individuals were sacrificed at approximately two-week intervals to compare the number of days raised in the lab and the number of rings deposited onto the otolith of the fish. During our study, Fundulus parvipinnis expressed an increased number of growth rings, but not at the levels predicted. The average time for the deposition of one ring was noticeably larger than a single day. While our experiment may not have resulted in the way we anticipated, these results still do reveal important information regarding experiments involving F. parvipinnis and their otoliths. Our results indicate a methodological change is needed regarding studying the otoliths of the California killifish. Our experiment remains preliminary and expanding this experiment to a long-term time scale would be beneficial to collect more data and strengthen results.

Arsenic Partitioning in Sediments Downgradient from an Abandoned Mine, San Diego

ANDREW BARNES and Dr. Beth O'Shea

Black Mountain is home to a former arsenic (As) mine that closed in the early 1920s with no known remediation or documentation. This study tests if the As is bound to the organic carbon, is associated with fine grain sediments, and if As concentrations change downstream of the mine. Total As was measured using the XRF. Sediment organic carbon (% OC) was estimated using LOI technique and sediment grain was measured with the LPS. As concentrations ranged from 2320.5 mg/ Kg to 15.4 mg / Kg and the concentrations decreased with distance from the mine. Average % OC and total As per site had a weak negative relationship. Percent fines (% Silts + % Clays) had no significant relationship with total As. These results suggest that As is predominantly not adsorbed to the Organic Carbon. As concentrations are not related to grain size and therefore not related to the exchangeable fraction as smaller grain sizes have greater surface area compared to larger grain sizes. Based on sequential extraction experiments, the As is bound in the crystalline matrix (Wright et al, in prep.). This study suggests that the As at Black Mountain will not be easily mobilized during storm events and therefore will not be easily released into the environment.

The effect of marine snow particle distribution on copepod behavior

ELENA BECKHAUS, Maya Young, Moira Décima and Jennifer Prairie

Marine snow is a major component of the biological pump, through which carbon is exported to the deep ocean. The sinking of marine snow can be disrupted by organisms that ingest or breakup the falling aggregates. Previous studies have found that zooplankton ingest these aggregates, which may have important impacts on carbon export. Marine snow can have patchy distributions, occurring in layers, which may further impact interactions with zooplankton; however, no experimental study has looked specifically at how the presence of a marine snow layer could affect zooplankton foraging behavior. In this study we examined how the distribution of marine snow particles affected copepod foraging and behavior, specifically with regard to their swimming patterns. We conducted a series of experiments in which copepods of the species Calanus pacificus were exposed to three different feeding environments: a layer of marine snow, a homogenous distribution of marine snow, and a control treatment without marine snow. Copepod behavior was recorded with two cameras that were set up perpendicular to one another, imaging the sides of the tank. MATLAB was used to reconstruct 3D copepod tracks, allowing us to calculate copepod location, velocity, and turning rate throughout the experiments. We observed that copepods performed a spiraling swimming behavior, likely in response to chemical plumes from the sinking marine snow aggregates, most frequently in the homogenous treatment. These results can further our understanding of interactions between zooplankton and marine snow, and thereby provide a contribution to the broader research of marine carbon cycling.

Synthesis of a Ligand for Enantioselective Catalysis

VALERIA REYES and Christopher Daley

Many chemical reactions yield enantiomer products, which are compounds that have the same type and number of bonds but are non-superimposable mirror images of each other, similar to one's right and left hands. The enantiomers' different spatial arrangements make them react differently with other enantiomer compounds. For example, enzymes in our bodies are chiral (single enantiomers), so they interact with each of the enantiomer forms of another chiral molecule differently. If a drug is administered as a racemic mixture (a 50:50 mixture of its enantiomer forms), each enantiomer can be metabolized differently; one producing the desired effect while the other may produce severe undesired side effects. Enantioselective catalysis is one method for controlling which enantiomer is produced. Our focus is on preparing organic molecules (ligands) that can be used with a metal to form catalysts; the catalysts will be used for numerous reactions to determine its effectiveness in driving the reaction to form only one enantiomer form. Our ligand is prepared in a 2-step process; an in-situ cadmium-bound ligand complex formation followed by isolating the ligand from the complex using a thiol-based substitution reaction. The isolated ligand can then be bound to a metal to form a potential enantioselective catalyst. The work on the isolation of the ligand will be presented, along with the progress on developing new metal-ligand complexes for use as potential enantioselective catalysts.

Heavy Metal absorbance and proximity to fresh water inputs by Arcuatula senhousia in Mission Bay

JUAN PABLO CHAVEZ and Eric Cathcart

Urban run-off constitutes a major source of anthropogenic metals input into estuarine systems which impacts coastal ecosystems and organisms. The toxic effects of both water and sediment pollution results in alterations of fecundity and survival of the biota. Mussels are good proxies for monitoring heavy metal inputs into marine ecosystems. Arcuatula senhousia is an invasive benthic species of bivalve with a lifespan of 1 to 2 years that lives in Mission Bay, an estuary located in a heavily populated area of San Diego, California. The focus of this study is on the absorbance of three specific metals (copper, lead and zinc) within the tissue of A. senhousia. Three sample locations were determined based on proximity to a known anthropogenic input source; specifically, Rose Creek and were sampled down an environmental gradient. Sediment samples and A. senhousia samples were collected from the three stations utilizing an Ekman grab. Following tissue dissection and desiccation, sediment samples and tissue samples were analyzed for metals on an X-Ray Fluorescence machine. The results show higher concentrations of metals near the point source and overall decreasing concentrations along the environmental gradient. In addition, particle size distributions show decreasing metals concentrations with increasing particle size. The result of this study shows the importance of long term metals analyses of marine ecosystems; specifically, studies utilizing bivalve proxies and also indicate the need for analyzing the metals concentrations of the water column in addition to the benthic environment.

Tracking the Population of White Sharks, Carcharodon carcharias, in South African Waters

MICHAEL DARBY and Nathalie Reyns

Many studies have shown dramatic declines in marine apex predator populations, including the white shark, Carcharodon carcharias, in South Africa which is currently listed as vulnerable on the IUCN red list. Understanding biological and ecological roles of C. carcharias is crucial for understanding the function of other apex predators in marine food webs. The objective of this study was to attain an accurate population count of C. carcharias off South Africa. Our hypothesis was that shark populations in the region are declining due to human activities. In this study, I compare multiple approaches for white shark population assessments, including my experience using distinct notches on the trailing edge of the dorsal fins to distinguish (and count) individuals, as well as genetic analysis from published literature. To identify individuals, sharks were baited to the boat and led to swim parallel so that their dorsal fin was presented from the side, and dorsal fin photos were taken. Fin ID photos were analyzed through software from Stellenbosch University, alongside fishery bycatch data. In 2014, the population was estimated to be 426 sharks. Two years later, genetic analyses produced an estimate of 333 sharks. In our study, the current population was estimated to be between 250 and 300 sharks. Additionally, we identified approximately 30 new individuals. Although this seems hopeful for the white shark population, that same number of sharks are killed annually by long lines and drum lines. Understanding and protecting C. carcharias is essential for future health of marine ecosystems and resources.

Reactions of the California and Kuroshio Currents to El Niño Events

ALLIE DOHERTY and Zhi-Yong Yin

El Niño Southern Oscillation (ENSO) creates variability in the eastern and western tropical Pacific, affecting sea surface temperature. This study attempts to quantify the effects of ENSO on the eastern and western Pacific sea surface temperatures (SST) by examining the anomalies and distribution in SST in the areas of the Kuroshio and California Currents. Winter and summer gridded 2°x2° SST data were correlated with the Nino 3.4 index, a measure of the intensity and phase of ENSO events, to determine how SST was related with the ENSO conditions from 1855 to 2015. Correlations were mapped for the area representing each current for summer and winter months. During El Niño events, winter SST tended to increase in areas of both the California and Kuroshio Currents, as indicated by positive correlations between SST and the Nino index (maximum r = 0.358, p-value = 0.01 for Kuroshio and maximum r = 0.684, p-value = 0.01 for California). On the other hand, SST tended to decrease in the Kuroshio Current for both summer and winter months, but the most significant decrease in SST was during the summer months. Understanding the relationship between ENSO and SST may provide insight to the connections between ENSO events and precipitation variations in East Asia and west coast of the US.

Sedimentation in the Tijuana River Estuary (TRE) and Its Relationship to Urbanization in the Watershed

MOLLY DOLAN and Suzanne Walther

In the past four decades, the Tijuana River Watershed (TRW) has experienced significant land use change along with rapid human population growth. Rapid urbanization has resulted in sedimentation issues in Tijuana River Estuary (TRE). An earlier study in 2001 suggested that sediment accretion rates ranged from 0.7 to 1.2 cm/yr, which is high for coastal wetlands (with rates in the 1-5 mm/yr range). When sediments accumulate faster than sea level rises in estuaries, the marsh plains can become elevated enough to change tidal wetlands to upland habitats. Obtaining sediment accretion rates is important for restoration efforts protecting tidal wetland vegetation and species. In this study, by digitizing land cover from satellite imagery using ArcGIS, we estimated the size of urban areas in 1984 to be about 32,555 acres. By 2018, that value rose to approximately 94,281 acres. Since 2000, there was a 33% increase in the urban areas in the TRW. Using a DJI quadcopter and Agisoft Photoscan software, we captured imagery of the study area and processed it to create a three-dimensional terrain model with a vertical resolution of about 18 m. A small portion of the terrain model is compared with a 2014 digital elevated model (DEM) to obtain the sedimentation rates for locations without vegetation cover. We then compare these rates with land cover changes in the watershed. Our method could allow more frequent monitoring of sedimentation rates for the TRE, which is important for restoration efforts and assessment of the impacts of sea level rise.

Airport Runoff and Heavy Metal Accumulation in Sediment and Mussels in San Diego Bay, CA

SAMANTHA DOUGLASS and Steven Searcy and Eric Cathcart

Commercial air travel is a growing industry around the world. Regular activities at airports, including take-offs and landings, refueling, ground vehicle operations, and aircraft and facility maintenance, can all result in metal pollutants that are washed off airport surfaces by rain and deposited into the surrounding ecosystem. In this study, we examined heavy metal concentration in sediment and mussel tissue (Mytilus galloprovincialis) from sites in the San Diego Bay adjacent to storm drains originating in the San Diego Airport and in control locations. We collected mussels at three sites in the bay, one of which was near an outfall that drained rain water from the airport runway and tarmacs. Mussels were standardized according to size, and the concentration of Cr, Pb, Cu, and Zn in the organisms' soft tissue and the surrounding sediment were analyzed using X-ray fluorescence. ICP-MS was also used to obtain higher resolution of the metal concentrations in the mussel tissue. Overall, there were significant differences in concentration between the airport and non-airport sites; however, among site variability suggest different sources of pollution in different parts of the bay.

Factors of Water-use Efficiency Represented by Leaf Carbon-13/Carbon-12 Isotope Ratios Among Pine and Fir species in the Lake Tahoe Basin

ANGELINA GHILOTTI, PATRICIA MALONEY, Camille Jensen, Aaron Vanderpool and Zhi-Yong Yin

Abiotic factors change along elevation gradients and influence biotic factors such as vegetation water use and photosynthetic demands. In this study, we collected needle samples from White Fir, Sugar Pine, and Jeffrey Pine at six sites around the Lake Tahoe Basin (LTB). We measured the needle carbon-13/carbon-12 isotope ratios (Delta 13C) processed independently of our lab as an index for plant water use efficiency. The six sites differ slightly in elevation changes, annual average precipitation, and yearly temperature max and mins. The elevations range from 1921-2149 ft. For the three species we found a trend of the highest negative isotopic values at mid elevations (2012-2078 ft). Jeffrey Pine shows the lowest isotopic values overall, being most water-use efficient on average. White Fir shows the highest isotopic values overall, although only slightly higher than Sugar Pine. The findings of this study contribute to knowledge of LTB native species' water-use efficiency and predictability of responses to drought stress.

Quantifying the Consumption of Algal Wrack with Dry Weight Analysis

ROB ELSENSOHN and Marisol Palomares and Drew Talley

Algal wrack (marine algae deposited on shorelines) is an important source of food and shelter for many organisms. By calculating the mass of wrack consumption it's contribution to intertidal food webs may be assessed. Wrack consumption can be quantified by determining the total loss of biomass through time. Samples of giant kelp (Macrocystis pyrifera) were placed on isolated sections of Black's Beach, San Diego, California and collected after 1, 3, 7, 12, and 21-day intervals. Wrack samples were cleaned using a sieve and deionized water, dried in a drying oven at 60°C, and weighed to within 0.01g to determine their final biomass. This value was compared to expected dry weights determined by an equation derived for the same taxa by Wickham et al., 2019. The difference between measured and expected dry weights was used to determine the amount of biomass consumed by organisms. The results of this study were inconclusive, as dry weight actually increased through time. Typically, consumption rates of algal wrack are highest during the first few days of exposure with continued consumption over time. It appears there was a propagation of error in our study, likely due to the methodology for cleaning the samples prior to analysis. Specifically, we suspect that the presence of residual sediment within dry samples increased with sample age, as more degraded samples could not be as effectively rinsed. Future algal wrack studies should quantify the effect of residual sediment, possibly by combusting the samples, before using expected dry weight calculations and models.

Beach Replenishment and Impacts on Beach Ecosystems.

ALISHA ELY and Steven Searcy

Sea-level rise is expected to continue over the next century. In San Diego, many beaches already experience high tide flooding and coastal erosion. Sea level is projected to rise 5 to 14 times faster by the end of this century. One remedy to coastal erosion is beach replenishment. This method transports sand onto beaches to increase beach width thereby slowing sand loss and protecting coastal properties. Despite its widespread use, little is known about how beach replenishment affects sandy beach intertidal invertebrates, which are key components of beach ecosystems. In this study, we used a BACI design (Before After Control Impact) to monitor the intertidal invertebrate community and sediment characteristics (beach slope, grain size, organic content) at a beach replenishment site in Del Mar and at an adjacent control site in Solana Beach, CA both before and after replenishment. In the short term, we found an immediate impact at beach replenishment sites with an increase in beach slope and changes to community structure. This change, however, was short-lived as storm activity shortly after the replenishment project quickly removed replenished sand and decimated invertebrate communities at both replenished and control locations. Future studies should look at the longer-term impacts of beach replenishment as well as how replenishment may affect beaches at different times of the year.

Comparing Degradation Rates of Biodegradable Materials in a Composting Environment

NICOLE EICHELMAN and Katharine Mathews

Composting is the aerobic process of recycling organic materials into usable fertilizer. Polylactic acid (PLA), commonly used in biodegradable utensils, is an organic material continually tested for complete degradation in southern California composting. PLA's ability to decompose can decrease a market for non-biodegradable plastics, decreasing the amount of single-use plastic material in county landfills. The Living Coast Discovery Center (LCDC) in Chula Vista, California regularly uses and composts World Centric biodegradable utensils in their Compost Demonstration Garden. The purpose of this study was to measure and compare the rate of degradation for two types of biodegradable materials: PLA and wood. Cups, forks and spoons in each material were placed on a wire grate inside separate LCDC outdoor compost piles for ten weeks, using labeled strings to locate each item. Once a week, both piles were aerated by transferring compost to new stalls, monitoring temperatures for the microorganism aerobic activity and weighing utensil masses periodically. Grates containing the utensils were also transferred. PLA and wood rates of decay were determined by subtracting initial mass from final mass, weighed on a microbalance to within 0.001g, and divided by the 70-day compost period. PLA and wood cups degraded 100%; PLA utensils lost 0-2% total biomass, decaying daily at a rate of 1.14%. Wood utensils lost 8-52% total biomass, decaying daily at 1.74%. At larger compost facilities, higher degradation rates are expected of both materials; smaller piles limit thermophilic activity. Composting biodegradable materials can decrease long-term landfill waste and promote production of sustainable good

Risk Assessmentof Heavy Metals in Storm Water from Rose creek, Tecolote Creek, and Mission Bay, CA

TYLER FIELDS and Zhi-Yong Yin

Heavy metals within urban storm water runoff may pose a health risk due to bioaccumulation, which has been shown to cause health problems, specifically kidney and liver, in humans and aquatic organisms. This study compares dissolved metals concentrations in storm water from an urban watershed to sediment metals concentrations adjacent to associated outfalls, specifically Rose Creek and Tecolote Creek in Mission Bay, San Diego, California. The sediment and water samples were collected from 2015-2019 and analyzed for metal concentrations of lead (Pb), copper (Cu), and zinc (Zn) by XRF and ICP-MS, respectively. These concentrations were compared to the water quality objectives in the Water Quality Control Plan for the San Diego Basin, to determine if the dissolved metal concentrations exceed watershed specific-screening levels. These screening levels are established based on the potentially adverse effects of specific metals to sensitive and beneficial organisms within the watershed. In addition, the dissolved metals concentrations were compared to the sediment concentrations at the outfalls to evaluate the contribution of the dissolved metals in the storm water to the benthic environment. It was hypothesized that higher dissolved metals concentrations would result in higher sediment metals concentrations at the outfalls. This study shows that storm water, especially in an urban environment, is potentially a significant contributor of metals into marine ecosystems. Future studies should include these contributions as these metals are an important component of marine biogeochemicalcycles.

Median Household Income as a Proxy for the Relationship between Socio-economic Status and Waste Generation

JULIA SANDS and Eric Cathcart

Pollution of the San Diego watersheds is a significant issue affecting biodiversity, human health, ecosystem services, and pollution of the ocean. The San Diego watershed is a vulnerable system in terms of the effects of trash and plastic debris, given that the watershed is a direct source of flooding and runoff to the Pacific Ocean. Anthropogenic debris has been shown to have significant impacts on all trophic levels in marine ecosystems. Quantifying the amount of debris from individual watersheds is crucial to understanding the sources and transport mechanisms of trash into the marine environment. Previous studies have demonstrated a positive correlation between median household income and solid waste generation. The purpose of this study is to utilize cleanup data from I Love a Clean San Diego to compare median household income to the volume of trash removed at each location. The study was conducted using cleanup data provided by ILACSD and the City of San Diego. The variables focused on in this study include date of cleanup, location, geographic coordinates, watershed, total trash collected, and number of volunteers. Geographic Information Systems (GIS) software was then used to compare size of watershed and household income to total trash collection at each site. The median household income values were collected from San Diego Census data to analyze spatial waste generation. These types of studies quantifying debris contributions of watersheds are important for progression in watershed health management and will be useful for environmental policymaking.

Movement and Dispersion Patterns of Aggregating Leopard Sharks (Triakis semifasciata) off San Diego, California

ANNABEL GONG and Andrew Nosal

Aggregation behavior is ubiquitous in elasmobranch fishes (sharks and rays), as hundreds to even thousands of individuals may gather at a particular location. However, the mechanisms underlying this phenomenon are poorly understood, specifically the contribution of social and non-social forces. That is, are the animals attracted to each other (social) or are they attracted to some environmental feature of the aggregation site (non-social), such as the presence of food, shelter, or favorable water temperature? In this study, the leopard shark (Triakis semifasciata) was used as a model species to begin exploring these questions by quantifying their fine-scale movement patterns within a seasonal aggregation that forms along La Jolla Shores Beach in Matlahuayl State Marine Reserve, San Diego County, California. In August 2019, we captured aerial video footage of a shark aggregation using an unmanned aerial vehicle (UAV). We then used an experimental software program to simultaneously track every shark in the video frame-by-frame. Using the sharks' trajectories, we examined individual shark positions and swimming speed relative to nearest neighbors in the aggregation. The aggregation consisted of approximately 150 sharks, exhibiting a non-uniform distribution and higher density near the center of the aggregation. Additionally, swimming speeds were slowest at the center of the aggregation. This work demonstrates the efficacy of using UAVs and novel software to non-invasively track large marine organisms in situ and lays the foundation for investigating complex social interactions within shark aggregations.

Single-Use Plastics: Is This an Issue That Can be Solved Through Legislation?

SHANE HADLEY and Eric Cathcart

Single-use plastics pose a threat to the environment and wildlife. These plastics have been shown to leach contaminants that impact land, water and air. Recently, legislation has been proposed around the world to combat the issue of plastic pollution, and many nations, including the United States, China and Chile, have already implemented fees or bans to reduce the use of single-use plastics. The effects of the litigation have only recently been assessed and the environmental changes that have resulted following bans or fees can be quantified to measure the success of the litigation. Public perception of these litigation efforts may also have an impact on their success and quantification of the effects of these efforts is typically obtained through surveys and questionnaires. Proposals to reduce plastics have not gone unopposed, and opponents argue that single-use plastics are cost-effective and minimally harmful if comprehensive recycling programs are set in place. This lack of agreement and cooperation between sides creates a social cost that must be associated with single-use plastic bans. By weighing the social costs against the environmental benefits, we can determine if reducing plastic waste through legislation is truly the best solution. In the end, this study provides historical evidence through cases such as China and Ireland that bans or fees on single-use plastics lead to enormous reductions in their use and production.

Discovering the Scale Insect Associates of Oaks in California

KAYCI JATICO and Geoffrey Morse

Armored scale insects are ubiquitous plant parasites that have the potential to threaten the stability of various ecosystems. Western oak species (Quercus) are cornerstones of numerous Californian ecosystems (e.g. scrub, savanna, woodland) but very little is known about their associations with armored scale insects. For example, we do not know if the majority of species that feed on oaks are restricted to oak lineages, to oaks in general, or are habitat generalists. We do not know if the large number of introduced invasive armored scale insects regularly use oaks as hosts. By analyzing population and community structure, my research aims to identify associations between related armored scale insects and related oak species. After sampling numerous oaks in San Diego County, molecular and histological methods will suggest possible distribution patterns amongst the associations between armored scale insects and oak trees on the west coast. These data, combined with a meta-analysis of available knowledge on oaks throughout North America, will serve as a foundational understanding of the relationship between armored scale insects and oak species. This in turn will provide insights into whether oaks can serve as vectors for the establishment of invasive species, or whether they are resistant to such invasions.

Investigation of Post-Translational Modification on NHE-1 Transport Function

RILEY HAMEL and Joseph Provost

The sodium hydrogen exchanger isoform 1 (NHE-1) is a sodium hydrogen antiporter that regulates intracellular pH (pHi), cell volume, dynamic actin remodeling processes, and coordination of cell migration. NHE-1 is post-translationally modified by phosphorylation and lipid modification (palmitoylation). The intracellular C-terminal domain of NHE-1 is reversibly phosphorylated at multiple sites by several protein kinases. We recently identified that NHE-1 is reversibly palmitoylated (S-acetylation). Such modifications are reported to regulate protein trafficking, membrane micro localization, and protein-protein interactions. Steady-state pHi assays incubated with pH-sensitive dye were conducted to measure the change in pHi of Chinese Hamster Lung Fibroblast Cells due to NHE-1. Investigating agonists and stimulating factors that increase NHE-1 palmitoylation allows us to determine the impact of palmitoylation on NHE-1 transport. Palmitoyl-transferases (PATs) catalyze the lipidation of proteins and are inhibited by 2-bromo-palmitate (2BP). The presence of 2BP causes a loss of palmitoylation to occur, effectively inhibiting LPA-induced NHE-1 activity by 0.1 pH units. Fetal Bovine Serum (FBS), Lysophosphatidic acid (LPA), Phorbol 12-myristate 13-acetate (PMA), and Insulin effectively stimulate NHE-1 by increasing pHi by 0.1 pH units. In the presence of kinase inhibitors, NHE-1 activity significantly decreases compared to agonist or serum treatment alone. The impact of the combination of kinase inhibitors and palmitoylation inhibitors on NHE-1 mediated pHi change was determined. The data supports the hypothesis that palmitoylation and phosphorylation coordinate to subtly modify NHE-1 activity in a novel rheostat of the cell.

Impacts of Climate Change on Intertidal Communities: Effects of Elevated Temperature and Predator Exposure on Chthamalus fissus

ELIZABETH BUSHNELL and Nathalie Reyns

There is concern that climate change might negatively impact foundation species such as barnacles in the rocky intertidal. In southern California, as sea surface temperature has increased, the predatory snail, Mexacanthina lugubris lugubris has expanded its range northward into the San Diego region where it preys on the barnacle Chthamalus fissus. In addition to higher predation, barnacles might also be experiencing thermal stress due to warming. We evaluated the impacts of temperature and M. lugubris snails on growth and mortality of barnacle C. fissus. Newly-settled barnacle metamorphs were reared under lab conditions using two experimental protocols. To examine the effects of temperature, replicate barnacles were reared at 14°C, 22°C and 28°C for 8 weeks. Barnacles were counted daily to track mortality and photographed weekly to measure growth. We examined the effects of snail predation on barnacle morphology by rearing replicate barnacles in direct and indirect contact with snails for 8 weeks. The operculum length and width were measured near the end of the experiment to determine if barnacle morphology changed in response to snail exposure. Although, no significant differences in morphology were found between metamorphs reared in contact or in the absence of snails, mortality was significantly higher in metamorphs when barnacles were exposed to snails. Results indicate that C. fissus would not tolerate the projected 4°C warming by 2100 due to climate change. Additionally, with increasing snail densities in southern California, we predict higher barnacle mortality. Thus, increased sea surface temperature can have ecological consequences on rocky intertidal communities.

Dissolved Uranium in the Groundwaters of the Western Peninsular Ranges Batholith, San Diego County, California

ALICIA KELLEY, Scott Snyder, and Eric Cathcart

Dissolved uranium can be found in most municipal and private potable water systems. Ingestion above the Maximum Contaminant Level (30 ug/L) has been shown to cause kidney issues as well as other health effects. Although public water wells are tested at least annually for water quality, private water wells in rural areas are not tested as frequently, if at all. Recently, dissolved uranium in excess of state and federal standards has been discovered in the groundwater in and around the Descanso region of San Diego County. This area is located within the Western Peninsular Ranges Batholith and is characterized by moderately fractured Cretaceous igneous intrusions with multiple late Cretaceous pegmatitic dikes. Based on reviews of mine claim data and field observations, the uranium deposits (uranophane) occur as a rind or film on weathered surfaces of the fractured pegmatite intrusions. Available data suggests the groundwater is fracture controlled and stratified as wells proximal to each other have highly variable uranium concentrations. In this study, chemical data from multiple municipal and private wells from 1991-2019 are compared to the state and federal limits on uranium. In addition, variability in dissolved uranium is compared to monthly rainfall amounts in Campo and Descanso due to their high MCL values. The results of this study show that more stringent testing of private wells in the region may be necessary.

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

MARIELLE KRIVIT and Geoffrey Morse

Species diversity varies across different insect lineages. One possible explanation for this diversity is that more diverse lineages are driven by intricate coevolutionary relationships. Many phytophagous insects must overcome significant plant defenses, such as accumulation of toxins, by developing specific adaptations of their own. This 'arms race' often leads to specialization and subsequent speciation within many insect taxa. Seed beetles in particular impose an intense selective pressure on plants by directly attacking 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, has been reared from host plants in different genera. To determine whether A. fraterculus is a true generalist or is actually composed of many specialist populations/species, I collected beetles at the same site from hosts in the genera Astragalus, Oxytropis, and Glycyrrhiza. This was repeated across eight localities in Colorado. I compared populations of the seed beetle reared from each host phenotypically and genotypically 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.

Quantifying Oxidant Formation from Brown Carbon Systems

JAKE TURLEY, Alexa Perez and David DeHaan

Recent studies demonstrate that fine Particle Matter (PM) performs a central role in human respiratory tract damage from oxidant formation caused by redox activity between lung antioxidants and PM. Oxidant excesses in the respiratory tract have been observed to correlate strongly with adverse circumstances of chronic cardiopulmonary disease, lung cancer and respiratory infections. Mounting evidence verifies that the oxidative stress associated with this high reactivity-brand of oxidant excesses leads to increased instances of cellular/ tissue injury, inflammation, and cardiopulmonary challenges of a neurodegenerative, pulmonary or systemic nature.

Algal Wracks and Biological Abundance

DAVIS LUANAVA, Marisol Palomares, and Drew Talley

Algal wrack mats, conglomerations of seaweed on sandy beaches, are important drivers of biodiversity on San Diego beaches. They provide an integral food source and habitat to many species, both terrestrial and marine. However, many beach communities remove the algal wracks to clear the beaches for recreational use which may have important ecological implications for the sandy beach communities. This study examined how algal wrack affected invertebrate species in the sediment underneath the algal wrack. We tested the hypothesis that biological abundance would increase with the amount of algal wrack. Replicate wrack mats of giant kelp were placed for 21 days during August 2018 on Black's Beach in La Jolla, CA. Sand samples were collected with a 30cm diameter corer which penetrated 20cm into the sediment. Cores were collected both underneath the mats, and from a paired control spots 1 meter away on days 1, 3, 7, 12 and 21. Coleoptera were the most abundant organisms collected during this study. Species abundance was universally higher underneath the wrack than in control plots. This could be caused by the cooler and wetter structure created for organisms, and the food the wrack provided. This study calls for further analysis of beach grooming for human recreational use and its implications on biological diversity.

Short-Term Impact on the Hawaiian Humpback Whale

HOPE MCLAUGHLIN and Eric Cathcart

During the winter months of each year, Megaptera novaeangliae, the North Pacific Humpback Whale, migrate from Alaska to the islands of Hawaii for the purpose of breeding and calving. Increased boat traffic associated with tourism in this area has heightened public concern for the recovering Humpback Whale population; motorized vessels are known to produce underwater noise that interrupts cetacean ability to communicate, rest, and navigate. The objective of this study was to evaluate the short-term impact of boat traffic on Humpback Whale behavior based on surface level activity and dive time. We surveyed pods of the North Pacific Humpback Whale in Maui, HA for a total of 52 hours during January 2019. Shore-line observations and a theodolite were used to record and map whale behavior in conjunction with boat traffic. We hypothesized whale surface activity would decrease and dive time would increase when boats were within ½ mile of the pod. The average surface level activity of the pods decreased and average dive time increased when boats were within ½ mile of whales compared to when boats were not present. Results of this paper help emphasize the idea that boat traffic may have short term impacts on whale behavior and the need for further research on anthropogenic noise.

Stress Fiber Formation in Lung Fibrosis Requires NHE1

TRINA NGUYENTU, Mishika Manchanda, and Joseph Provost

Idiopathic Pulmonary Fibrosis (IPF) is a progressive lung disease with unknown causes in older adults. Fibrosis is the deregulation of wound healing leaving excessive scar tissue. Fibroblast cells support the growth and health of connective tissues and maintain the extracellular matrix (ECM). As fibrosis progresses, fibroblasts transdifferentiate into myofibroblast resulting in lung tissue stiffening, which leads to a decline in lung function and ultimately mortality. Fibroblasts and myofibroblasts cause increase stiffness in fibrotic tissue by forming actin stress fibers. NHE is an ion transporter protein important for cell migration, matrix remodeling, and intra- and extracellular pH regulation. The purpose of this study was to investigate if NHE1 exacerbates IPF. We measured actin stress fiber formation by treating cells with three profibrotic agonists: transforming growth factor-b (TGF-b), serotonin (5HT), and lysophosphatidic acid (LPA) in the presence and absence of ethyl-isopropyl amiloride (EIPA). The results showed individually treated cells with NHE1 had the highest percentage of stress fiber formation, and treated cells without NHE1 had a lower percentage. This reveals NHE could be responsible for mediating a fibrotic characteristic in lung cells. Interestingly, when agonists were added in combinations, there was no stress fiber formation when compared to treated single agonist cells. These results show a type of antagonism in controlling fibrosis. We wonder if this might point that an imbalance of agonists could lead to disease progression. Our work highlights for the first time that NHE1 has a role supporting profibrotic factors and may be a target to fight IPF.

The Socioeconomic Effects of Aquaculture on Wild-Caught Freshwater Ornamental Fisheries

THOMAS OH and Scott Dowd

The global trade for ornamental fish is a multibillion dollar industry that has been traditionally sourced from developing countries, and includes over 2,500 species, 60% of which are freshwater. While the majority of freshwater fish are now captive-bred, many are still removed from wild populations. This case study aims to evaluate the socioeconomic effects of aquaculture on wild-caught freshwater ornamental fisheries and the associated local communities. A literature review was conducted to identify and evaluate the regions of Barcelos, Rio Negro, Brazil and Lake Malawi, Africa, where the growth of aquaculture is having significant socioeconomic effects. Exporters in these regions depend on the local communities for extraction of fish and with the rapid growth of aquaculture and price competition, these areas are experiencing ecological and socioeconomic declines. In Barcelos, Rio Negro, Brazil, the Cardinal Tetra is the flagship fish, accounting for 70% of all fish sold in the region. However, the ornamental trade has experienced rapid declines in total fish exports from 56.6 million in 2000 to 6.4 million in 2014. There has been a concurrent increase in deforestation for subsistence agriculture. Lake Malawi, Africa has experienced similar effects as the total export value of the fishery has decreased from $129,595 in 2000 to $37,935 in 2014. In both case study regions, the growth of aquaculture has resulted in significant declines in production as well as negative effects on the associated local communities who rely on the fishery for subsistence.

Impact of Rainfall During El Nino Years on the Presence of Bacteria in Urban Stormwater on the Coastal Waters of San Diego

JAKE OHLENDORF and Jacob Rollins

Storm drain systems in urban areas serve to minimize flooding during periods of annual rainfall and divert the urban runoff to receiving bodies of water, which becomes a potential source of coastal bacteria that impacts human and marine health. Water samples from storm drain outfalls and receiving water were collected monthly during the wet weather season (November-April) and weekly during the dry weather season (May-October) at seven sampling sites that are located on the coast from La Jolla down to Pacific Beach. Analysis on water samples provided total bacteria counts (fecal coliforms, Enterococcus, and total coliforms) that were detected in coastal receiving water from November to April in both El Nino and non-El Nino years. Averages in bacteria counts from the wet weather season in 2015-16 range from 0-3951 colony forming units (CFU) while in 2017-18 ranged from 0-5435 CFU. These bacteria counts seem to indicate that El Nino years do not necessarily increase the presence of bacteria in coastal receiving waters even though the rainfall amounts were higher. Additionally, the bacteria counts were higher at two sites (EH290 and EH300) than those at other sampling sites. Further investigation on the relationship between urban stormwater flushing and presence of bacteria would be beneficial in determining the discrepancies in bacteria counts. With other sources of pollution being difficult to track, monitoring pollution from storm drain outfalls is important in assessing human impacts on coastal environments.

The Use of SPR to Probe HMGB1 Binding Interactions with Cell Clearance Molecules

ELIZABETH WADE, Payson Broome, Daniel Ghebreigziabher, Jonah Halsell, Anthony J. Bell Jr.

High Mobility Group Box 1 (HMGB1) is a small protein found primarily in the nucleus of eukaryotes. HMGB1 is composed of three parts: a-box, b-box and an acidic terminus of glutamic and aspartic acid residues. Beyond its role in DNA transcription, HMGB1 is characterized by its activity as a proinflammatory cytokine. In damaged or infected cells, HMGB1 will relocate to the extracellular matrix (ECM), where it selectively binds to immune receptors. The two most common HMGB1 receptors are Receptor for Advanced Glycation Endproducts (RAGE) and Toll-like Receptors (TLRs). HMBG1 binding to RAGE and TLRs facilitates innate immune and proinflammatory responses. Ideally, HMGB1 would operate in the ECM to expunge infectious pathogens. However, this does not seem to always be the case. Studies show that the presence of HMGB1 in the ECM has been associated with diseases associated with defective cell clearance, such as lupus and cystic fibrosis. There are four classes of cell clearance molecules in our bodies: eat me signals, find me signals, phagocyte receptors, and adaptor molecules/opsonins. It is unknown how HMGB1 and these classes of cell clearance molecules coordinately interact in patients with such diseases.

Assessment of Ferocactus gatesii populations in Bahía de los Ángeles using Manual Collection and UAVs

ILANA RIVERA LARREA and Drew Talley

Bahia de los Angeles is an archipelago consisting of 16 islands with diverse cactus populations (West 2002). Restricted to a subset of these small islands is an endemic cactus, the Bahía de los Ángeles biznaga (Ferocactus gatesii). Despite its rarity, and loss of individuals due to illegal harvesting, there have been no quantitative surveys of this population, and little is known about their recruitment or ecology (West 2002). The goal of this study is to assess the F. gatesii populations in Bahia de los Angeles using both terrestrial and Unmanned Aerial Vehicle (UAV) methodologies, to assess the accuracy and effectiveness of UAV census for this species. From a total of 16 islands in Bahía de los Ángeles, a subset of three islands were selected for this study. Dronedeploy was used to capture images, stitch them together, and form a high-resolution image of the island. These images were used to identify individual F. gatesii, and each was measured ('trunk' diameter) and assessed for reproductive status (flowers). The same parameters were collected on the ground. Surveyors walked the entirety of the islands and identified individual cactus. All parameters collected through field work were compared to those collected using UAVs. Preliminary analysis shows the UAV can correctly identify 100% of F. gatesii greater than 18 cm in diameter, while also identifying reproductive status. This suggests that, for monitoring adult populations of this threatened endemic, UAV surveys provide a rapid and effective method, but that there may be limitations in identifying newly-recruited individuals.

Factors Influencing the Distribution of Fecal Bacteria in Stormwater in the City of San Diego

IOANA TCHOLAKOVA and Zhi-Yong Yin and Annica Ly

Bacteria advisories are often issued in San Diego after a major storm event because of the gastrointestinal diseases associated with high fecal bacteria counts. Fecal coliform bacteria and enterococcus are two fecal indicator bacteria that are monitored throughout the City of San Diego (City) and are often found to be of exceedance of the total maximum daily load (TMDL), a measure of nonpoint-source pollution level. To better address this exceedance, we studied what factors are influencing the distribution of fecal bacteria within the City. We delineated watershed areas from the digital elevation model of San Diego that lead to each monitored outfall in FY17. We standardized the outfall values to watershed area and compared them to the weighted averages of physical and social conditions within each watershed. While there was no significant correlation between bacteria counts and the physical condition of the watersheds, there were trends suggesting higher bacteria counts to be associated with higher populations, lower population densities, and larger drainage areas. Additionally, large counts of enterococcus were found in drainage areas with large Hispanic population ($r = 0.608$, p-value = 0.002), while small counts of fecal coliform were seen in drainage areas with large white populations ($r = -0.429$, p-value = 0.036). Fecal bacteria concentrations appeared to be related to both physical and social factors, which will help jurisdictions target their water quality improvement initiatives in vulnerable areas.

Casimir Juggling

CONNOR HAFEN and Daniel Sheehan

Casimir forces can dominate system behavior at the nanoscale; increasingly, efforts are being made to control and exploit them [1-3]. Here we propose a simple method for contact-free, dynamic levitation, handling, and physical diagnosis of micron and sub-micron particles in vacuum using these forces. This `Casimir juggling' should sidestep the negative effects of stiction and contact contamination. Analytic calculations and numerical modeling show particles can be levitated, transported and deposited with nanometer precision using kHz-MHz active-feedback Casimir probes. Standard laboratory techniques appear adequate to experimentally test this proposal.

Observing Colloidal Fluids In Shear Flow Using Custom Light-Sheet Microscopy

JING WANG and Ryan McGorty

We study liquid-liquid phase separation (LLPS) with a colloid-polymer system subjected to shear. Our colloid-polymer mixture consists of temperature-responsive PNIPAM microgel particles and polymers acting as a depletant. This mixture separates into two phases: a colloid-poor, or 'gas' phase, and a colloid-rich, or 'liquid' phase. We observe the process of phase separation using a custom-built light-sheet microscope, which allows for simultaneously acquiring optically-sectioned images of our sample and shearing the sample in a Couette geometry. We measure the size and shape of elongated liquid domains that have been deformed due to flow as a function of shear rate. The temperature-responsive feature of our colloidal particles allows us to further explore the kinetics of phase separation under shear flow. We hope our study of phase separation under shear can provide fundamental insights into hydrodynamics and thermodynamics and provide novel strategies for structuring soft materials.

Baseline Assessment Of The Proposed Rewild Area in Mission Bay, San Diego CA

JORGE SAAVEDRA-ALVARADO and Eric Cathcart

Over 90% of the wetlands that existed in California prior to the 1920's have disappeared. The remaining wetlands in Southern California have been significantly altered by coastal development and impacted by other anthropogenic stressors such as stormwater runoff and dredging. These stressors may affect the resilience of marine estuaries, which provide crucial ecosystem services such as juvenile nursery habitat and carbon sequestration. Mission Bay, San Diego, California is the largest aquatic park (4,235 acres) in the United States, and since the 1920's, it has been subject to multiple phases of alteration including dredging and the creation of artificial shorelines and islands. There are currently only 40 acres of wetlands remaining in Mission Bay. A recently proposed project (ReWild) to rehabilitate wetlands in the northeast corner of Mission Bay, San Diego, California has been put forth by the San Diego Audubon Society. As part of the proposal effort, data from an ongoing multi-year study of geologic, biologic and physical/chemical benthic data from Mission Bay, completed by the University of San Diego, was compiled for the proposed ReWild area. This project establishes baseline measurements from Fall 2015 - Fall 2019 and examines trends in sediment (grain size, organic matter, metals concentrations), water temperature, and water nutrient concentrations that will be utilized in the design proposals for the rehabilitation site. Long term data sets such as this are crucial for monitoring these sensitive marine ecosystems and can provide useful data for maintaining and rehabilitation of wetland environments.

The Effects of Using Social Media on Psychology 101 Students at USD

KODI THURBER, DANA ROSANSKY, CAROLINE UHLIG, Marissa Patterson, Scott Kilcoyne, Charlotte Infante, John Woodward 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.

Understanding the Root of Morphological Differences Between Two Subspecies of Comarostaphylis diversifolia Using Phylogenetic and Morphological Analysis

LAUREL SPACCARELLI, Kaitlyn Coleman and Michael Mayer

Comarostaphylis diversifolia (summer holly) is a shrub native to Southern California coastal chaparral habitat. There are 2 subspecies of Comarostaphylis diversilfolia: spp. diversifolia and spp. planifolia. Subspecies diversifolia is generally found inland in a warmer, drier microclimate, whereas subspecies planifolia is found near the coast in a milder, more humid microclimate. Subspecies diversifolia generally displays curled leaves of varying degrees throughout the plant, whereas subspecies planifolia has flat leaves. Here we investigate if their morphological differences are due to a phenotypically plastic response to the local environment, or if they have diverged genetically. We collected samples from many different populations of each subspecies, extracted DNA, amplified 4 regions of their non-coding chloroplast DNA, and sequenced it for analysis. We also collected morphological data to understand the degree of phenotypic plasticity in spp. diversifolia. Our phylogenetic data, analyzed using maximum likelihood, suggests that planifolia is somewhat genetically distinct from diversifolia. It also suggests that the ancestral state includes having the plastic ability to curl leaves in response to the environment, but that planifolia lost its plasticity over time due to selective pressure for success in the milder conditions close to the coast.

How Extreme is Specialization in Seed-Feeding Beetles when Their Hosts are Poisonous?

MEGAN PRIEST and Geoffrey Morse

The paradigm of insect-plant research is that coevolutionary dynamics select for specialization in the interaction. The purpose of this study is to follow a population genomic method to dissect the host plant specificity of seed beetles (Acanthoscelides) on multiple varieties of the toxic legume Astragalus lentiginosus. Acanthoscelides impose direct fitness consequences on A. lentiginosus through consuming the plants' offspring (seeds), thus being a primary driver for high diversification and likely coevolution. I propose that through the seed beetles' imposition of antagonistic selection pressures and the resulting diversity of A. lentiginosus, populations of Acanthoscelides will have genetic association with the particular variety of host plant that they were collected from. I have examined the population genetic structure of 115 individuals from 15 varying populations found on several A. lentiginosus varieties in CA, AZ, UT, and NV. I will present the results of population genetic analyses based on molecular markers in order to assess whether there is evidence of host-associated specialization in the beetle. This study creates the opportunity to assess population dynamics of seed beetles, which impose great losses in legume crop yield each year.

The Presence of Microplastics Offshore of Southern California

RACHEL SARNER and Sarah Gray

Every year, at least eight million tons of plastic enters the ocean with some sinking to the sea-floor. Micro-sized fibers, granules, plastic films and spherules of plastics (microplastics) are a large part of this pollution. The objective of this research was to develop a methodology to determine how the abundance of microplastics varied with distance from shore/population and with water depth offshore of San Diego. Samples were collected on the RV Sally Ride and RV Sproul research vessels in 2018 using a multicorer, which was deployed at water depths ranging from 100 to 960 meters. In addition, sediments were collected in San Diego Bay for comparison. To extract microplastics from the samples, approximately 100mL of sediment from the upper layer (0-1 cm) of the cores was processed by density floatation in Zinc Chloride (density 1.5 g/cm^3). Floating microplastics were transferred onto a gridded filter and systematically categorized and counted under a microscope. Microplastic fibers were found as deep as 960 meters suggesting that plastic pollution is accumulating in the deep basins of the Southern California continental margin. Ongoing analyses of sediments (and analytical blanks) will determine whether microplastic abundance varies with distance offshore or water depth. A better understanding of the microplastic distributions in offshore sediments will help us better predict the impact of plastics on marine life which inhabit the deep sea.

Achieving Temporal Super-Resolution with Dual-Color Differential Dynamic Microscopy

RUILIN YOU and Ryan McGorty

We introduce dual-color differential dynamic microscopy (DDM) for detecting fast dynamics. DDM has been used extensively to measure the diffusive or ballistic motion of small particles, macromolecules and bacteria. Rather than localizing and tracking individual particles, DDM works by measuring the intensity fluctuations in images across a range of detectable spatial frequencies and provides data similar to that provided by dynamic light scattering. However, DDM is limited by the camera frame rate. Fast dynamics can be measured with high-speed cameras but those are typically expensive. We have developed a dual-color imaging setup which allows us to detect dynamics faster than the camera's frame rate. We trigger blue and red light at well-defined times within a single image exposure. By analyzing each color channel separately and in combination we detect dynamics that are several times faster than the camera frame rate.

Full genome sequencing shows evidence of regional pathogen diversity in Agraulis vanillae nucleopolyhedrovirus (AgvaNPV)

SAVANNAH SHIELDS and Arietta Fleming-Davies

Disease-causing viruses can adapt to their host, becoming more specialized and thus better able to infect a particular host species or genotype. If the disease, or pathogen, interacts with a host specific to the same geographic area, then both hosts and pathogens will co-evolve in response to each other, leading to local adaptation. I studied the host/pathogen relationship between Agraulis vanillae, commonly known as the Gulf fritillary butterfly, and nucleopolyhedrovirus (NPV), a lethal virus which is transmitted when it contaminates passion flower vines, the food species of the host larvae. I used next-generation sequencing techniques to sequence and analyze full genomes of 21 virus isolates collected at various locations in San Diego county, to look for evidence of regional diversity in this pathogen. I found evidence of geographic structure on a very small spatial scale, with two groups of genetically different strains found in North San Diego County versus the city of San Diego. This genetic variation was observed in key genes, important for disease transmission and virus reproduction. This genetic variation is consistent with pathogen evolution of specialization to its location-specific host, or with geographic barriers to dispersal of the pathogen. To determine whether local adaptation is in fact occurring here, future work is needed to compare infection rates of these northern and central San Diego strains in larvae from those same populations.

Studying Evolution of Neuronal Specification Through Comparison of Related Nematode Nervous Systems

SYDNEY WONG and Curtis Loer

The nervous system is a complex, highly organized network of nerve cells (neurons) responsible for control of the body and communication among its parts. Neuronal specification, the developmental process of generating specific types of neurons, is directed by molecular mechanisms regulating gene expression. Transcription factor proteins regulate gene expression, defining where and when particular neuronal identities are generated. Transcriptional control is central to the terminal fate of neurons, in which 'terminal selector' transcription factors control the activation and continued expression of most neuronal identity genes, such as those needed for using the neurotransmitter serotonin. Studying neuronal specification in the model organism Caenorhabditis elegans can give insight into basic, core mechanisms that operate in humans since many genes in C. elegans have functional counterparts in humans. C. elegans can also be used as a model for human diseases, including neurological disorders. Serotonin regulates many behaviors and other functions in C. elegans. One terminal selector controlling serotonin neuron fate is the POU homeodomain transcription factor encoded by the gene unc-86. There are clear orthologs (matching genes) of C. elegans unc-86 in the nematode relatives P. pacificus and O. tipulae, which have similar serotonin neurons and nervous systems to C. elegans. Comparison to C. elegans provides opportunities to gain insights into the evolution of neuronal specification by changes in terminal selectors like unc-86. Preliminary work suggests its pattern of expression in each species is similar, but not identical to that of C. elegans.

Cigarette Recycling Program Proposal to Reduce Environmental Impact of Cigarette Butts at SAN

VANESSA VLASAK and Paula Morreale

Yearly, around 6 trillion cigarettes are sold globally, and 4.5 trillion of these end up littered in the environment. As cigarettes end up in the landfill or in the environment, they continue to be harmful as they leach toxins into water ways and the cellulose filters can take more than 10 years to biodegrade. To reduce the environmental impact of cigarette butt waste at the San Diego International Airport (SAN), a pilot study was implemented for a cigarette recycling program. As part of the pilot study, cigarettes were collected from a specific smoking area for a month and shipped to a recycling company (TerraCycle). The number of cigarettes shipped per week was recorded and by the end of the pilot program 17,000 cigarette butts (17 pounds) had been collected. Before the pilot rollout, three different program scenarios were assessed, which included collection only, collection and new cigarette receptacles, and collection and new cigarette receptacles with marketing content advising passengers to recycle their butts rather than litter. The first scenario was ultimately chosen to assess the effectiveness of the collection and shipping procedure, and if successful the other scenarios would be explored. The effectiveness of the proposal and implementation of the cigarette recycling program at SAN was successful in decreasing the volume of discarded cigarette butts to the environment. Further implementation of this pilot program at SAN as well as other municipal airports will be discussed, as well as the potential environmental benefits of these programs.

Pharmacological manipulation of HEG1-KRIT1 protein complex modulates endothelial vasoprotective functions through expression of KFL4/2

ANTONIO ROJAS and Alexander Gingras

Endothelial cells (EC) line the entire circulatory system and control the passage of materials into and out of the bloodstream. EC dysfunction is damage to EC that impairs the function of the endothelium, and plays a central role in the development of vascular disease states such as atherosclerosis (plaque deposits/build-up), thrombosis (blood clots), and their pathological consequences, including heart attack or stroke. Kruppel-like factors 4 and 2 (KLF4 and KLF2) are transcription factors with critical roles in endothelial phenotypic and vascular homeostasis. Increased levels of endothelial KLF4/2 serve vasopotective functions. In this study we examined potential pharmacological inhibitors of HEG1-KRIT1 protein complex in order to upregulate KLF4/2 transcription factors in the EC. Analysis of GFP-KRIT1 FERM domain binding HEG1 coated beads through flow cytometry demonstrated that the KRIT with the mutated lysing residues displayed lower levels of KRIT1 binding when compared to the wild type. We evaluated whether the small molecule HKi002 would affect endothelial KLF2 and KLF4 gene expression. HUVEC and hCMEC/D3 human cell lines, were treated with the HKi002 inhibitor and KLF2 and KLF4 expression levels were determined. We observed that incubation of HUVEC cells with HKi002 upregulated both KLF2 and KLF4 expression in a dose-dependent manner. These results indicate that pharmacological inhibition of KRIT1-HEG1 protein interaction can be used to study the early and sustained effects of upregulation of KLF2 and KLF4. Future studies will focus on identifying other small molecule inhibitors that demonstrate high levels of KLF2/4 upregulation and in-vivo experimental trials on mice.

Humanities

Post-World War II Manga in Japan: Pluralities of Memory and the Construction of a New Peaceful Identity

BETHANY HARRIS and Yi Sun

In the ashes of post-World War II Japan and among the widespread poverty and devastation, cheap entertainment in the form of manga flourished on an unprecedented level. Manga was used not only to reenact and process war trauma, but also as a tool that helped usher in a new era of pro-American democracy and science. Manga in support of Japan's new image quickly became popularized and embraced by the public, such as Osamu Tezuka's Astro Boy, but this was only one lens that captured Japanese memory of WWII. Keiji Nakazawa published the first documentary form of manga in his I Saw It, a firsthand account of the Hiroshima bombing. This became popularized because Japan was a victim of the bombings rather than the aggressor. In addition to examining both of these works, this paper will examine lesser-known works, such as avant-garde manga published in the magazine Garo, that depict harsh realities that are largely removed from Japan's collective memory today about the war. Special attention will be given to lesser-known works of the time period from the 1950s-1970s to illuminate the aspects of the war that have been phased-out of Japan's collective memory. The argument this paper makes is twofold: manga that was popularized and integrated into collective memory was in support of Japan's new identity as a peaceful nation, and manga that depicted Japan in a negative light or wrote about wartime atrocities was largely forgotten and did not make it into Japan?s sanitized version of WWII.

Hong Kong 1920-1984: Conflicted Identity and Race to Revolution

GRAHAM HENDRICKand Yi Sun

This project examines the emergence of Hong Kongese political identity in 1920-1984. Based on current events, commentators and historians have highlighted the importance of this unique identity and the historical processes that influenced it, however, they disagree on the nature and the underlying causes of the identity. Based on analysis of primary historic documents such as British colonial legislation, Chinese intragovernmental communications and propaganda, and the actions of the Hong Kongese people themselves, this paper examines the Hong Kongese identity from a framework that does not rely on a binary, either solely pro-West or pro-Chinese, definition of identity. The study identifies several factors including liberal economic and political practices by the British Colonial government, the Communist Chinese Government overbearing influence, and Hong Kongers' own determination to blend Eastern and Western culture. As a result, it argues the current scholarly debate surrounding the Hong Kongese identity creates false dichotomies, mirroring old Cold War ideologies, rather than addressing the nuance that Hong Kong has been created in a world in between the two cultures, with the citizens being firmly rooted in both Western and Eastern ideology. This study has implications for understanding the violent tensions today as young contemporary Hong Kongers have become disillusioned with British promises and mainland Chinese interference. It lends insight into present violent disputes between the Hong Kongese citizens and the People's Republic of China, as in both cases we can see the effects of the earlier constitutional language and party policy in the contemporary era.

Chicanx Episodic Television and Representation

IVONNE RAMIREZ and Kristin Moran

Film and television have a history of not effectively representing marginalized communities, or not representing them at all. In terms of representing the Chicanx community, there are few television shows and films that depict the intersectional Chicanx community. The focus of this research are two shows that intend to be represent Chicanx culture: Netflix's On My Block (2018), and Hulu's East Los High (2013). Both shows are supposed to be focused on representing Chicanx youth culture in high school. Both shows revolve around different Chicanx issues, but my research question is to find out who these shows are meant for and their potential impact.

American Psychiatry and the Pathologizing of Homosexuality during WWII: An Examination of the Impact on US Military, Queer communities in the military and discourses on masculinity, 1938-1945

JAKE PREUIT and Clara Oberle

After World War I, the field of psychiatry in the US grew immensely and turned to create the perfect soldier. Increasingly, they advocated screening for mental and physical illness prior to recruits joining the military. Thus by 1939, the psychiatrists such as Dallas G. Sutton in an article entitled The Utilization of Psychiatry in the Armed Forces advocated for screening recruits along those lines. One of the mental illnesses they created as a category for screening was 'homosexuality.' This study examines the impact of such proposed screening for 'undesirable' traits, including homosexuality (defined as 'mental illness' by the psychiatrists). It looks specifically at the impact through three perspectives of those affected. 1) The individual perspective: How were service members and civilians affected personally? How did those who fit under 'mental illness' experience the change in laws and administration? 2) How did the changes affect the community, in particular, queer communities on and off base? 3) How did the new anti-homosexual laws and military policies that followed the psychiatrists' suggestions impact more comprehensive public concepts of (ideal vs. abnormal) masculinity? The project engages with diaries, memoirs, letters, legislation, journal articles, video and audio interviews of veterans, and multiple secondary sources to bring a new understanding of the adverse effects of the Psychologists' interventions in the 1930s on queer service members' lives and their surrounding communities. In the process, it engages with the often-disparate fields of Queer theory, military history, and the history of science and medicine.

Has the United States Sized out of the Democratic Project?

KATE BURNITE and Timothy McCarty

Prior to the 18th century, experiments in democratic government tended to be small-scale affairs. In Federalist 10, James Madison famously argued that an extended republic was not only possible but preferable for the pursuit and maintenance of the democratic project in the modern world. In the centuries that have followed, we have come to take for granted that democracy is possible on the scale of the nation-state. And yet, the drastic sociopolitical changes underwent globally in the past two centuries prompt a renewed engagement with questions of scale and design in democratic government and practice. Through an interdisciplinary analysis utilizing the lenses of philosophy, political science, history, and architecture & design, I intend to reexamine the question of democratic scale and design in the context of 21st-century challenges: To what extent can the problems of American democracy be attributed to problems of scale? If indeed the contemporary democratic problems are attributable to problems of scale, are there ways to design new kinds of democratic spaces to alleviate the uniquely 21st-century challenges of democracy, or must we consider the radical possibility that we?ve gotten too big for our democracy?

Cinching the Lily: Fettering and Flamboyant Fashion in the Victorian Era

MINA DE GUIA and Mary Hotz

The frivolous and flamboyant nature of Victorian womenswear—and its urgent relation to the life of its wearer, and to the “Woman Question” on the whole—-deserves attention. Despite its delicate bows and ruffles, Victorian fashion was physically demanding and often dangerous—a tangible illustration of the violent enforcement of hyper-femininity, which was widely rewarded through sexual attention, religious praise, and social approval. Such messaging was especially reflected in ephemera—conduct books, medical journals, domestic magazines, and advertisements—which represented a significant amount of the Victorian woman’s daily reading and thus functioned as an efficient form of social control. In conversation with this ephemeral material, this project explores women’s clothing as a mode of confinement while invoking material history and feminist criticism as its theoretical “boning.”

The False Frontier: Neocolonial Nostalgia in the Outer Space Imaginary

NICHOLAS COHN and Atreyee Phukan

This project traces the political function of nostalgia in the ongoing development of the 'outer space imaginary'--the linked discourse between outer space fiction and real-world outer space policy--from the 20th through the early 21st century. In considering the modern outer space imaginary, this project constructs and analyzes a timeline of selected works of science fiction and legal policy. Centered around Stanislaw Lem's novel Solaris (1961) and its Russian and U.S. film adaptations in subsequent decades (1972, 2002), it compares this reiterated narrative with contemporaneous legal rhetoric. I posit that the gradual domestication of Solaris' core narrative typifies a manipulative neocolonial nostalgia that permeates the outer space imaginary and has directed the present path of space policy towards privatization.

Imagining Resistance in Digital Spaces: The Oaxacalifornia Community on Self-Representation and Cultural Preservation

PERLA CRUZ and Amanda Petersen

Through this project, I examine contemporary media discourse that seeks to preserve Indigenous Oaxacan culture within the Mixtec community in the United States. By analyzing the migration diaspora of this community and the struggle to maintain visibility, my analyses present the resistance efforts that communication practices such as podcasts and social media space employ. I evaluate works such as the podcast Tuun Dali by a group of indigenous scholars and examine the digital space of Oaxacan Twitter and Instagram. In examining these discourses as texts, my investigation reveals how these groups reclaim and reconnect their identity despite not being physically present in their native land. Through their struggle to maintain cultural connections, such as language, customs and traditional practices abroad, these grassroots movements insist on self-representation and resist erasure and the lingering impact of the post-colonial experience.

Student-Parent Relationships and Academic Success

YARISSA VALDEZ and Jonathan Bowman

There is a need for non-instructional support for students' academic success (Wasonga, Christman, & Kilmer 2003). Research shows that academic prowess is not enough for students to excel in school; they also need social support from friends and family (DeBerard, Spielmans, & Julka, 2004). An influential relationship is one between a student and a parent. The relationship between a student and parent can impact multiple aspects of a student's life, including their academic self-perception. According to Sohn, Lee, Jang, Kim (2010), closer student-parent relationships yield higher grades. Confidence has been found to be linked to academic achievement (Stankov, Lee, Luo, Hogan 2012) and this study measures self-perceived competence as an indicator of academic success. Previous research has been done about the benefits of supportive interpersonal relationships for college students but little has been found about the cultural implications of students ethnic backgrounds. This study investigates and compares the differences in interactions between students and parents of Hispanic and non-Hispanic descent to better understand how ethnic differences in family structure affect students academically.

Engineering, Math and Computer Science

Industrial Wastewater Restoration

ALEC DACHS, KYLE DAVIS, BRANDON KENNEDY, NADEEM IBRAHIM and Frank Jacobitz and Yaal Lester

One of the major environmental concerns since the industrial revolution has been the byproduct of wastewater from production. Other forms of wastewater come from basic human use, agriculture, and domestic activities. Industrial wastewater can contain a large range of contaminants due to the variety of industries present today. Examples of these contaminants include heavy metals, plastics, oils, radioactive waste, and other suspended solids. Most of this wastewater enters sewage systems that transport it to treatment plants before being reintroduced to the environment. The treatment plants use techniques such as flocculation and settling to remove the contaminants. It is a relatively effective process, but there is still more that can be done. Currently, Israel is leading the way in wastewater remediation. This project will look more closely at the challenges and successes Israel has experienced and report an apt treatment process for the restoration of industrial wastewater into a natural stream. This project will be completed using combined efforts and perspectives from students at the University of San Diego and the Azrieli College of Engineering.

Using Appropriate Technology Principles in the Design of a Remediation Device for the Removal of Bacteria and Toxic Metals for Use in Rural Uganda

AVA BELLIZZI, Christina Kozlovsky and Frank Jacobitz

According to the World Health Organization (WHO), 2.2 billion people worldwide lack reliable access to uncontaminated water as of 2019. Uganda is among the countries most heavily impacted by poor water quality. Current water filtration technologies are often too expensive or complex to be successfully implemented in the rural communities that are home to the vast majority of the population. A broader collaboration within the University of San Diego and international partners focuses on the design of a low cost, low maintenance water filtration system targeting bacterial and toxic heavy metal contamination. This appropriate technological approach holds the potential to secure long-term benefits in regard to water quality in both rural Ugandan communities and throughout the developing world. In consideration of appropriate technology for the user population, the filtration system design focuses on the use of locally available plants as viable filtration matrices and employs readily accessible materials and manufacturing techniques for Uganda. In support of the broader group effort, this project uses the engineering design methodology to evaluate whether the final design constitutes appropriate technology for the intended population. Considerations such as affordability, manufacturability, environmental and social sustainability, community engagement, and socio-cultural viability will serve as focal points of this engineering design analysis. On a broader scale, the potential for the device to be expanded and adapted to accommodate additional developing communities facing poor water quality will be explored.

THEOSTEM

BRANDON KENNEDY and Rico Monge

Science, Technology, Engineering, and Mathematics (STEM) are subjects that hold great promise but fail to actualize solutions to humanity?s most pressing problems. While the world?s population could have been fully fed, clothed, and housed since the 19th century thanks to the technological advancements of that era, the gap between the rich and poor has increased, aided in large part by STEM fields. These fields have been rigorously and blindly pushed for in the American education system; rigorous for profit and blind because critical thinking is not part of the process anymore. Students from lower socioeconomic backgrounds are the ones most affected by this due to the need of breaking the cycle of poverty in their families: there is more money to be made in STEM related fields of work. Technology is made on command by students entering the workforce without understanding the implications of their work as they are stuck in a calculative way of thinking; the answer to their lack of wealth is doing blind science. In a world full of deadly weapons, the technology behind them will not be the cause of human destruction but the increasing inability for people to think in a meditative way. Technology can be a catalyst for positive change, but the one unique characteristic of people to think must first be brought back to the front lines of anything STEM related

Industrial Wastewater Analysis and Treatment for Direct Crop Irrigation

CHAD BEAR, JOSEPH BECERRA, LIDORI EDRI, MYCHAEL MEIER, Yaal Lester and Frank Jacobitz

Industrial wastewater from metal finishing and the production of electrical and electronic components (40CFR 433, 469) consists of water discharged from facilities that perform several metal finishing operations such as, electroplating, electroless plating, anodizing, coating, chromating, phosphating, coloring, chemical etching, milling as well as the manufacturing of printed circuit boards, semiconductors, electronic crystals, cathode ray tube and luminescent materials. These discharged waters are known to contain toxic metals and other contaminants which are by products of finishing and manufacturing processes and are harmful to the environment. This wastewater requires significant treatment in order to reuse for direct crop irrigation. The main pollutants in this water are high pH, CD, CN, Cr, Cu, Fl, Pb, Sb, Ni, Ag, Zn, and a myriad of organic pollutants. The recommended treatment of this water consists of screening, coagulation/flocculation, sedimentation, filtration, and disinfection along with other methods based on the exact pollutants present. Our team has the privilege of being comprised of students from the University of San Diego as well as the Azrieli College of Engineering in Jerusalem. This work describes the analysis of an Industrial wastewater sample analysis and proposes a suitable treatment process for use as direct crop irrigation.

Head Impact Tracking Sensor

NOLAN BISOGNO, DAVID HUNT, VICTORIA KLAZURA, CHRIS REESE and Bryan Cornwall and Venkat Shastri

There is a large number of undiagnosed concussions occurring in athletics. Given this concern, the team initially sought to develop a sensor system capable of detecting impacts to the head. As the team started the research and development process they identified groups of end users and their needs. These include athletes, coaches, and training staff that wanted accurate measurement in a discrete form factor for a reasonable price. Although safety was the primary goal of the project, performance metrics were identified as a desirable and easily implemented feature. Ultimately, the final project goal is to develop a sensing system that is affordable, improves safety, and gives the performance metrics desired by athletes. The design goal is a wireless sensor system that can be easily fit into a headband worn by players. The current prototype features accelerometers and gyroscopes as the method to track player movement and a Bluetooth module to transmit the data wirelessly to a computer, where algorithms are being made to analyze this data. A printed circuit board (PCB) design has even been created and tested at this stage. Finally, some preliminary calculations have also been made in regard to wireless communication and data storage. Moving forward, the team continues to work on smaller designs for the product and to incorporate more features. A mobile application is in development and a test stand is being considered to validate the measurements from the sensor. The presentation will highlight the project's progress including research, prototyping, and testing

Agricultural Wastewater Reuse for Indirect Potable Reuse

KORAL BRAYLOWSKI, KENDRIC CLAGETT, CHASE MINEHAN, SABRINA SMITH, Frank Jacobitz and Yaal Lester

Around the globe, populations experience drought conditions related to the overuse of fresh potable water. Many populations fail to recognize the untapped potential of their wastewater. Wastewater is any water that has been altered through human use such as for domestic, industrial or agricultural purposes. Depending on the source of the wastewater, it may contain a multitude of different pollutants. Typically, the reuse of water from sources such as these is off putting and frowned upon by general populations. Even so, wastewater has been treated on some level and most commonly reused in agricultural settings. Current wastewater treatment technology allows for our wastewater to be a large reliable source of potable water. Treating wastewater to a tertiary level has the ability to boost the health of the environment it is returned to, supplement drought-ridden water supplies, and decrease the strain on current water resources. Our team is privileged to have the opportunity to work with the Azrieli College of Engineering in Jerusalem. As a country, Israel is currently developing the cutting-edge technology in the wastewater industry, creating a positive global impact. Our focus will be on the process of cleaning agricultural wastewater, with common pollutants including fertilizer, organic wastes (manure) and industrial byproducts for reuse as indirect potable water.

Simultaneous Collisions in Various Numbers of Dimensions

CHRISTOPHER CURRIE, DEVIN VILLALPANDO, GINA AGUIRRE and Lukasz Pruski

The project is a continuation of research conducted by students in the summers of 2017 and 2018, which dealt with hierarchical systems of collisions of many balls. However the current project focuses on simultaneous collisions of balls, i.e., situations where more than two balls collide, each with each other, at the same time. The simultaneity condition requires much more complicated mathematical treatment to ensure the physical principles of conservation of momentum and energy are satisfied. We study the collisions in 2D, 3D, and 4D. We have developed a novel computational approach that combines hand computations and MATLAB symbolic computations with computer simulation. We have developed several web-based, interactive computer programs that determine the balls' behavior during simultaneous collisions and visualize their motion. The programs are written in Javascript, with CSS and HTML components and use the Three.js API (application programming interface) and library of 3D routines.

Recycling Agricultural Wastewater for Direct Crop Irrigation

DIANE CASTELLANOS, AMIT HAZUT, VICTORIA KLAZURA, MIREYA ROBERTO, Yaal Lester and Frank Jacobitz

Wastewater is water that has previously been used in a municipal, industrial, or agricultural process. In this project, we will be focusing on the recycled use of agricultural wastewater. Agricultural wastewater is water that has been used for agricultural purposes, such as watering crops, preparation and processing of crops from the field in centralized facilities, or raising dairy cows. These sources can influence the type of contaminants, such as components found in fertilizers and pesticides, polluting the wastewater. Dairies are important sources for heavily polluted wastewater, both in Israel and California. Sewage from dairy farms is formed from several activities including manure and water for washing and maintaining the farm and milking facilities. The produced wastewater typically has high concentration of organic matter, nutrients, salts and pathogens, which can potentially contaminate soil and water sources if not well treated. Most water treatments comprise of mechanical, chemical, and biological methods to clean the water. There are several options for reusing treated water such as in agriculture, environmental restoration, or indirect potable reuse. Israel reuses over 80% of its wastewater, making it a world leader in water reuse. Despite being dominated by desert, Israel is a water-rich country, acting as an example for the rest of the world. In attempts to learn from Israel's water successes, our team is a collaboration of students from the University of San Diego and the Azrieli College of Engineering in Jerusalem. Together, we analyzed a sample of agricultural wastewater and studied reuse in direct crop irrigation.

Simulation of Flow over a Roughness Element

IAN SYSYN, PATRICK BONNER and 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 (Mäteling E., Lemarechal J., Klein C., Puckert D.K., Rist U. (2020) Experimental Investigation of Mixed Convection in Horizontal Channel Flow in Combination with Cylindrical Roughness Elements. In: Dillmann A., Heller G., Krämer E., Wagner C., Tropea C., Jakirli? S. (eds) New Results in Numerical and Experimental Fluid Mechanics XII. DGLR 2018. Notes on Numerical Fluid Mechanics and Multidisciplinary Design, vol 142. Springer, Cham), which visualizes the transition of the laminar boundary layer ahead of the roughness element to a more vertical flow state in its wake through the use of temperature-sensitive paint. The simulations are broken up into two parts. First, a laminar Blasius boundary layer is simulation as the inflow condition ahead of the roughness element. Then, the interaction of the boundary layer with the roughness element is simulated and analyzed. The simulations show the disturbance of the boundary layer by the roughness element and the development of a more complex, vertical wake flow.

Comparison of Plantar Pressure of Different Prosthetic Feet in Able-Bodied Volunteers Simulating Active Foot Amputees During Locomotion

JACQUELINE PUGA, REBECA REYES SICAIROS and Bryan Cornwall

Active foot amputees may choose from a variety of prosthetic foot designs to accommodate their financial and daily lifestyles, yet it is unclear what design is similar to non-amputee gait, specifically in pressure distribution. The hypothesis is that there are differences in plantar pressure distributions for different types of prosthetic feet during gait and pressure distributions are comparable to able-bodied gait. The purpose of this study is to inform active foot amputees of what prosthetic foot designs can help them complete their daily tasks similar to non-amputees through plantar pressure comparisons. The study will be conducted by using an orthopedic boot system that attaches to different prosthetic foot designs. The orthopedic boot (OB) will be used by able-bodied-non-amputee volunteers, so that their foot is immobilized from the knee down to simulate active foot amputees. The three prosthetic foot designs that will be tested are the articulated foot, tec limbs, and Niagara foot and will be attached to the left orthopedic foot. The S.A.C.H foot will be the control group attached to the right boot. The prosthetic feet are put into a shoe that has the Tekscan F-scan sensors in the insole. This Tekscan system has been used clinically and in research to evaluate dynamic pressure distribution in gait and running. To our knowledge, it has not been used to evaluate dynamic pressure distribution in amputee gait. Preliminary results demonstrate differences exist and further research is recommended with this system.

BIBBLE: A Mobile App aimed to Serve the Needs of Student Life

JOY OLOWONIYI, Tobenna Okunna, Sebastian Ramirez, Marcus Rogers, Jason Knapp and Charles Pateros

Students across the world in higher education, whether they are in a junior college or university, experience a detachment and a lack of meaningful engagement with the people in their academic community. This issue is vital because students need a supportive and accessible community. Bibble is the solution to this problem. Bibble is a mobile application that gives a platform for students to exchange and communicate with other students on their campus. Each school has its own platform creating a micro-community that gives students a safe haven to voice their thoughts, connect with new people, and engage. Students on the platform can exchange (buy or sell) items such as textbooks, dorm supplies, and any other student-life needs. Bibble also provides a space for students to share their thoughts and follow relevant topics. Using our hashtag system, clubs, fraternities, and other student organizations will be able to utilize this to connect better with their members. Student life can be difficult, but Bibble makes it easier!

The Development of a Remediation Approach for the Removal of Bacteria and Toxic Metals for Use in Rural Uganda

CHRISTINA KOZLOVSKY, AVA BELIZZI, Molly Klein, Ariel Shasha, Liron Kanisberg, Yaal Lester and Bryan Cornwall

Reliable access to safe drinking water is among the United Nations' Sustainable Development Goals. This goal remains unrealized in rural Ugandan villages, where water contaminated with bacteria and toxic metals is common. This project is a broader collaboration at the University of San Diego with international partners and involves a two-step approach that makes use of locally available materials. A tea bag filled with treated banana peels and activated carbon will be designed to target toxic metals. This particular Mechanical Engineering Capstone project emphasizes the elimination of bacteria from water using the xylem and phloem of native plants, including eucalyptus, as a filtration matrix. Water from local rivers, boreholes, lakes, and collection systems is filtered using a simple set up in which a sample of tree branch is tightly sealed in a PVC tube and water is forced through the sample using a syringe. Preliminary results indicate that this technique is effective at removing fecal coliforms from contaminated water. Further testing is conducted through a collaboration with Azrieli College of Engineering Jerusalem in Israel. The development of a reliable sealing mechanism between the xylem sample and its housing and establishment of an adequate flow rate will inform the design of the filtration mechanism. The intended final design is a system that is effective at removing bacteria and select toxic metals from water at an acceptable flow rate; the design must be sustainable at the local rural Ugandan level utilizing appropriate technology.

Municipal Wastewater for Indirect Potable Reuse

MATTEO HERNANDEZ, JULIA MAHROOS, NADAV SHPIEGLER, MIRA WILEY and Yaal Lester and Frank Jacobitz

Collecting wastewater is vital for public health and water security in our increasingly water-scarce world. Municipal wastewater is classified as water collected from sewers and wastewater from homes and businesses. Before it is released into the environment, it is treated in a dedicated facility. Indirect potable reuse utilizes an environmental buffer such as lakes, rivers, or aquifers, to further filter the water. In this system, wastewater is collected, treated, and released - where it is filtered by natural systems until it eventually re-enters a treatment facility and is reclaimed and treated to meet drinking standards. Israel is the world leader in water reclamation and reuse, setting the example for the boundless possibilities through water treatment. Our team has the privilege of working with students and faculty at the Azrieli College of Engineering in Jerusalem to better understand the treatment and its implications to encourage the adoption of these technologies in countries such as the U.S., and especially in drought-prone regions such as California. As populations increase and the climate crisis becomes increasingly problematic, both developed and developing nations will feel the effects of water scarcity. It is crucial that we critically analyze the Israeli techniques of treating municipal wastewater for indirect potable reuse, and begin the implementation of these processes before it is too late.

SAE Baja Senior Design Project

VALERIYA FOX and ZEKE BUCKNER and SAM MEISNER and AARON MEYER and MIRA WILEY and FREDDY ROCHA and CARLO SANCHEZ and CHAD BEAR and DESTIN ALTMAN and MYCHAEL MEIER and JOSHUA REYNOLDS and Steve Saxer and Daniel Codd

The Baja SAE project at the University of San Diego was established in 2016. The team's goal is to design and fabricate an off-road vehicle to perform all capabilities of the Baja SAE competition in Tucson, AZ April 16-19. This report highlights areas of design for vehicle #27. This document contains information pertaining to the design features and analysis of each major subsystem of the car. The vehicle is designed to improve upon the designs of previous years and be safe, durable, and effective.

Nuvve Mobile App

MICHAEL DANA, ALTHEA FASTIDIO, CALVIN FERRARO, RORY ABRAHAM and Jay Kunin

In 1996, researchers at the University of Delaware began pioneering a unique approach to storing and utilizing renewable energy sources called Vehicle-To-Grid (V2G) power. The driving principle of V2G is that energy can be discharged from the lithium-ion batteries of electric vehicles (EVs) for consumption in the grid. Renewable energy sources need storage, and the growing market for electric vehicles presents a plentiful source of potential energy storage. V2G offers a mechanism to exploit these otherwise untapped storage resources for use in the grid. Nuvve is a global leader in commercial V2G solutions, which have the potential to improve the utilization and economic viability of renewable energy and electric vehicles. This project focuses on building a cross-platform mobile application through which individual EV owners can connect with V2G services offered by Charge Point Operators (CPOs). These CPOs could be anything from a shopping mall or apartment complex to an entire metropolitan area. By opting-in to V2G services while charging their vehicles, individual EV owners have the opportunity to earn money by providing power capacity and sending energy back and forth to regulate the grid, while CPOs can reduce costs and energy consumption by utilizing energy from EV batteries during peak hours. In addition to building an application to facilitate these activities, we have built a scalable and robust suite of cloud-hosted microservices to manage and coordinate Nuvve's users and services. Our mobile application relies heavily on these back-end microservices, and they have been designed with Nuvve's long-term goals in mind.

Halon: Tower Defense

JOBE SOFFA CLARKE, Karston Kelly, Parth Bansal, Thaddeus Steele and Charles Pateros

For our project we set out to create a uniquely engaging product within a sub-genre of strategy games known as Tower Defense. This is a genre where waves of enemies attempt to travel through a maze to reach the exit while players attempt to build defenses strong enough to stop them. We want to take the genre in a new direction by putting more power in the hands of the players. By giving players agency over aspects of the genre that they don't normally control, such as maze design, we believe that the creativity of players will be able to shine in a way that encourages competition and community. With this in mind, we chose to construct this product on the game development platform known as Unity. At the beginning of this project, most of us had little to no experience with this development engine, and as a result were tasked with learning difficult skills on the fly to produce high quality content. Whether developing algorithms for enemy pathing and resource placement, constructing an intuitive UI for the players, or adjusting assets from the Unity store to suit our design needs, we have overcome each obstacle placed in our path. We are on schedule to finish a single player build of the game by the end of March, and are currently planning on implementing multiplayer by the end of May.

Social Sciene and Behavioral Neuroscience

Pharmaceutical Effects of Ketamine on Rat Performance in the Traveling Salesperson Task

ALEXANDRA UNAPANTA, Chloe Dennis, Charlotte Lee, and Rachel Blaser

The Traveling Salesman Problem (TSP) -- a task in which the goal is to select the shortest possible route between a series of targets -- has been used to study spatial cognition and memory in both human and non-human subjects. Ketamine, a non-competitive antagonist of NMDA (N-methyl-D-aspartate) channels, is a drug commonly used to induce dissociative anaesthesia. Recently, subanesthetic doses of ketamine have shown to suppress feelings of anxiety, fear, and depression in subjects, and was approved as a pharmaceutical treatment for severe major depressive disorder (MDD). In order to assess the long-term effects of this drug on cognition, our two-part study examines subanesthetic doses of ketamine on rat TSP performance. First, we familiarized and pre-trained rats to human handling as well as the TSP task. During testing, rats were placed in an arena with a specific spatial configuration of baited targets. Their performance was video- recorded and coded for various behavioral measures such as latency and memory span. In Experiment 1, rats were administered a subcutaneous injection of either saline or ketamine hydrochloride (5mg/kg) minutes prior to testing. Preliminary data shows significant differences in TSP performance between control and ketamine-dosed rats. In Experiment 2, rats were administered subcutaneous injections of either saline or ketamine hydrochloride (5mg/kg) daily a week prior to testing, as well as the week of testing. Our goal is to better understand the cognitive mechanisms involved in the TSP, as well as characterize any cognitive deficits that may be produced by acute or chronic ketamine exposure.

Red Shirt Color has no Effect on Winning in the English Premier League**ANGELA**

HADDAD, SHAKIRA TREJO and Nadav Goldshmied

Attrill, Gresty, Hill and Barton (2008) conducted a seminal study in elite English soccer demonstrating in archival research that from 1947 to 2003 seasons, teams wearing red uniforms won more than teams in other uniform colors. Their study was one of only very few that extended the color-in-context theory (Elliot & Maier, 2007) to team, ball-oriented long-duration sports. The current investigation explored the Premier English League from its inception in 1992 until the 2018 season and failed to detect through a one-way ANOVA test any uniform color effects (including red) (p-value= 0.520). Instead it was found that stadium capacity, which served as proxy to teams' wealth and resources, was strongly correlated with winning at home (p-value= 0.046) [as well as with away winning]. We further explored the original study's claim regarding the difference in performance between teams from the same city (i.e., derby matches) in which the team wearing red uniforms as their home color, ranked consistently better than their non-red wearing in-town rival. We found it difficult to substantiate such a claim as many of the teams were not playing in equally competitive leagues. We additionally discuss other weaknesses of the original study and call into question color effects in this athletic context.

Effects of temporal delay on memory

BRITTANY BOSKO and Stephen Pearlberg

The reliability and validity of participants self-reported confidence while making eyewitness memory judgements is a hotly debated topic within the criminal justice system. In current research I hypothesize that eyewitnesses will report greater confidence in memory when given slight affirmation. University of San Diego undergraduates: complete a short survey measuring confidence in memory, view a brief film of a mock robbery, complete an immediate free recall assessment, and answer follow-up questions regarding the crime they witnessed. Participants are then presented with photographic line-ups and are asked to identify the perpetrators. Subjects are randomly assigned to receive either slight positive or negative affirmation of their assessments from the investigator, regardless of their accuracy. Three days later, participants complete an identical assessment instrument to measure any variation in memory and reported confidence. Results, conclusions, and future implications will be discussed.

Hydra Hunters: Community Outreach and Exploration with Citizen Science

CATHERINE TAN, Kimberly Sladek and Callen Hyland

Cnidarians of the genus Hydra are found all over the world in a wide range of habitats. Hydra are also important in biomedical research as model organisms for regeneration and aging. Recently, a team of scientists at UC Irvine and Pomona College has used DNA sequencing to trace the evolution of Hydra and understand how they have dispersed across the globe. We aim to expand the reach of these studies by mobilizing citizen scientists in San Diego County to search for Hydra specimens in local fresh water environments. With funding from the USD Associated Students Government, we have created Hydra collecting kits that will be distributed to members of the public at a workshop where we will teach the techniques of Hydra collecting and identification. We have also developed a hands-on workshop for youth observe and do hands-on experiments with Hydra. These workshops introduce students to the scientific investigations and raise awareness about a little-known aspect of the local environment.

Associations between Parenting Style and Five-Factor Personality Traits

DARLENE NGO and Michael Ichiyama

Because parents are typically the first agents of socialization for children, it is reasonable to draw hypothesis that they would have an association with personality traits. The purpose of this study is to identify an association between Baumrind's (1966) parenting styles and the Five Factor Personality Model. A total of 767 undergraduate students completed an online research survey that included measures of maternal and paternal parenting style (Authoritarian, Authoritative, and Permissive) and the subscales of the Neo-Five Factor Personality Inventory, which measured traits of Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. Two multiple regression models will be computed for male and female students with each personality trait as the dependent variable and mother and father parenting styles serving as predictor variables. Such analysis will allow us to additionally explore cross-gender interactions between children and parents. This study may help us better understand environmental factors of personality and adopt a more holistic approach toward parenting and its importance in personality development.

Effect of Hippocampal Infused DREADDs on the Traveling Salesman Problem in Rats

GREER MARSHALL, Larissa Olivas, Rachel Blaser and Jena Hales

The hippocampus is critically involved in memory formation and retrieval. Although studies using traditional tests and lesion methods have been essential for investigating hippocampal function, relying solely on such methods can limit our understanding of hippocampal involvement in cognition and behavior. Our research examined the role of the hippocampus in rats' performance on the naturalistic foraging task, the Traveling Salesman Problem (TSP). Our lab previously found that rats with conventional hippocampal lesions had impaired TSP performance. Our current study explored a chemogenetic method for disrupting hippocampal function that leaves brain tissue intact and allows for more temporal control over this disruption. Twelve rats received virus-mediated DREADD infusions via stereotaxic surgery targeting the entire hippocampus. Following recovery and pretraining on the TSP, the virus was fully expressed and rats were tested on four task configurations. Prior to testing, rats received saline (control) injections or injections of CNO to locally suppress hippocampal neural activity by binding to the synthetic DREADD receptors. After being tested on each configuration with both injection types, the rats were perfused and their brains fixed for sectioning. Preliminary results suggest rats were impaired on TSP performance after receiving the CNO versus saline injections when the configurations were more complex and involved more targets. Comparing these results to prior data shows that while hippocampal lesioned rats were impaired across many different configurations, the DREADD infused rats were more selectively impaired on specific configurations, providing additional insights into how the hippocampus is involved in rat performance in the TSP.

Soccer Fandom Impacting Hiring Decisions

INES NOEL, JOSEPH ACHWILL and Nadav Goldschmied

Although some past research suggests that hiring decisions are influenced by factors beyond work qualifications, a recent study found no evidence for biased hiring decisions. This study found that an American citizen, who was a fan of the Mexican soccer team rather than the U.S. National soccer team was no less likely to be hired for a CIA Analyst job (a U.S.National security position) or for a U.S. Agency for International Development Research (a non-National security position) [Jassim, O?Brien & Goldschmied 2019]. The current investigation set out to expand on this past experiment, by looking at whether the effect was present with a different sample as well as occupations. This study was conducted with Naval Reserve Officers Training Corps (NROTC) students who were thought to be more concerned with National security issues. Participants read about a candidate who was, again, either a fan of the Mexican or U.S. National soccer team. However, the candidate, this time around, applied for a border patrol agent stationed either on the Mexican or the Canadian border. The results did not support the prediction that an applicant, who was a fan of the Mexican National team, and applied to patrol the Mexican border, would be perceived as less qualified than a candidate who was a fan of the U.S. National team.

Differences in Undergraduate Drinking Motives and Alcohol Involvement as Influenced by Gender and Neuroticism

JAYMI WILSON and Stephen Pearlberg

College marks the onset of drinking behaviors for many undergraduate students as they enter a new environment devoid of previous inhibiting variables. Whatever the reason college students choose to drink, and not all of them do, it is imperative that we understand the motives and influences that can lead to increased alcohol related risks in college. This study examines the relationship between drinking motives and alcohol involvement in undergraduate students as defined by gender, expanding on previous literature by not only analyzing the effects of a direct relationship between drinking motives and alcohol involvement but also analyzing the impact subject personality, namely neuroticism, may play in mediating and changing the relationship. Utilizing existing data and multiple regression analysis, this study evaluates the influence neuroticism has on alcohol involvement. Mediated path models for male and female subjects are used to test for gender differences in drinking outcome. I hypothesize that female undergraduates will have an increased likelihood of a mediated relationship between neuroticism and drinking outcomes because females are more likely to be neurotic than males. I also hypothesize that males will be less likely to report emotional reasons for drinking and as such will be unlikely to produce the mediated results. This study will provide insight into the gender differences in drinking motive and provide implications for changing the approaches we take to alcohol involvement by gender.

Approaches to Studying Neural Regeneration in Hydra

JENNIFER DESANTIS, Kenneth Badami, Victoria Rodriquez, Natalie Fung, Palak Shah and Callen Hyland

Hydra vulgaris is a freshwater cnidarian with a simple body plan that is well known for its regenerative abilities. After being cut in half, each half can regenerate its missing parts. Even small fragments of the animal's body wall can regenerate into a complete animal. As Hydra's body column regenerates, its nervous system must also regenerate, but little is known about how neurons regrow, reconnect, and reform a functional nerve net. Our lab is taking several approaches to investigating the mechanisms underlying neural regeneration in Hydra. We use fluorescence imaging of Hydra expressing EGFP in the nervous system to track the progress of regeneration in both fragments and whole animals recovering from injury. Preliminary data shows that while the epithelium heals within the first three hours after injury, severed edges of the nerve net take much longer to reconnect, raising the possibility that new neurons must differentiate from stem cells to fill in gaps. Long term imaging of Hydra behavior during the early stages of regeneration will reveal at what stage of neural regeneration animals are capable of generating whole-organism spontaneous behaviors and responding to mechanical stimuli. Hydra's remarkable plasticity is also evident in its response to food deprivation - the entire animal gets smaller while metabolizing its own cells through autophagy. We are using fluorescence imaging to investigate how nervous system density and connectivity is regulated during starvation-induced shrinkage

Stories of Transition: Refugee Youth and Their Transition into U.S. K-12 Education

JESSE MAGAÑA and Greg Prieto

This study will look at the education system and how it serves refugee students who have been identified as English Language Learners in the local San Diego area and understand where resources are lacking in assisting refugee students as they aim to both integrate and build social capital. As of the fiscal year 2017 there were 25.9 million displaced people who have to forcibly leave their countries (2018). According to the United Nations Refugee Agency the U.S. receives less than one percent of the refugee population per year. Studies indicate that schooling experiences are important for integration generally because they are the first places where refugee youth will establish themselves upon their arrival (2008, Pg 390) One of the most difficult parts for refugee families is the transition into an entirely new education system for their children. For this purpose, educational integration is critical because it shapes longer term social mobility (2018). The feeling of being displaced then comes with the struggles of possibly having to learn a new language, make new friends, and learn an entirely new culture. Through the sociological lens we will be able to look at the attainability of social capital for refugee youth through one on one interviews with students and administrators from San Diego schools, as well as ethnographic observation at refugee advocacy agencies. Ultimately, how well these students transition into the K-12 education system will determine how well they transition in the k-12 education system.

The Accuracy of Undergraduates' Memory of the Columbine School Shooting

JULIA MALKIEWICZ, OLIVIA HAYS, Camille Roth, Kelly Perreault and Nadav Goldschmied

We administered a questionnaire to University of San Diego students and prompted participants to describe any memories they had regarding the 'Columbine School Shooting.' Subsequent questions probed for the recognition memory of the participants. We collected demographic information, political affiliation tendencies as well as their opinions regarding guns in America. Among the 54 participants who were able to provide information beyond that which was presented within the event's title (i.e., High-Knowledged, HK), we found that they accurately recalled both the year and state of the shooting, as well as the number of perpetrators and their ages relative to the 74 Low-Knowledged participants (i.e., those who could not contribute additional details beyond the title provided). However, the HK participants overestimated the number of fatalities relative to LK. Factors like religiosity, support of the NRA, political affiliation, and firearm ownership did not separate between HK and LK.

Effects of Medial Entorhinal Cortex Lesions in Rats on the Traveling Salesman Problem

LARISSA OLIVAS, VICTORIA CENDEJAS and Rachel Blaser and Jena Hales

While laboratory-based experiments are beneficial for isolating and targeting specific behaviors, they can restrict our understanding of these behaviors and how they apply in natural settings. The Traveling Salesman Problem (TSP) is a spatial task that differs from many other behavioral tasks because it explores foraging behavior in a naturalistic setting rather than examining an animal's ability to perform a specific behavior. Although foraging is a natural, spontaneous behavior, it is also complex, in that it involves decision-making, attention, course planning, memory, spatial processing, and navigation. Our research study examined the role of the medial entorhinal cortex (MEC) in the TSP task. Previous research from our lab found that rats with hippocampal lesions were impaired on certain TSP measures, including making more errors by revisiting targets, taking longer to complete the task, and using routes that were less optimal compared to the control rats. Experiments utilizing oversimplified conditions have shown that the MEC plays an important role in spatial processing and spatial memory in ways that are similar to, and yet distinct from, those of the hippocampus. Thus, comparing the effects of MEC lesions to those of hippocampal lesions while rats are performing the TSP task can shed light on the relative contributions of these different anatomical brain areas to naturalistic foraging behavior.

Impact of Religiosity on Prosocial Behavior

MICHAEL APOSTOL and Rebekah Wanic

Many religious traditions are grounded partly in an ethic of care, promoting prosocial behavior and leading to the creation of many hospitals, homeless shelters, and charities (Hardy, 2013). Not surprisingly then, prior research has attempted to explore the connection between religion and prosocial behavior among individuals, often using measures of religiosity as an assessment of the centrality or salience of religion in an individual?s life (Huber and Huber, 2012). Findings on the connection between the two variables have been mixed and prior research is plagued by two main issues: vague measures of religiosity and a lack of ecological validity. The current set of studies seeks to address these shortcomings. Specifically, Study 1 utilizes a more comprehensive measure of religiosity, the Centrality of Religiosity Scale (CRS; Huber and Huber, 2012) and evaluates the relationship between CRS scores, donation likelihood, and framing effects. Participants were asked to donate to either a religious or non-religious organization, with the question framed to emphasize either gain or loss. In Study 2, the CRS is integrated with a replication of Grossman and Parrett?s (2011) field experiment assessing the impact of religiosity on restaurant tipping. A positive correlation between CRS scores and donations (Study 1) or tipping (Study 2) was expected (Galen, 2012; Regnerus, Smith, & Sikkink, 1998) along with increased donations for the religious and loss-framed scenarios (Study 1). Contrary to expectations, religiosity was unrelated to prosocial behavior across both studies, however, a loss-framed message led to increased willingness to donate.

Role of the hippocampus and medial entorhinal cortex in discriminating elapsed time duration in rats

NINA S. TABRIZI, Megan Elyamani, Thomas Hunt, Emerald Weeth, Anette Vo, Jena B. Hales

Space and time are both essential features of episodic memory, for which the hippocampus and medial entorhinal cortex (MEC) are critical. Neurons have been identified in the hippocampus that fire with spatial-specificity, known as place cells, or with temporal-specificity, known as “time cells”. Recent studies have suggested that the MEC may play a role in hippocampus-dependent temporal processing as MEC lesions disrupt temporal patterns in the hippocampus (Schlesiger et al., 2015; Robinson et al., 2017). In order to directly study the role of the hippocampus and MEC in processing elapsed time, we created a novel time duration discrimination task. Twenty-four rats were tested on a figure-8-maze and experienced a 10- or 20-second time delay at the end of the center arm. During this delay, a 2000Hz tone played for the 10- or 20-second duration. Rats learned to make a decision to turn left or right out of the delay box depending on the preceding tone duration (10 seconds = left turn; 20 seconds = right turn). Once the rats reached a 90% criterion performance, they received a hippocampal, MEC, or sham lesion surgery. After recovery, rats were tested to determine hippocampal or MEC involvement in discriminating time duration. All lesion rats were impaired relative to the sham rats, and failed to return to criterion performance. Results indicate that rats with either hippocampal or MEC lesions are significantly impaired at discriminating the duration of elapsed time in order to perform the associated behavioral response.

Perceptions and Misperceptions: College Students with Down Syndrome

ZIA YURCHUCK and Stephen Pearlberg

People with Down syndrome are often left out of the college narrative, yet many colleges and universities are opening doors to students with intellectual and developmental disabilities (IDD). Current research suggests that the perceived capabilities of individuals with IDD impacts the expected achievement of people with IDD. However, studies are commonly conducted done in colleges. The purpose of current research is to understand the views USD students hold towards students with IDD. Undergraduates are exposed to descriptions of student candidates for an on-campus position that are randomly assigned to either; have IDD/don’t have IDD or are qualified/unqualified. They then rank each applicant and make a hiring decision as a product of these rankings. Based on previous research, I hypothesize that USD students will indicate a preference for a student that doesn’t have IDD. The results of this research could have important implications for people with disabilities attending college.

The Effect of Ethanol on Zebrafish Behavior

RACHEL ALEF and Rachel Blaser

Zebrafish (Danio rerio) have been extensively studied in behavioral pharmacology research because they are model organisms for animals of higher complexity. Therefore, studying how they respond to drugs of abuse, such as ethanol, may help us understand how these same drugs affect humans. Research from our lab has demonstrated that alcohol decreases behaviors related to anxiety in zebrafish. In humans and rodents, the effects of alcohol are modulated by social variables. Although zebrafish are a social species, potential interactions between social conditions and alcohol have not been explored. The goal of this experiment was to determine whether social conditions interact with alcohol to affect anxiety-related behavior in zebrafish. In our experiment, zebrafish were housed individually, in pairs, or in groups of four. After one week, they were individually dosed with either 0%, 0.5%, or 1% alcohol. Using Ethovision tracking software, we determined how much time the fish spent in the shallow side of a test tank (suggesting that the fish were less anxious). Our current results demonstrate that ethanol increases duration in the shallow end. Fish housed in pairs also spent less time in the shallow side than those housed alone or in groups of four. Finally, single-housed fish showed the largest change in behavior in response to ethanol. These results suggest that social conditions do affect how zebrafish respond to ethanol, and build on the evidence that zebrafish are a relevant model organism for studying anxiolytic medications.

Committing to College Readiness from Middle School and Beyond: A Case Study of a College Preparatory Middle School

TATIANA ZAMORA and Victoria Rodriguez

College readiness has many components that include different academic, cognitive, and social skills as well as transitional and content knowledge. College readiness has typically been a focus within high school curriculum, however, recent research is emphasizing the need for college preparation to begin even earlier than a student's first year of high school. This case study examines St. Olive Academy, a college-preparatory middle school that serves students who identify as members of underrepresented ethnic groups, aspiring first-generation college-going students, and come from low-income families. By utilizing classroom observations and interviews, this study examines what St. Olive Academy is doing to prepare students for college while identifying its effectiveness. This study expands the current definition of college readiness by incorporating cultural factors and school culture along with the other previously defined components.

Perceptions of Female Candidates for Promotion: Who Do We Hire?

ROSHNI POLE and Stephen Pearlberg

The “unofficial” yet acknowledged barrier considered as the “glass ceiling” has been assessed in workplace environments, yet few studies have considered whether such stereotypes exist in higher education. “Glass ceiling” is used to describe career-related advancement in a profession, specifically affecting women. The purpose of current research is to examine whether certain perceptions exist for candidates for promotion in a higher education setting, and if this is moderated by gender. Based on prior research that shows females are perceived as less successful than males in the workplace, I hypothesize that the female candidates will be less likely to be promoted than male candidates. To test this hypothesis, undergraduate students are randomly assigned to view descriptions of promotion candidates that are either; male/female or unqualified/qualified, then rank the candidates from being the best to worst for promotion. The results of this research could have important implications for females in the workplace.

FDI and Portfolio Flow Drivers

SAMI ZAIA and Ryan Ratcliff

International capital flows are of major concern to policymakers due to their fluctuating nature and how that can impact domestic markets and interest rates. This research project attempts to discern what are the main drivers of international capital flows and elaborates on the current literature modeling the cross-sectional variation. It aims to decompose these capital flows into those that are foreign direct investment (FDI) and portfolio investment driven by the same economic factors, and to identify new factors that drive one flow but not the other. Our approach uses international economic theory to describe these flows, distinguishing itself from other literature that uses gravity model variables—such as distance and the financial markets level of development—to do so.

Exploring the Relationship Between Instagram Appearance Anxiety and Related Constructs

STEPHANIE MISKO and Stephen Pearlberg

Adolescents and young adults use social media to connect and communicate more than ever, with nearly three quarters of American teenagers utilizing Instagram and making it the most popular photo sharing platform (Roesler, 2018). Users post pictures and videos often designed to portray an idealized lifestyle, with positive social feedback indexed by the number of viewings, likes, and positive comments the posts receive. Sherlock and Wagstaff (2018) reported that the frequency of Instagram use is correlated with depressive symptoms, self-esteem, general and physical appearance anxiety, and body dissatisfaction. Such symptoms may be exacerbated by the extent of positive social feedback received and the platform recently announced a trial program to deter a focus on content performance by hiding performance metrics (Instagram, 2019). The current research aims to more fully explore the connection between users' social anxiety and Instagram use. Specifically, a two-phase program was designed to investigate the relationship between female undergraduates' patterns of Instagram usage and self-reported levels of social appearance anxiety. An exploratory survey was designed to assess how patterns of Instagram usage may affect participants' self-esteem, social anxiety, and social appearance anxiety. These findings will be used to guide an experimental design manipulating photographic content and perceived liking to explore causality between variables. Results, implications and future directions will be discussed.

Morenas en España: The Experience of College Age Black Women in Spain

GEQUASHA COLLINS and Rebekah Wanic

Many universities encourage, and may even require, students to study abroad. Research indicates that study abroad participation is lower in Black students but few studies have explored potential reasons for this difference. It is possible that Black students are deterred because study abroad requires participants to adjust to new customs and surroundings, along with confronting potential language barriers, and such students already encounter adjustment obstacles in the traditional college experience that their non-minority counterparts do not (White, 2005). In addition, anticipated or experienced racism may play a role. The aim of the present study is to explore the experience of racism and discrimination among college women in Spain. While research has strongly established these negative social experiences for African Americans in America, there is a lack of literature exploring their experience by Blacks in Spain, especially for women. College-age Black women (n = 40), including both Americans studying abroad and native Spaniards, responded to interview and scaled items designed to explore their perceptions of racism in Spain. It was expected that study abroad participants would differ from native Spaniards in their perceptions of discrimination abroad, that both groups would report that men experience more discrimination than women, and that reports of experienced discrimination would be moderated by identification with the Black identity. Results and implications will be discussed.

Essential Qualities for Mentors Serving in Spaces of Empowerment

JUSTIN OLIVARES-VERMILLION and Ricardo Medina

This study examines a specific empowerment and restorative focused organization, Círculo de Hombres; an organization that places a heavy emphasis on culture and intergenerational relationships as pillars to their methodology and success. This examination operates within the existing literature of Empowerment Theory. Empowerment Theory has been utilized as an approach to positively develop and mobilize individuals and communities by targeting the development of the intrapersonal, interactional, and behavioral components of participants. The aim of this present study is to identify expressed needs in the literature by identifying effective mentorship qualities seen in Círculo de Hombres mentors, whose prioritization and focus on the quality of space and intergenerational relationships, foster empowerment outcomes in both youth and adults. The data used in this study consisted of a review of relevant literature around empowerment theory, the collection of qualitative data by co-researcher Rudy Garcia-Perez in the form of recorded interviews, and correspondence with field leaders. The results of this study, although preliminary, correspond with literature on Empowerment Theory. Further research will consist of correspondence with leaders within the field and as well as with academic literature concerned with intergenerational relationships and Empowerment Theory.

Arts and Creative Works

Color in the Mexican Modern Architecture of Luis Barragán

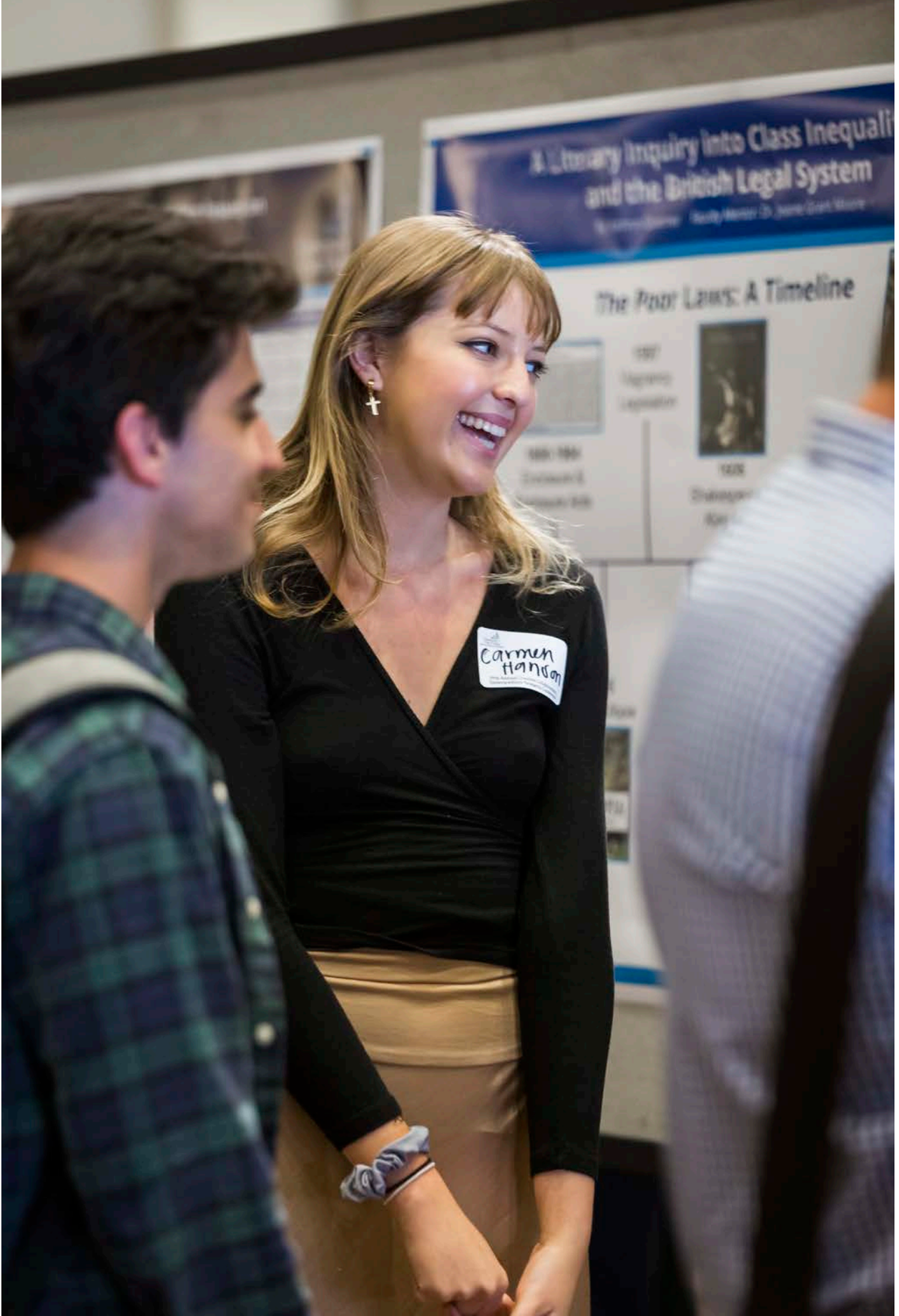
DANIEL RODRIGUEZ and Daniel Lopez-Perez

Color has been essential to the Mexican culture from its pre-Columbian origins to contemporary times. This research explores color in Mexican Modern Architecture and its application in the work of the architect Luis Barragán (1902-1988). This study analyzes a series of images of Barragán's five most recognizable constructions and it experiments with the colors used in the fore, middle, and background of each image. With the use of computer design software, this experiment develops an index of the colors incorporated by Barragán by simplifying the amount of colors percieved by the human eye. This study also analyzes the perceptual, psychological, cultural, and political implications of color in his work. Through this work, researchers are able to understand how color is used specifically by Barragán and recognize how it differs from popular Mexican art and architecture.

Affordable Dense Urbanism through Accessory Dwelling Units

VICENTA MARTINEZ GOVEA, JANETTE DE LOS SANTOS and Daniel Lopez-Perez

The City of San Diego is undergoing its most profound housing crisis and is in dire need of 88,096 units to meet the high demand. This research focuses on finding possible solutions to the housing crisis in San Diego by analyzing its different neighborhoods in order to gain a more comprehensive view of the problem. The need for low and affordable homes is vital given only 30% of people can afford to own a house. A solution to the lack of affordable housing that has led to a housing crisis is the construction of Accessory Dwelling Units (ADUs). An ADU is a dwelling less than 1,200 sq-ft and no more than 30 feet tall and can be used as a separate and rentable dwelling unit that sits above a standard garage. This research project produced an index of ADU's that are combined to produce city-approved plans and designs for homeowners to use throughout San Diego's neighborhoods. An ADU is compared to Tetris where different size rooms can be arranged within a confined space to create various open spaces and then stacked and adapted throughout San Diego. The usage of prefabricated cross laminated timber panels proves to be the most economic construction method. Fee waivers are being distributed by the city to provide homeowners an incentive to build and provide those in need with an affordable housing option. San Diego could construct 115,731 ADU's within the next year and provide a diverse stock of affordable, low-cost units.



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